EPOSTERS
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TUESDAY, SEPTEMBER 17, 2019
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S. J. Torabi, P. R. Brauer, P. P. Salehi, A. K. Ma, J. Y. Lee, Y. H. Lee* (United States)

DAY17 - STATION 11 - CLEFT LIP PALATE

13H25 - 13H30 **17-11-091 | CASE REPORT: THERAPY ON HAEMANGIOMA PATIENT WITH CLEFT LIP AND PALATE**
S. I. Wahdini*, I. Dachlan, I. L. Putri (Indonesia)

13H30 - 13H35 **17-11-092 | USE OF A MODIFIED ENHANCED RECOVERY PROTOCOL IN PRIMARY CLEFT PALATOPLASTY**
C. M. Brady*, S.E. Hush, M. Soldanska, J.K. Williams (United States)

13H35 - 13H40 **17-11-093 | USE OF ACELLULAR DERMAL MATRIX IN CLEFT PALATE SURGERY, KING SAUD UNIVERSITY MEDICAL CITY EXPERIENCE**
B. A. Ahmad*, M. A. Almarghoub, T. R. Alhumsi, A. E. Kattan, A. G. Gelidan (Saudi Arabia)

13H40 - 13H45 **17-11-094 | ASSESSING ADHERENCE TO RECOMMENDED GUIDELINES OF TIMELINESS OF PRIMARY OROFACIAL CLEFT SURGERY: IMPACT ON CLINICAL OUTCOMES**
K. Martin*, O. Adetayo and Albany Medical College (United States)

13H45 - 13H50 **17-11-095 | FILLING THE VOID: INTERPOSITIONAL BUCCAL FAT PAD TO DECREASE FISTULA FORMATION AND MAINTAIN PALATAL LENGTH**
T. Thurston, J. Vargo, C. Vercler, S. Kasten*, S. Buchman (United States)

13H50 - 13H55 **17-11-096 | SINGLE-STAGE DIRECT REPAIR FOR UNILATERAL CLEFT LIP, ALVEOLUS AND PALATE: PRE-SURGICAL ORTHODONTICS AND SURGICAL PROCEDURE**
A. Oyama*, E. Funayama, T. Okamoto, Y. Yamamoto (Japan)

13H55 - 14H00 **17-11-097 | A NEW PRIMARY CLEFT LIP REPAIR TECHNIQUE THAT COMBINES THREE SURGICAL CONCEPTS**
E. Funayama*, A. Oyama, M. Osawa, Y. Yamamoto (Japan)

14H00 - 14H05 **17-11-098-N / S7B-14 | MANAGEMENT OF PERSISTENT BUCCOPHARYNGEAL MEMBRANE WITH DISTRACTION OSTEOGENESIS AND PHARYNGEAL FLAP RECONSTRUCTION**
C. Gordon*, S. Rapp (United States)

14H05 - 14H10 **17-11-099 | THE EFFECT OF THE CLEFT LIP SCAR AND CLEFT SIDE NOSTRIL WIDENING BY DIFFERENT SITES OF BOTULINUM TOXIN INJECTION**
T. Lu*, P. K.-T. Chen (Taiwan)

DAY17 - STATION 12 - CRANIOFACIAL RECONSTRUCTION

13H25 - 13H30 **17-12-100 | VERSATILITY OF THE FREE VASTUS LATERALIS MUSCLE FLAP: ORBITAL RECONSTRUCTION AFTER REMOVAL OF COMPLEX VASCULAR MALFORMATION IN A PEDIATRIC PATIENT**
F. Grussu, U. Urbani, G. Spuntarelli*, S. F. Marino, G. Ciprandi, M. Zama, L. Santecchia (Italy)

13H30 - 13H35 **17-12-101-N / 18-12-212 | THE IMPACT OF HUMANITARIAN TRANSFERS IN THE TREATMENT OF CRANIOFACIAL DISORDERS**
E. M. Rüegg*, A. Bartoli, B. Pittet-Cuénod (Switzerland)

13H35 - 13H40 **17-12-102 | REVIEW OF PEDIATRIC CRANIOMAXILLOFACIAL RECONSTRUCTION: EXPERIENCE FROM A SINGLE, LARGE INSTITUTION**
R. F. Dempsey, A. S. Volk, M. Masoumy, K. E. Kania, M. Maricevich, R. S. Maricevich, W. C. Pederson, E. P. Buchanan* (United States)

13H40 - 13H45 **17-12-103 | EXTERNAL PORT TISSUE EXPANSION IN THE PEDIATRIC POPULATION: CONFIRMING THEIR SAFETY AND EFFICACY**
E. Wolfswinkel*, B. Azadgoli, A. Fahradyan, P. Goel, M. Tsuha, W. Magee III, J. Hammoudeh, M. Urata, L. Howell (United States)

13H45 - 13H50 **17-12-104 | SUPERFICIAL TEMPORAL ARTERY AND VEIN AS RECIPIENT VESSELS FOR FACIAL AND CRANIAL MICROSURGICAL RECONSTRUCTION**
M. Kambe*, K. Takanari, K. Ebisawa, T. Miyanaga, T. Uchibori, Y. Nakamura, H. Ito, Y. Kamei (Japan)

13H50 - 13H55 **17-12-105-N / 19-11-301 | ANTHROPOMETRIC STUDY OF HUMAN EAR: A BASELINE DATA FOR FIRST STAGE MICROTIA RECONSTRUCTION**
A. T. Prasetyo, I. L. Putri* (Indonesia)

13H55 - 14H00 **17-12-106 | CRANIOPLASTY WITH CUSTOM-MADE TITANIUM MESH FOR LARGE SKULL DEFECT AFTER FREE FLAP COVERAGE OF INFECTED SCALP DEFECT**
S. J. Lee*, S. H. Kim, H. J. Kim, H. S. Jeong, I. S. Suh (Republic of Korea)

14H05 - 14H10 **17-12-108 | THE ZYGOMATICOSPHENOIDAL ANGLE: A REFERENCE FOR SURGICAL NAVIGATION IN ZYGOMATICOMAXILLARY COMPLEX FRACTURE REPAIR**
B. J. De Ruiter*, A. Levin, D. Nash, G. Kamel, E. Mostafa, D. Baghdasarian, E. H. Davidson (United States)

WEDNESDAY, SEPTEMBER 18, 2019
13H15-14H00 | E-POSTER AREA

DAY18 - STATION 1 - NEURO/CRANIOSYNOSTOSIS

13H15 - 13H20 **18-1-109 | PEDIATRIC SKULL FRACTURE CHARACTERISTICS ASSOCIATED WITH DEVELOPMENT OF LEPTOMENINGEAL CYSTS IN YOUNG CHILDREN AFTER SKULL TRAUMA**
J. Lopez*, J. Chen, A. Reategui, N. Khavanin, P. N. Manson, A. H. Dorafshar, R. J. Redett (United States)

13H20 - 13H25 **18-1-110 | MEASUREMENT OF INTRACRANIAL PRESSURE UNDER GENERAL ANESTHESIA IS NOT RELIABLE**
R. Bristol*, C. Sarris (United States)

13H25 - 13H30 **18-1-111 | OSTEOPETROSIS LEADING TO SUBTOTAL LOSS OF THE VISCEROCRANIAL BONES**
H.-P. Howaldt, A. Howaldt*, U. Kornak, J.-F. Wilbrand, S. Böttger (Germany)

13H30 - 13H35 **18-1-113 | RISK OF INTRACRANIAL EXTENSION OF CRANIOFACIAL DERMOID CYSTS ACCORDING TO LOCATION**
J. Burge*, J. Overland, A. Holmes (Australia)

13H35 - 13H40 **18-1-114 | SURGICAL CHALLENGES OF ABNORMAL LOCATION OF ANTERIOR CEREBRAL ARTERY IN THE MANAGEMENT OF FRONTOETHMOIDAL MENINGOECEPHALOCELE - ACFU EXPERIENCE**
V. Prasad*, D. David, S. Santoreneos, M. Moore (Australia)

13H40 - 13H45 **18-1-115 | CENTRAL RETINAL ARTERY OCCLUSION FOLLOWING CALVARIAL EXPANSION FOR RAISED INTRACRANIAL PRESSURE**
G. Roumeliotis*, S. Campbell, S. Das, J. Jayamohan, T. Lawrence, S. Magdum, S. Wall, D. Johnson (United Kingdom)

13H45 - 13H50 **18-1-116 | PRIMARY OSSEOUS PECOMA IN THE PAEDIATRIC CRANIOFACIAL SKELETON. A REPORT OF THE INDEX CASE**
W. Flapper*, J. Diab, S. Santoreneos, L. Moore, T. O'Neill and The Australian Craniofacial Unit (Australia)

13H50 - 13H55 **18-1-117 | CRANIOMETER-APP - A NOVEL MOBILE SOFTWARE TO ASESS CRANIAL DEFORMITY**
J.-F. Wilbrand*, K. Sohrabi, M. Wilbrand, P. Fischer, H.-P. Howaldt (Germany)

13H55 - 14H00 **18-1-117BIS-N / 19-9-285 | SQUAMOSAL SUTURE SYNOSTOSIS: ITS ASSOCIATIONS AND CLINICAL SIGNIFICANCE**
J. E. Brooker, W. Chen*, X. Zhu, J. H. Pang, J. Y. Lee, J. E. Losee, J. A. Goldstein (United States)

DAY18 - STATION 2 - SYNDROMIC CRANIOSYNOSTOSIS

13H15 - 13H20 **18-2-118 | UNDIAGNOSED NORMOCEPHALIC PANCRANIOSYNOSTOSIS PRESENTING AS BILATERAL ABDUCENS NERVE PALSY**
M. Baron, L. A. Dvoracek*, M. Bykowski, J. A. Goldstein, J. E. Losee (United States)

13H20 - 13H25 **18-2-119 | MULTIDISCIPLINARY MANAGEMENT OF CHILDREN WITH GENETICALLY CONFIRMED CROUZON SYNDROME: A RETROSPECTIVE REVIEW IN THE OXFORD CRANIOFACIAL UNIT**
M. J. Abukhder*, H. Care, S. Wall, S. Magdum, S. Kilcoyne, J. JayaMohan, D. Johnson, A. Wilkie (United Kingdom)

13H25 - 13H30 **18-2-120 | A PROSPECTIVE STUDY OF FORCES IN CRANIOFACIAL DISTRACTION**
A. Wes*, L. Lin, D. Mazzaferro, M. Hast, R. Zhang, S. Naran, S. Bartlett, J. Taylor (United States)

13H30 - 13H35 **18-2-121-N / 19-2-225 | ANALYSIS OF AIRWAY AND MIDFACE IN CROUZON SYNDROME**
A. J. Forte, X. Lu*, P. Hashim, D. Steinbacher, M. Alperovich, J. Persing, N. Alonso (United States)

13H35 - 13H40 **18-2-122 | AN INTERNAL DISTRACTION DEVICE FOR MIDFACE DISTRACTION OSTEOGENESIS: THE NAVID SYSTEM TYPE Z'GOK**
T. Hirao*, Y. Sakamoto, T. Sakamoto, T. Ishii, K. Kishi (Japan)

13H40 - 13H45 **18-2-123 | OUTCOMES IN INTERNAL VERSUS EXTERNAL MIDFACE DISTRACTION IN SYNDROMIC CRANIOSYNOSTOSIS: A SYSTEMATIC REVIEW**
A. A. Bertrand*, K. J. Lipman, J. P. Bradley, J. Reidhead, J. C. Lee (United States)

13H45 - 13H50 **18-2-124 | THREE-DIMENSIONAL AIRWAY ANALYSIS IN APERT SYNDROME**
A. J. Forte, X. Lu*, P. Hashim, D. Steinbacher, M. Alperovich, J. Persing, N. Alonso (United States)

13H50 - 13H55 **18-2-125 | POST-EXPANSION CRANIAL SHAPE AND DEFECT HEALING IN SAETHRE CHOTZEN BILATERAL CORONAL SYNOSTOSIS COMPARED TO NON-SYNDROMIC CONTROLS**
W. Adidharma, C. Purnell, M. Calis*, E. Mercan, R. A. Hopper (United States)

13H55 - 14H00 **18-2-126 | SIMULTANEOUS LEFORT II DISTRACTION AND FRONTO-MALAR ADVANCEMENT: CORRECTING SEVERE MIDFACE RETRUSION IN A PATIENT WITH CROUZON'S SYNDROME**
S. De Stefano*, E. Nadal Lopez, M. Sabas (Argentina)

DAY18 - STATION 3 - CRANIOSYNOSTOSIS/SAGITTAL

13H15 - 13H20 **18-3-127 | SURGICAL PROCEDURES OF NON-SYNDROMIC SAGITTAL CRANIOSYNOSTOSIS BY THE TYPE OF CRANIAL SHAPE**
D. Senda*, K. Shimoji, H. Mizuno, Y. Komuro (Japan)

13H20 - 13H25 **18-3-128 | MULTIPLE TONGUE-IN-GROOVE TENONS REMOLDING CRANIOPLASTY IN LATE CORRECTION, MULTISUTURAL AND REVISION CRANIOSYNOSTOSIS SURGERIES.**
C. Herlin*, G. Captier, M. Bigorre, E. Chang-Seng, T. Roujeau (France)

13H25 - 13H30 **18-3-129 | EVALUATION OF SURGICAL OUTCOMES IN SAGITTAL CRANIOSYNOSTOSIS WITH 3D CURVATURE ANALYSIS - OPEN VERSUS ENDOSCOPIC TECHNIQUE**
D. Khechoyan*, D. Stow, C. Forrest, J. Drake, A. Kulkarni, J. Phillips (United States)

13H30 - 13H35 **18-3-130-N / 19-2-226 | DOES VECTOR CORRELATE WITH IMPROVEMENT IN SLEEP APNEA FOLLOWING SYNDROMIC MIDFACE DISTRACTION?**
M. T. Liu*, C. A. Purnell, M. W. Evans, S. Kim, B. B. Massenburg, R. A. Hopper and Division of Plastic Surgery, Department of Surgery, University of Washington; Craniofacial Center, Seattle Children's Hospital in Seattle, Washington (United States)

13H35 - 13H40 **18-3-131 | RADIATION-FREE 3D HEAD SHAPE AND VOLUME EVALUATION AFTER ENDOSCOPICALLY ASSISTED STRIP CRANIECTOMY FOLLOWED BY HELMET THERAPY FOR SCAPHOCEPHALY**
G. de Jong, J. Meulstee, E. van Lindert, W. Borstlap, T. Maal, H. Delye* and Craniofacial Team Nijmegen (Netherlands)

13H40 - 13H45 **18-3-132 | COMPARISON OF PARENTAL SATISFACTION AND OUTCOMES OF STRIP CRANIECTOMY WITH HELMET VERSUS SPRING-MEDIATED REMODELING IN SAGITTAL CRANIOSYNOSTOSIS**
L. G. F. Smith, V. Shah, H. Duenas, A. E. Graver, L. S. Governale, G. D. Pearson, A. I. Drapeau* (United States)

13H45 - 13H50 **18-3-133 | CALVARIAL VAULT RECONSTRUCTION FOR SAGITTAL CRANIOSYNOSTOSIS AFTER 1 YEAR OF AGE**
D. C. Nguyen, G. B. Skolnick, S. D. Naidoo*, M. D. Smyth, K. B. Patel (United States)

13H50 - 13H55 **18-3-134 | MANAGEMENT OF SAGITTAL SYNOSTOSIS IN THE SYNOSTOSIS RESEARCH GROUP (SYNRG)**
B. Gociman*, F. Siddiqi, J. Goldstein, M. Smyth, R. Anderson, K. Patel, C. Birgfeld, I. Pollack, M. Tamber, T. Imahiyerobo, J. Kestle (United States)

13H55 - 14H00 **18-3-135 | FRONTAL WIDENING AND REMODELING FOR SCAPHOCEPHALIC CHILDREN OLDER THAN ONE**
G. Paternoster*, H. Khonsari, S. Haber, X. L. Jing, S. James, X. Liu, C. Legros, E. Arnaud (France)

DAY18 - STATION 4 - CRANIOSYNOSTOSIS/MISCELLEANOUS

13H15 - 13H20 **18-4-136 | SERIOUS COMPLICATIONS AFTER LE FORT III DISTRACTION OSTEOGENESIS IN SYNDROMIC CRANIOSYNOSTOSIS: EVOLUTION OF PREVENTIVE AND THERAPEUTIC STRATEGIES**
C. E. Raposo-Amaral, Y. Moresco de Oliveira, R. Denadai, C. A. Raposo-Amaral*, E. Ghizoni, T. M. D. M. Lameiro (Brazil)

13H20 - 13H25 **18-4-137 | BENIGN FEVER IS VERY COMMON FOLLOWING TRANSCRANIAL SURGERY FOR CRANIOSYNOSTOSIS: PERSISTENT FEVER IS ASSOCIATED WITH COMPLICATIONS**
M. R. Bykowski*, A. M. Ayyash, L. A. Dvoracek, A. Konanur, M. Haredy, J. Daggett, J. E. Losee, J. A. Goldstein (United States)

13H25 - 13H30 **18-4-139 | FRONTO-ORBITAL ADVANCEMENT REMODELLING (FOAR) - THE DEVELOPMENT OF AN IMPROVED TECHNIQUE IN MINIMISING BLOOD LOSS OVER 10 YEARS**
J. Jones*, D. Rodrigues, W. Lo, M. Evans, N. White, H. Nishikawa, S. Dover, E. Carver (United Kingdom)

13H30 - 13H35 **18-4-140 | THE PATH TO TRANSFUSION FREE CRANIAL VAULT SURGERY THROUGH CONTINUED QUALITY AND SAFETY EVALUATION**
A. Beethe*, J. Kugler, R. Spitznagel, M. LeRiger, K. Pellegrino (United States)

13H35 - 13H40 **18-4-141-N / 19-7-271 | TEMPORAL FAT GRAFTING IN CHILDREN WITH CRANIOFACIAL ANOMALIES**
A. Fahradyan*, P. Goel, W. Madeleine, D. Gould, M. M. Urata (United States)

13H40 - 13H45 **18-4-142 | EFFECT OF PARENTAL ENGLISH PROFICIENCY ON PSYCHOSOCIAL FUNCTIONING IN CHILDREN WITH CRANIOFACIAL ANOMALIES**
H. Hoang*, E. Nahabet, M. J. Pfaff, F. S. De Leon, E. J. Volpicelli, H. M. Potemra, J. Lin, J. A. Zimmerman, J. P. Bradley, L. F. Wilson, J. C. Lee (United States)

13H45 - 13H50 **18-4-143 | QUANTITATIVE EVALUATION OF TREATMENT FOR CRANIOSYNOSTOSIS FROM 3D PHOTOGRAPHY**
A. R. Porras*, L. Tu, S. N. Magge, D. Tsering, G. Buck, E. Mantilla-Rivas, A. Oh, R. Keating, G. Rogers, M. G. Linguraru (United States)

13H50 - 13H55 **18-4-144 | TOMOGRAPHIC EXOPHTHALMOMETRY IN PATIENTS UNTIL 3 YEARS OF AGE**
D. C. Gomez Prada, R. Prada Madrid*, L. Trsitancho (Colombia)

13H55 - 14H00 **18-4-138 | GASTRO-OESOPHAGEAL REFLUX, GLUE EAR AND INTRACRANIAL HYPERTENSION: AN INVESTIGATION OF 182 CONSECUTIVE INFANTS IN THE OXFORD CRANIOFACIAL UNIT**
S. Kilcoyne*, E. Gallo, C. Bonini, S. Overton, S. Wall, J. Jayamohan, S. Magdum, P. Scully, A. Judge, D. Johnson (United Kingdom)

DAY18 - STATION 5 - IMAGING/PLANNING

13H15 - 13H20 **18-5-145 | THE USE OF 3D PRINTING IN CRANIOSYNOSTOSIS SURGERY**
V. Ivanov*, A. Kim, W. Khachatryan (Russian Federation)

13H20 - 13H25 **18-5-146 | PREOPERATIVE SIMULATION AND OPERATIVE FACILITATION OF FRONTO-ORBITAL REMODELING IN CRANIOSYNOSTOSIS USING A NOVEL TEMPLATE**
E. Watanabe*, K. Imai, N. Kunihiro, H. Motomura (Japan)

13H25 - 13H30 **18-5-147 | CRANIAL SHAPE COMPARISON FOR AUTOMATED OBJECTIVE 3D CRANIOSYNOSTOSIS SURGERY PLANNING**
M. Tolhuisen, G. de Jong, R. van Damme, F. van der Heijden, H. Delye* (Netherlands)

13H30 - 13H35 **18-5-148 | VIRTUAL PLANNING IN LE FORT III DISTRACTION OSTEOGENESIS**
H. J. Vercruysse*, J. Rubio-Palau, N. Nadjmi, M. De Praeter, D. Dunaway (Belgium)

13H35 - 13H40 **18-5-149-N / S9B-02 | USING AUGMENTED REALITY TO REMOTELY TEACH CLEFT SURGERY: BUILDING LONG- TERM INTERNATIONAL CAPACITY AND SUSTAINABILITY**
R. M. Vyas* (United States)

13H40 - 13H45 **18-5-150-N / 19-7-267 | DISCOVERING THE TRUE RESOLUTION OF POSTOPERATIVE SWELLING AFTER RHINOPLASTY USING 3-DIMENSIONAL PHOTOGRAPHIC ASSESSMENT**
J. Schreiber, E. Marcus, O. Tepper*, J. Layke (United States)

13H45 - 13H50 **18-5-151 | DIAGNOSIS OF CRANIOSYNOSTOSIS: ARE CT SCANS NECESSARY?**
A. Fahradyan*, K.-A. Mitchell, G. Daneshgaran, A. Wexler, S. H. Francis (United States)

13H50 - 13H55 **18-5-152-N / 19-7-269 | INTEGRATING 3D-PRINTED MODELS FOR SOFT TISSUE APPLICATIONS IN CRANIOFACIAL SURGERY**
J. Schreiber, H. Rudy, E. Uppal, E. Garfein, O. Tepper* (United States)

13H55 - 14H00 **18-5-153 | MORPHOMETRIC ANALYSIS IN CRANIOSYNOSTOSIS RECONSTRUCTION SURGERY BASED ON STRUCTURED LIGHT SCANNING**
D. García-Mato, M. García-Sevilla, S. Ochandiano*, C. Navarro-Cuéllar, J. V. Darriba-Allés, R. García-Leal, J. Pascau (Spain)

DAY18 - STATION 6 - HYPERTELORISM

13H15 - 13H20 **18-6-154 | PROTECTION OF MEDIAL CANTHAL LIGAMENT ATTACHMENT DURING CORRECTION OF HYPERTELORISMS**
Z. Yu*, M. Wei and Unit of Craniofacial Surgery, Dept. of Plastic and Reconstructive Surgery, Shanghai Ninth People Hospital (China)

13H20 - 13H25 **18-6-155 | TESSIER NUMBER 3 FACIAL CLEFT: A CASE REPORT OF A NEW METHOD OF REPAIR AND A REVIEW OF LITERATURE OF AVAILABLE TECHNIQUE**
A. Elsherbiny*, M. Al-Qattan (Saudi Arabia)

13H25 - 13H30 **18-6-156 | PAI SYNDROME IN A 4-MONTH-OLD INFANT: RARE LIPOMAS ALONG WITH MIDLINE FACIAL ALVEOLUS CLEFT**
I. Shiokawa*, N. Ohshima, N. Mizumura, A. Momosawa (Japan)

13H30 - 13H35 **18-6-157 | A NOVEL PROPOSAL: ALGORITHM FOR THE STRATIFICATION AND TREATMENT OF THE HYPERTELORISM**
H. O. Malagon Hidalgo, M. L. Aguirre Cazares* (Mexico)

13H35 - 13H40 **18-6-158 | TESSIER 9 LATERAL ORBITOCRANIAL CLEFT: A CLINICAL AND RADIOLOGICAL OVERVIEW OF AN UNDERDIAGNOSED ENTITY**
C. Amm* (United States)

13H45 - 13H50 **18-6-160 | INNOVATIVE 3-D PRINTED TITANIUM PLATES WITH INTEGRATED POSITIONING CONFIRMATION PROCESS FOR CORRECTION OF VERTICAL ORBITAL DYSTOPIA**
D. A. Staffenberg, B. S. Eisemann*, D. S. Harter (United States)

13H50 - 13H55 **18-6-161 | VIRTUAL PLANNING AND DESIGN OF CUTTING AND POSITIONING TEMPLATES FOR FACIAL BIPARTITION: FIRST GLOBAL REPORT**
H. O. Malagon Hidalgo, M. L. Aguirre Cazares*, A. Ibarra Reyes, E. Velazquez Varela (Mexico)

13H55 - 14H00 **18-6-162 | VARIANT OF FRONTO-ORBITAL ADVANCEMENT BEFORE HYPERTELORISM CORRECTION**
G. Paternoster, H. Khonsari, S. Haber*, J. Britto, D. Benderbous, S. James, E. Vergnaud, C. Legros, E. Arnaud (France)

DAY18 - STATION 7 - ORTHOGNATHIC

13H15 - 13H20 **18-7-163 | ANTERIOR TONGUE MICROGLOSSIA: IMPACT ON FACIAL DEVELOPMENT AND PRESENTATION OF TWO CASES**
J. Puente Espel*, R. D. Wallace, J. W. Thompson, P. Konofaos (United States)

13H20 - 13H25 **18-7-164 | A 28 YEAR REVIEW OF AIRWAY MANAGEMENT IN TREACHER COLLINS SYNDROME**
I. Okonkwo*, V. Ratnamma, A. Rickart, V. Sharma, J. Navaratnarajah (United Kingdom)

13H25 - 13H30 **18-7-165 | EXPERIENCE WITH A NEW INTERNAL LE FORT I DISTRACTOR – THE TRANS-NASAL DEVICE**
M. Lypka*, H. Hendricks (United States)

13H30 - 13H35 **18-7-166 | ACCURACY OF CUSTOM PRINTED PLATES FOR 2 JAW ORTHOGNATHIC SURGERY:**
R. Yang*, P. Shakoori, A. Azzolini, J. Swanson, J. Taylor, S. Bartlett (United States)

13H35 - 13H40 **18-7-167 | THE DENTAL PATHWAY, AND A REVIEW OF THE ORAL HEALTH OF CHILDREN ATTENDING THE NATIONAL PAEDIATRIC CRANIOFACIAL CENTRE IN IRELAND.**
M. Kelly*, E. McGovern, D. J. Murray (Ireland)

13H40 - 13H45 **18-7-168 | VIRTUAL PLANNING SEQUENCE FOR THE TREATMENT OF HEMIHYPERPLASIA**
S. Shen*, X. Wang (China)

13H45 - 13H50 **18-7-169 | ABLEPHARON MACROSTOMIA: LOWER LID RECONSTRUCTION AND A REVIEW OF THE LITERATURE**
N. Kurnik, L. Mansueto *, G. Leach, D. Singh (United States)

13H50 - 13H55 **18-7-170 | CONGENITAL INFILTRATING LIPOMATOSIS OF THE FACE: STATE OF THE ART AND CASE REPORT**
D. C. Gomez Prada*, R. Prada Madrid (Colombia)

13H55 - 14H00 **18-7-171 | SURGICAL APPROACH OF INFANTILE HEMANGIOMAS OF THE NOSE**
M. V. C. Ferreira*, D. C. Goldenberg, R. C. Lobato, V. Kharmandayan, R. Gemperli (Brazil)

DAY18 - STATION 8 - HEMIFACIAL MICROSOMIA/ROBIN

13H15 - 13H20 **18-8-172 | EFFICACY OF ARTHROPLASTY OF THE TEMPEROMANDIBULAR JOINT AND INSERTION OF A MATTHEWS DISTRACTOR AS TREATMENT FOR ANKYLOSIS OF THE JOINT. A CASE SERIES**
M. Kelly*, A. Bowen, D. Murray (Ireland)

13H20 - 13H25 **18-8-173 | CRANIAL ANCHORED MANDIBLE DISTRACTION OSTEOGENESIS (CAMO)**
R. Dempsey, E. Dong, A. Volk, T. Truong, J. Wirthlin, E. Buchanan* (United States)

13H25 - 13H30 **18-8-174 | LIMITATIONS OF DISTRACTION - A CHANCE FOR RECONSTRUCTION**
J. Wittig*, P. Schachner, S. Lux, A. Gaggl (Austria)

13H30 - 13H35 **18-8-175 | ERROR ANALYSIS OF A SURGERY SIMULANTION SYSTEM FOR UNIDIRECTIONAL MANDIBULAR DISTRACTION OSTEOGENESIS**
X. Wang*, H. Sun, Z. Liu (China)

13H35 - 13H40 **18-8-176 | MAXILLOFACIAL DEFORMATION IN CONTRALATERAL CONTROL SIDE IN HEMIFACIAL MICROSOMIA**
R. Shibazaki-Yorozuya*, Y. Watanabe, T. Akizuki, S. Nagata (Japan)

13H40 - 13H45 **18-8-177-N / S7B-09 | SURGICAL CORRECTION OF SEVERE MANDIBULAR HYPOPLASIA IN HEMIFACIAL MICROSOMIA AT THE AUSTRALIAN CRANIOFACIAL UNIT**
L. Monshizadeh*, W. Flapper, B. Grave, M. Moore, D. David (Australia)

13H45 - 13H50 **18-8-178 | PROSPECTIVE RANDOMIZED CONTROLLED CLINICAL TRIAL FOR THE TREATMENT OF MASSETER HYPOPLASIA IN HEMIFACIAL MICROSOMIA**
W. Han*, X. Yang, X. Chen, W. Mooi, M. A. Zin, G. Chai, Y. Zhang (China)

13H50 - 13H55 **18-8-179 | CURRENT TRENDS IN SURGICAL AIRWAY MANAGEMENT OF NEONATES WITH ROBIN SEQUENCE**
A. K. Oh*, K. L. Fan, M. Mandelbaum, J. Buro, A. Rokni, J. W. Chao, G. F. Rogers (United States)

13H55 - 14H00 **18-8-180 | ORTHODONTIC ELASTIC TRACTION ASSISTED THE HEMIFACIAL MICROSOMIA TREATMENT DURING ACTIVATION PERIOD OF DISTRACTION OSTEOGENESIS FOR HFM**
Q. Xiaohui*, C. Gang, S. Huifang, Y. Xianxian, Z. Yan (China)

DAY18 - STATION 9 - RESEARCH

13H15 - 13H20 **18-9-181 | THE EFFECT OF HAEMOSTATIC AGENTS ON WOUND HEALING IN CROUZON MICE**
P. Anderson* and Australian Craniofacial Unit (Australia)

13H20 - 13H25 **18-9-182 | DO MURINE MODELS WITH BOTH FGFR2 AND TWIST MUTATIONS HAVE A WORSE PHENOTYPE?**
P. Anderson* and Australian Craniofacial Unit (Australia)

13H25 - 13H30 **18-9-183 | MULTISUTURAL SYNOSTOSIS AND SEVERE CRANIOFACIAL ASYMMETRY IN HUWE1-SYNDROME**
I. Mathijssen*, S. Versnel, J. Spoor, M.-L. V. Veelen (Netherlands)

13H30 - 13H35 **18-9-184 | NOVEL VARIANT IN FGFR2 RESPONSIBLE OF FAMILIAL SCAPHOCEPHALY**
A. Szathmari, F. Di Rocco*, A. Gleizal, C. Paulus, P.-A. Beuriat, C. Mottolese, C. Collet (France)

13H35 - 13H40 **18-9-185 | MUTATION SPECTRUM INCHINESE PATIENTS WITH CRANIOSYNOSTOSIS**
Y. Wu*, M. Peng, J. Chen, X. Mu, S. Wang (China)

13H40 - 13H45 **18-9-186 | SWEENEY-COX SYNDROME: A CASE REPORT. SURGICAL CONDUCT**
D. N. Camargo*, A. S. Silva, V. L. N. Cardim (Brazil)

13H45 - 13H50 **18-9-187 | EXOME SEQUENCING IN CRANIOSYNOSTOSIS AT THE NORWEGIAN NATIONAL UNIT FOR CRANIOFACIAL SURGERY**
E. Tønne*, B. Due-Tønnessen, U. Wiig, K. Tveten, M. A. Kulseth, K. Heimdal (Norway)

13H50 - 13H55 **18-9-188-N /19-12-310 | CROUZON WITH ACANTHOSIS NIGRICANS: A RARE VARIANT OF CROUZON SYNDROME DUE TO FGFR3 MUTATIONS - FUNDAMENTAL AND CLINICAL APPROACHES**
M. Cornille, R. H. Khonsari*, N. Kaci, M. Bensidhoum, F. Di Rocco, Y. Heuzé, L. Legeai-Mallet (France)

13H55 - 14H00 **18-9-189 | THE RETENTIVITY OF OSTEOGENIC CAPACITY IN THE PREFABRICATED PERIOSTEOFASCIAL FLAP USING THE VASCULAR TISSUE TRANSFER**
I. Lee, B. Lee* (Republic of Korea)

DAY18 - STATION 10 - CRANIOFACIAL TRAUMA

13H15 - 13H20 **18-10-190-N / 19-11-299 | SPORTS-RELATED INJURIES IN THE PEDIATRIC POPULATION: ANALYSIS OF FACIAL FRACTURE PATTERN AND MANAGEMENT STRATEGIES**
A. A. Dobitsch, N. C. Oleck, F. C. Liu, J. N. Halsey*, I. C. Hoppe, E. S. Lee, M. S. Granick (United States)

13H20 - 13H25 **18-10-191-N / 19-9-288 | IMPLICATIONS OF FACIAL FRACTURE IN AIRWAY MANAGEMENT OF THE ADULT POPULATION: WHAT IS THE MOST EFFECTIVE MANAGEMENT STRATEGY?**
T.-M. T. Le*, N. Oleck, A. Dobitsch, F. Liu, J. Halsey, E. Lee, M. Granick (United States)

13H25 - 13H30 **18-10-192 | PEDIATRIC FACIAL FRACTURES, CHARACTERISTICS AND PATTERNS IN THE UNITED STATES: A SURVEY OF RECENT TRAUMA QUALITY IMPROVEMENT PROJECT (TQIP) DATA**
K. E. Park*, A. S. Elzanie, K. Alizadeh, A. Azim, R. Latifi, E. G. Zellner (United States)

13H30 - 13H35 **18-10-193 | VISUAL PERCEPTION OF ASYMMETRY IN PARRY ROMBERG DISEASE: A PRE- AND POST-SURGICAL EYETRACKING ANALYSIS**
T. Boonipat*, A. Abu-Ghname, U. Bite, M. Stotland, S. Mardini (United States)

13H35 - 13H40 **18-10-194-N /19-5-249 | QUANTIFYING NORMAL HEAD FORM AND CRANIOFACIAL ASYMMETRY OF ELEMENTARY SCHOOL STUDENTS IN TAIWAN**
P. Chou*, R. R. Hallac, A. A. Kane, L.-J. Lo (United States)

13H40 - 13H45 **18-10-195 | CHALLENGES OF PEDIATRIC NASO ORBITO ETHMOID FRACTURES**
C. El Amm* (United States)

13H45 - 13H50 **18-10-196 | PATTERNS OF NASOORBITOETHMOID FRACTURES IN THE PEDIATRIC POPULATION**
T.-M. T. Le, N. Oleck, F. Liu, A. Dobitsch, J. Halsey*, E. Lee, M. Granick (United States)

13H50 - 13H55 **18-10-197 | ESTABLISHING A PROTOCOL FOR CLOSED TREATMENT OF MANDIBULAR CONDYLE FRACTURES WITH DYNAMIC ELASTIC THERAPY**
G. Kamel*, D. Baghdasarian, B. De Ruiter, A. Levin, E. Mostafa, E. Davidson (United States)

13H55 - 14H00 **18-10-198 | PERIORBITAL AND GLOBE INJURIES IN PEDIATRIC ORBITAL FRACTURES: A RETROSPECTIVE REVIEW OF 116 PATIENTS AT A LEVEL 1 TRAUMA CENTER**
J. N. Halsey*, M. Argüello-Angarita, I. C. Hoppe, E. S. Lee, M. S. Granick (United States)

DAY18 - STATION 11 - CLEFT LIP PALATE

13H15 - 13H20 **18-11-199 | REVISION RATES OF CLEFT LIP AND NASAL DEFORMITIES IN NASOALVEOLAR MOLDING VERSUS LIP ADHESION**
I. Ickow*, L. Dvoracek, J. Goldstein, L. Grunwaldt, J. E. Losee, L. Schuster, W. Chen, J. Brooker (United States)

13H20 - 13H25 **18-11-200 | SECONDARY CLEFT RHINOPLASTY IN 1720 PATIENTS: ARE NATIONAL PRACTICES CONSISTENT WITH GUIDELINES?**
F. Chouairi, S. J. Torabi, K. S. Gabrick, J. A. Persing, M. Alperovich* (United States)

13H25 - 13H30 **18-11-201 | CONGENITAL MUSCLE HYPOTONIA IS ASSOCIATED WITH PLATYBASIA: A NOVEL PATHOANATOMIC BASIS FOR RECALCITRANT VELOPHARYNGEAL INSUFFICIENCY**
M. R. Bykowski*, L. A. Dvoracek, M. D. Ford, A. J. Davit, L. J. Grunwaldt, J. A. Goldstein, J. E. Losee (United States)

13H30 - 13H35 **18-11-202 | THE CORRELATION BETWEEN SPEECH OUTCOMES AND THE AMOUNT OF MAXILLARY ADVANCEMENT AFTER ORTHOGNATHIC SURGERY IN PATIENTS WITH CLEFT LIP AND PALATE**
J. H. Ha*, Y. T. Koo, H. Park, A. Yoo, J. Chung, S. Kim (Republic of Korea)

13H35 - 13H40 **18-11-203 | PARAMEDIAN CLEFT OF THE LOWER LIP: A FIRST CASE DESCRIBED IN THE LITERATURE**
J. Chauvel-Picard*, J. Massardier, A. Gleizal (France)

13H40 - 13H45 **18-11-204 | SECONDARY CORRECTION OF WHISTLING DEFORMITY IN BILATERAL CLEFT LIP; REVISION OF OUR CASES**
M. I. Falguera*, S. Heredero, A. San Juan, F. Alamillos, A. Dean (Spain)

13H45 - 13H50 **18-11-205 | A STUDY TO REVEAL VARIATION OF THE COMMON FACIAL VEIN, INCLUDING ITS RELATION TO IMPORTANT LOCAL STRUCTURES, WITH REGARD TO FACIAL RECONSTRUCTION**
C. Patel*, D. Gahir (United Kingdom)

13H50 - 13H55 **18-11-206 | PRACTICAL APPLICATION OF AUGMENTED REALITY IN CRANIOFACIAL SURGERY**
C. El Amm*, J. Potts, D. Sharber (United States)

DAY18 - STATION 12 - CRANIOSYNOSTOSIS/ COGNITIVE

13H15 - 13H20 **18-12-208 | EVALUATION OF A PEDIATRIC FACIAL PARALYSIS EDUCATION AND FAMILY SUPPORT DAY**
M. Heinelt*, K. Zuo, J. Copeland, E. Ho, R. Zuker, G. Borschel (Canada)

13H20 - 13H25 **18-12-209 | CHILDREN'S UNDERSTANDING OF THEIR CRANIOFACIAL DIAGNOSES**
J. Rhodes, R. Trivelpiece* (United States)

13H25 - 13H30 **18-12-210 | SENSITIVITY AND SPECIFICITY OF PARENTAL REPORT OF CONCERN FOR IDENTIFYING HEARING AND LANGUAGE DIFFICULTIES IN INFANTS WITH CRANIOFACIAL DIAGNOSES**
S. Kilcoyne*, S. Overton, D. Johnson, S. Wall, A. Benson (United Kingdom)

13H30 - 13H35 **18-12-211 | THE SENSITIVITY AND SPECIFICITY OF PARENTAL REPORT OF CONCERN FOR IDENTIFYING LANGUAGE DISORDER IN CHILDREN WITH CRANIOFACIAL DIAGNOSES**
S. Kilcoyne*, S. Menon Rajan, S. Overton, S. Wall, D. Johnson (United Kingdom)

13H40 - 13H45 **18-12-213-N / 17-5-040 | ORBITAL ASYMMETRY IN INFANTS WITH ISOLATED UNI-CORONAL SYNOSTOSIS PRIOR TO SURGERY**
R. Sandy*, T. A. Darvann, N. V. Hermann, J. Nysjö, R. H. Khonsari, E. Arnaud, S. James, G. Paternoster, S. Kreiborg (Denmark)

13H45 - 13H50 **18-12-214 | LARGEST REPORTED ODONTOGENIC MYCOBACTERIUM ABSCESSUS OUTBREAK AND TREATMENT OF A PEDIATRIC PATIENT WITH EXTENSIVE MANDIBULAR OSTEOMYELITIS**
N. Pourtaheri*, M. Kanack, M. Mueller, D. Jaffurs, R. Vyas (United States)

13H50 - 13H55 **18-12-215 | DIRECT TO SURGERY? SURGICAL OUTCOMES IN PEDIATRIC PATIENTS WITH INFANTILE HEMANGIOMA: A RETROSPECTIVE CASE-CONTROL STUDY**
K. A. Grunzweig*, N. Goel, C. Wee, A. Kumar (United States)

13H55 - 14H00 **18-12-216 | CONTEMPORARY CRANIOFACIAL MANAGEMENT AND OUTCOMES OF FRONTO-ETHMOID 'IVORY OSTEOMA'**
J. Jones*, D. Zakei, M. Evans, D. Rodrigues, N. White, H. Nishikawa, S. Dover (United Kingdom)

THURSDAY, SEPTEMBER 19, 2019
13H15-13H55 | E-POSTER AREA

DAY19 - STATION 1 - NEURO/CRANIOSYNOSTOSIS

13H15 - 13H20 **19-1-217 | IATROGENIC PAN-CRANIOSYNOSTOSIS AFTER CA REPLACEMENT THERAPY: TWO CASES OF THE HYPOPHOSPHATASIA**
S. Kyutoku*, H. Iwanaga, Y. Kajimoto, K. Otani, K. Ueda (Japan)

13H20 - 13H25 **19-1-218 | ATLANTOAXIAL ROTATIONAL SUBLUXATION. A RARE COMPLICATION AFTER PEDIATRIC CRANIOFACIAL PROCEDURES. A SINGLE SURGEONS EXPERIENCE SPANNING 3 DECADES**
R. Yang*, A. Azzolini, J. Swanson, J. Taylor, S. Bartlett (United States)

13H25 - 13H30 **19-1-219 | FRONTO-ORBITAL ADVANCEMENT AS A TREATMENT FOR RECURRENT VPS FAILURE**
A. Brisbin, L. Dvoracek*, J. Losee, S. Greene, J. Goldstein (United States)

13H30 - 13H35 **19-1-220 | RELATION BETWEEN INTRACRANIAL STRUCTURAL CHANGE AND DEVELOPMENTAL OUTCOMES AFTER DISTRACTION METHOD FOR BI-CORONAL SYNOSTOSIS**
M. Kato*, K. Mizutani, M. Nagakura (Japan)

13H35 - 13H40 **19-1-221 | SERIAL VISUAL EVOKED POTENTIALS FOR ASSESSMENT OF VISUAL FUNCTION IN CRANIOSYNOSTOSIS**
M. M. Haredy*, J. Goldstein, A. Liasis, V. Fu, A. Davis, J. Losee, K. Koesarie, K. Nischal (United States)

13H45 - 13H50 **19-1-223 | ABNORMAL COAGULATION AFTER CRANIOSYNOSTOSIS SURGERY**
D. Nielsen*, I. Okonkwo, S. Wilmshurst, K.-B. Ong, D. Dunaway (United Kingdom)

13H50 - 13H55 **19-1-224 | LONG TERM QUALITY OF LIFE AND COMPLICATIONS WITH SYNDROMIC CRANIOSYNOSTOSIS.**
R. Kitabata*, Y. Sakamoto, T. Miawa, K. Yoshida, K. Kishi (Japan)

DAY19 - STATION 2 - SYNDROMIC CRANIOSYNOSTOSIS

13H15 - 13H20 **19-2-225-N / S4B-11 | TWO AND THREE SEGMENTS SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION: A CLINICAL TRIAL**
M. D. Pereira*, G. P. R. Prado, L. M. Ferreira (Brazil)

13H20 - 13H25 **19-2-226- N / 18-3-130 | BEYOND VIRCHOW: UNDERSTANDING THE GROWTH VECTORS OF ISOLATED SAGITTAL SYNOSTOSIS IN INFANTS**
E. Mercan*, A. M. Maga, M. Calis, N. Kurnick, R. A. Hopper (United States)

13H25 - 13H30 **19-2-227 | THE MIDFACE REVISITED: OUTCOMES OF INTRACRANIAL VERSUS SUBCRANIAL APPROACHES TO THE FRONTOFACIAL SKELETON**
N. C. Munabi*, E. Nagengast, A. Fahradyan, D. Gould, P. Goel, M. Williams, J. Hammoudeh, M. Urata (United States)

13H30 - 13H35 **19-2-228 | IS IT SAFE TO USE FRONTO-FACIAL MONOBLOC ADVANCEMENT AND CUTTING GUIDES ON ADULT PATIENTS WITH A CROUZON SYNDROME?**
B. Laure*, C. Queiros, N. Travers, A. Listrat (France)

13H35 - 13H40 **19-2-229-N / 19-8-280 | APERT SYNDROME MANAGEMENT : ROLE OF POSTERIOR DISTRACTION AND MONOBLOC FACIAL BIPARTITION DISTRACTION**
C. E. Raposo-Amaral, Y. Moresco de Oliveira *, R. Denadai, C. A. Raposo-Amaral, E. Ghizoni (Brazil)

13H40 – 13H45 **19-2-231 | FACTORS OF DECANNULATION AFTER LE FORT III DISTRACTION FOR SEVERE SYNDROMIC CRANIOSYNOSTOSIS WITH TRACHEOSTOMY**
K. Kawamoto*, K. Imai, S. Taniguchi (Japan)

13H45 - 13H50 **19-2-232 | PREMATURE AGING IN CRANIOFACIAL DYSOSTOSES ASSOCIATED WITH FGFR2 GENE MUTATIONS**
E. M. Wolfe*, S. A. Wolfe, S. Mathis, J. Hernandez-Rosa, S. Bhatti (United States)

13H50 - 13H55 **19-2-230-N / S2-03 |ADAPTED OCCIPITAL DISTRACTION IN SYNDROMIC AND MULTISUTURAL CRANIOSYNOSTOSIS**
I. Mathijssen*, S. Versnel, J. Spoor, M.-L. V. Veelen (Netherlands)

DAY19 - STATION 3 - CRANIOSYNOSTOSIS/METOPIC

13H15 - 13H20 **19-3-233 | METOPIC SYNOSTOSIS: PRE AND POST-OPERATIVE EVALUATION OF CRANIOFACIAL DEFORMITY**
H. Matushita*, N. Alonso, D. D. Cardeal, M. J. Teixeira (Brazil)

13H20 - 13H25 **19-3-234 | WHAT CRANIOMETRIC MEASURE BEST DEFINES METOPIC SYNOSTOSIS?**
A. H. Nassar*, E. Mercan, B. B. Massenburg, C. Birgfeld, A. Lee, R. A. Hopper (United States)

13H25 - 13H30 **19-3-235 | HOW MUCH ORBITOFRONTAL DIFFERENCE ATTRACTS ATTENTION? USING EYE-TRACKING AS A PROXY FOR PERCEPTION OF DEFORMITY DUE TO METOPIC CRANIOSYNOSTOSIS**
M. P. Pressler*, R. R. Hallac, J. R. Seaward, A. A. Kane (United States)

13H30 - 13H35 **19-3-236 | ASYMMETRIC CRANIECTOMY VERSUS VASCULARIZED PERICRANIAL FLAP IN PREVENTING PERSISTENT CRANIAL DEFECTS AFTER SAGITTAL CRANIECTOMY**
B. M. French, C. C. Wilkinson* (United States)

13H35 - 13H40 **19-3-237 | THE METOPIC HINGE: A TECHNIQUE FOR ANTERIOR VAULT REMODELING IN METOPIC CRANIOSYNOSTOSIS**
K. Magoon, A. Azzolini, R. Yang*, S. Bartlett, J. Swanson, J. Taylor (United States)

13H40 - 13H45 **19-3-238-N / S8A-01 | THE CC-UK: DEVELOPMENTAL OUTCOMES IN CHILDREN WITH METOPIC CRANIOSYNOSTOSIS AT 7 AND 10 YEARS OF AGE**
L. Culshaw, A. Kearney, K. Piggott, H. Thornhill, H. Care, L. Dalton *, D. Dunaway, M. Evans, J. Horton, D. Johnson, P. Kennedy-Williams, L. Middleton-Curran, G. O'Leary, C. Parks, N. Rooney, G. Wright (United Kingdom)

13H45 - 13H50 **19-3-239 | THE OBSERVATION OF THE SPHENOID GREATER WING OF TRIGONOCEPHALY PATIENTS WITH COMPUTED TOMOGRAPHIC**
C. Dong* (China)

13H50 - 13H55 **19-3-240 | GENERATING FICTIVE TRIGONOCEPHALY DATA USING A GENERATIVE ADVERSARIAL NETWORK TO PRODUCE DATA TO TRAIN DEEP LEARNING ALGORITHMS**
A. Sterkenburg*, G. de Jong, J. Meulstee, H. Delye (Netherlands)

DAY19 - STATION 4 - CRANIOSYNOSTOSIS/MISCELLEANOUS

13H15 - 13H20 **19-4-241 | ANAESTHESIA FOR CRANIOPAGUS CONJOINED TWINS - LESSONS LEARNED FROM SUCCESSFUL SEPARATION OF 3 SETS IN A SINGLE CENTRE**
J. Herod, K. Ong, R. King, D. Dunaway*, S. Wilmshurst, O. Jeelani (United Kingdom)

13H20 - 13H25 **19-4-242 | NASAL RECONSTRUCTION USING A CUSTOMIZED THREE-DIMENSIONAL–PRINTED STENT FOR CONGENITAL ARHINIA**
D. Y. Kim*, Y. J. Lee, J.-W. Rhie (Republic of Korea)

13H25 - 13H30 **19-4-243 | SURGICAL NEONATAL TREATMENT OF CONGENITAL NASAL PYRIFORM APERTURE STENOSIS (CNPAS): PRESENTATION OF TWO CASES**
D. C. Goldenberg*, V. Kharmandayan, M. V. Ferreira, R. Zatz, J. A. Goldenberg, R. Gemperli (Brazil)

13H30 - 13H35 **19-4-244 | PREDICTING BLOOD PRODUCT TRANSFUSION IN CRANIOFACIAL SURGERY PATIENTS USING MACHINE LEARNING BASED ON THE PEDIATRIC CRANIOFACIAL COLLABORATIVE GROUP**
A. Fernandez*, L. Zamora, A. Jalali, L. Ahumada, P. Stricker, M. Rehman, J. Fackler and Pediatric Craniofacial Collaborative Group (United States)

13H35 - 13H40 **19-4-245 | EFFECTIVE INTERDISCIPLINARY MANAGEMENT OF CHRONIC OBSTRUCTIVE NASOPHARYNGEAL STENOSIS (NPS): A CASE STUDY**
C. M. Brady, V. Chien*, G. Silva, E. Pua, M.W. Granger, J.E. Riski, M. Soldanska, J.K. Williams (United States)

13H40 - 13H45 **19-4-246 | THE BRACHIOCEPHALIC APPROACH FOR CENTRAL VENOUS CATHETERS PLACEMENT IN PEDIATRIC CRANIOFACIAL SURGERY**
V. Alessandri, V. Tortora, A. Vittori, G. Spuntarelli, S. Picardo, M. Zama, V. Caverni* (Italy)

13H45 - 13H50 **19-4-247 | THE EFFICACY OF TRANEXAMIC ACID IN REDUCING BLOOD LOSS AND TRANSFUSION REQUIREMENTS IN CRANIOSYNOSTOSIS SURGERY - A LARGE SCALE COHORT STUDY**
A. Varidel*, D. Marucci, M. Cooper, J. Loughran (Australia)

13H50 - 13H55 **19-4-248 | TREATMENT STRATEGY FOR CRANIOSYNOSTOSIS - SELECTION OF CONVENTIONAL CRANIOPLASTY, SUTURECTOMY OR DISTRACTION OSTEOGENESIS**
T. Akai*, M. Yamashita, H. Iizuka, S. Kuroda (Japan)

DAY19 - STATION 5 - IMAGING/PLANNING

13H15 - 13H20 **19-5-249-N / 19-12-307 | EVALUATION OF CLINICAL OUTCOMES OF 3D PRINTING GUIDES COMBINE WITH NAVIGATION TECHNIQUE IN REDUCTION OF ZYGOMATICO-ORBITAL-MAXILLARY COMPLEX FRACTURES**
Z. M. Aung*, G. Cha, X. Chen, L. Lin, Y. Xin, W. Chen, W. Han, X. Yang, H. Xu, Y. Zhang (China)

13H20 - 13H25 **19-5-250 | BLACK BONE MRI IS AS ACCURATE AS CT SCANS IN VIRTUAL SURGICAL PLANNING FOR FIBULA FLAP MANDIBULAR RECONSTRUCTION: A MEANS TO REDUCE RADIATION EXPOSURE**
W. Gibreel*, M. Suchyta, S. Mardini (United States)

13H25 - 13H30 **19-5-251 | COMPARISON OF 3D RECONSTRUCTED MR IMAGES WITH CT: PROOF OF CONCEPT**
K. B. Patel*, P. K. Commean, C. Eldeniz, G. B. Skolnick, M. Goyal, M. Smyth, U. Jammalamadaka, H. An (United States)

13H30 - 13H35 **19-5-252 | A 3D MORPHABLE HEAD MODEL FOR APERT AND CROUZON SYNDROME**
E. O' Sullivan*, T. Papaioannou, S. Zafeiriou, D. Dunaway (United Kingdom)

13H35 - 13H40 **19-5-253 | VIRTUAL 3D PLANNING OF OSTEOTOMIES FOR CRANIOFACIAL SURGERIES**
B. Laure*, N. Travers, A. Listrat (France)

13H40 - 13H45 **19-5-254 | PREOPERATIVE PLANNING USING THREE-DIMENSIONAL SIMULATION FOR CRANIO-MAXILLOFACIAL SURGERY**
T. Okumoto*, S. Kondo (Japan)

13H45 - 13H50 **19-5-255 | THE ROLE OF 3D-PRINTING CRANIOFACIAL MODEL SIMULATION IN CONGENITAL CRANIOFACIAL SURGERY**
T. M.-H. Hsieh, G.-T. Shen*, M.-F. Kuo, B.-C. Huang, T. J. Liu, Y.-F. Wu, H.-W. Yang, H.-C. Dai (Taiwan)

13H50 - 13H55 **19-5-256 | 3D PRINTED MODELS VS. VIRTUAL SURGERY SIMULATION IN CRANIOFACIAL SURGERY EDUCATION**
C. El Amm*, A. Franklin (United States)

DAY19 - STATION 6 - CRANIOPLASTY

13H15 - 13H20 **19-6-257-N / 19-12-305 | USE OF NOVEL TECHNOLOGIES IN THE ANALYSIS, PLANNING AND SURGERY FOR CRANIOPAGUS TWINS. PAST, PRESENT AND FUTURE**
J. Ong*, K. Y. Chooi, G. James, F. D'Arco, R. Hayward, O. Jeelani, D. Dunaway (United Kingdom)

13H20 - 13H25 **19-6-258 | SPLIT CALVARIAL GRAFT FOR RECONSTRUCTION OF FULL THICKNESS CALVARIAL DEFECTS**
R. Agarwal*, R. Agarwal (India)

13H25 - 13H30 **19-6-260 | THE UTILITY OF PARTICULATE BONE GRAFT CRANIOPLASTY FOR PRIMARY CRANIAL VAULT EXPANSION**
A. Azzolini*, K. Magoon, R. Yang, J. Swanson, S. Bartlett, J. Taylor (United States)

13H30 – 13H35 **19-6-261 | ADULT CRANIOPLASTY RECONSTRUCTION WITH CUSTOMIZED CRANIAL IMPLANTS: DOES RADIATION THERAPY AFFECT OUTCOMES?**
K.-A. Mitchell*, M. Belzberg, A. Asemota, N. Benshalom, C. Gordon (United States)

13H35 - 13H40 **19-6-262 | REPAIR OF CRANIAL BONE DEFECTS IN CHILDREN USING SYNTHETIC HYDROXYAPATITE CRANIOPLASTY (CUSTOMBONE®)**
P.-A. Beuriat*, A. Szathmari, F. Di Rocco, C. Mottolese (France)

13H40 - 13H45 **19-6-263 | USE OF CUSTOM-MADE TITANIUM THREE-DIMENSIONAL IMPLANTS FOR A FRONTO-ORBITO-ZYGOMATIC RECONSTRUCTION IN RARE FACIAL CLEFTS: THE FIRST CASE REPORT**
J. Chauvel-Picard*, A. Gleizal (France)

13H45 - 13H50 **19-6-264 | CRANIOPLASTY CRIPPLES & MICROSURGICAL RECONSTRUCTION**
N. Maltzaris*, D. Kotoulas, M. Kotrotsou, S. Stavrianos (Greece)

DAY19 - STATION 7 - CRANIOFACIAL AESTHETICS

13H15 - 13H20 **19-7-265 | AESTHETIC GENIOPLASTY BASED ON STRATEGIC CATEGORIZATION**
H. S. Moon, C. H. Hwang*, M. C. Lee (Republic of Korea)

13H20 - 13H25 **19-7-270-N /S6A-03 | BIFRONTOORBITAL REMODELING REVISITED: LONG TERM FOLLOW-UP OF OPERATED PATIENTS FOR SYNOSTOTIC PLAGIOCEPHALY**
J. Puente Espel, J. Chang, G. Paternoster, R.-H. Khonsari*, J. Chen, S. James, D. Renier, E. Arnaud (United States)

13H25 - 13H30 **19-7-267-N / 18-5-150 | A 3D STATISTICAL FACE MODEL FOR SYNDROMIC CRANIOFACIAL PATIENTS**
A. Papaioannou*, L. S. van de Lande, S. Zafeiriou, D. J. Dunaway (United Kingdom)

13H30 - 13H35 **19-7-268-N / 19-11-304 | AUTOLOGOUS FAT: CORRECTION OF SECONDARY DEFORMITIES DUE TO CRANIOSYNOSTOSIS**
B. A. Toth* (United States)

13H35 - 13H40 **19-7-269-N / 18-5-152 | QUANTIFICATION OF BONE AND SOFT TISSUE DEFORMATIONS IN CRANIOFACIAL PATIENTS**
L. S. van de Lande*, P. G. Knoops, O. Jeelani, S. Schievano, D. J. Dunaway (United Kingdom)

13H40-13H45 **19-7-266-N / 19-12-312 | THE USE OF A TENDON PULLEY TO ACHIEVE A MULTI-VECTOR LINE OF PULL IN LENGTHENING TEMPORALIS MYOPLASTY: A NEW TECHNIQUE TO OPTIMIZE THE SMILE**
W. Gibreel*, M. Suchyta, S. Mardini (United States)

13H45 - 13H50 **19-7-272 | AUTOLOGOUS FAT GRAFT FOR CORRECTION OF FACIAL ASYMMETRY IN PEDIATRIC PATIENTS WITH PARRY-ROMBERG SYNDROME**
Y. Watanabe*, T. Akizuki (Japan)

DAY19 - STATION 8 - CRANIOSYNOSTOSIS/MISCELLEANOUS

13H15 - 13H20 **19-8-273 | INTRACRANIAL VOLUME IN PATIENTS WITH SHUNT-RELATED CRANIOSYNOSTOSIS**
E. Mantilla-Rivas*, L. Tu, A. R. Porras, H. Alexander, M. Manrique, J. R. Bryant, R. Keating, S. N. Magge, J. S. Myseros, C. Oluigbo, A. K. Oh, M. G. Linguraru, G. F. Rogers (United States)

13H20 - 13H25 **19-8-274 | INCIDENTAL DIAGNOSIS OF CRANIOSYNOSTOSIS AT THE ER: SERIES OF 331 PATIENTS**
M. Manrique*, E. Mantilla-Rivas, J. Bryant, R. Keating, A. R. Porras, M. G. Linguraru, A. K. Oh, G. F. Rogers (United States)

13H25 - 13H30 **19-8-275 | ASSOCIATION OF CRANIOSYNOSTOSIS WITH CHARGE SYNDROME**
A. L. Alexander*, A. Sethi, A. Tian, B. French (United States)

13H30 - 13H35 **19-8-276-N / 19-9-283 | NOTHING CAN STOP THE PEDIATRIC NEUROSURGEON: HOW TO MANAGE FRONTO-ORBITAL ADVANCEMENT WITHOUT BIOABSORBABLE PLATES**
T. Protzenko*, A. Bellas, M. S. Pousa (Brazil)

13H35 - 13H40 **19-8-277 | DYNAMIC OSTEOTOMIES WITH EXPANDING SPRINGS FOR CRANIOESTENOSIS BY TRANSPLANTED OSTEOPETROSIS**
G. M. D. C. Peres*, V. L. N. Cardim, A. S. Silva (Brazil)

13H40 - 13H45 **19-8-278 | OPTICAL COHERENT TOMOGRAPHY AND TRANSORBITAL ULTRASOUND IN PATIENTS WITH CRANIOSYNOSTOSIS. ARE THEY USEFUL TOOLS TO ASSESS INTRACRANEAL HIPERTENSION?**
H. Malagon*, A. Ibarra (Mexico)

13H45 - 13H50 **19-8-279 | THE IMPORTANCE OF CLOSE NURSE FOLLOW UP DURING TREATMENT WITH CRANIOREMOLDING ORTHOSIS FOR CRANIOSYNOSTOSIS**
T. Rambøl*, R. Rapp, E. Nordahl, B. Due-Tønnessen (Norway)

DAY19 - STATION 9 - CRANIOFACIAL RECONSTRUCTION

13H15 - 13H20 **19-9-281-N / 17-12-105 | REPARATIVE PROCEDURE IN LARGE LOSSES OF SCALP AND BONE OF THE SKULL AFTER RESECTION OF ADVANCED RECURRENT TUMOR ABOUT 2 CASES**
S. Naija*, G. Chebbi, M. Haythem, H. Brahem, R. Benmhamed, K. Akkeri (Tunisia)

13H20 - 13H25 **19-9-282-N / 17-12-101 | MANDIBULAR RECONSTRUCTION USING DOUBLE STEP DISTRACTION OSTEOGENESIS IN SEVERE BILATERAL MANDIBULAR RAMUS HYPOPLASIA**
S. De Stefano*, E. Nadal Lopez, M. Sabas (Argentina)

13H25 - 13H30 **19-9-283-N / 17-10-090 | USING THE SUBMENTAL FLAP FOR RECONSTRUCTION OF TRAUMATIC FACIAL DEFECTS - A CASE SERIES STUDY**
M. Mohammadi Khah*, R. Tabrizi (Islamic Republic of Iran)

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T. Elbanoby*, A. Elbatawy (Egypt)

13H35 - 13H40 **19-9-285-N / 19-12-308 | MODIFIED TECHNIQUE FOR ELEVATION OF EAR FRAME IN MICROTIA RECONSTRUCTION USING SPLIT THICKNESS COSTAL CARTILAGE GRAFT**
I. L. Putri* (Indonesia)

13H40 - 13H45 **19-9-287 | RELATIONSHIP OF MANDIBULAR MORPHOLOGY TO EXTERNAL EAR VOLUME IN TREACHER-COLLINS SYNDROME**
X. Ma*, L. Teng (China)

13H45 - 13H50 **19-9-288-N / 19-12-306 | APPLICATION OF AUGMENTED REALITY FOR THE POSITIONING OF RECONSTRUCTED EAR**
T. Nuri*, K. Ueda, D. Mitsuno (Japan)

DAY19 - STATION 10 - CRANIOFACIAL TRAUMA

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B. Parent, M. R. Bykowski*, S. Ramgopal, J. A. Goldstein, J. E. Losee (United States)

13H20 - 13H25 **19-10-290 | ORBITAL RECONSTRUCTION IN ADULT AND PEDIATRIC CRANIOFACIAL TRAUMA AND CONSERVATIVE MANAGEMENT OF THE ORBITAL WALLS**
J. Michienzi*, A. Wolfe, C. E. Raposo-Amaral, R. Perez (United States)

13H25 - 13H30 **19-10-291 | THE FUNCTIONAL OUTCOME OF MANDIBULAR CONDYLAR HEAD FRACTURES**
B.-R. Lai*, Y.-Y. Chu, C.-F. Chen, J.-R. Yang, H.-T. Liao (Taiwan)

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Y.-Y. Chu*, H. T. Liao (Taiwan)

13H35 - 13H40 **19-10-293-N / 18-10-191 | AN ANALYSIS OF PLATE FORM DISTORTION AFTER GRAFTING: CASES OF ORBITAL WALL FRACTURE**
M. Fukuba*, M. Tamaki, T. Sekiguchi, M. Fujii, T. Shibuya, T. Yamamoto, K. Dogo, H. Yamaoka, M. Okochi, Y. Komuro (Japan)

13H40 - 13H45 **19-10-294 | THE ORBITAL INDEX: A NOVEL RISK STRATIFICATION SYSTEM FOR PREDICTING LATE ENOPHTHALMOS IN ORBITAL FLOOR FRACTURE MANAGEMENT**
B. J. De Ruiter*, F. Lalezar, D. Baghdasarian, A. Levin, E. Mostafa, E. H. Davidson (United States)

13H45 - 13H50 **19-10-295 | THE APPLICATION RESEARCH OF TREATMENT ON OLD POST-TRAUMATIC ENOPHTHALMOS WITH CUSTOMIZED MEDPOR BASED ON DIGITAL TECHNOLOGY**
F. Niu*, J. Chen, J. QIAO, X. Fu (China)

DAY19 - STATION 11 - AESTHETICS

13H15 - 13H20 **19-11-297 | FINITE ELEMENTAL BIOMECHANICAL SIMULATED ANALYSIS OF THE NASOLABIAL FOLD**
G. C. Chen, X. Lu* (China)

13H20 - 13H25 **19-11-298 | A NOVEL METHOD OF CORRECTING LOWER FACIAL SYMMETRY: COMPUTER-ASSISTED SURGERY WITH MANDIBULAR OUTER CORTEX "SANDWICH" GRAFTING**
G. Wu*, W. Shangguan (China)

13H25 - 13H30 **19-11-299- N / 18-10-190 | TRANSCONJUNCTIVAL INCISION FOR ORBITAL FRACTURES REPAIR. INCIDENCE OF COMPLICATIONS AND RECOMMENDATIONS TO AVOID THEM IN A MEDICAL CENTRE IN MÉXICO**
H. O. Malagón-Hidalgo, E. García-Cano*, S. A. Mejia-Valero, J. E. Chang-Contreras (Mexico)

13H30 - 13H35 **19-11-300 | INTRAOPERATIVE 3-DIMENSIONAL RECONSTRUCTIVE SCANS ARE USEFUL FOR FACIAL FRACTURE TREATMENT IN HYBRID OPERATION ROOM**
Y. Terabe* (Japan)

13H35 - 13H40 **19-11-302 | NASAL ANTHROPOMETRY ON FACIAL COMPUTED TOMOGRAPHY SCANS FOR RHINOPLASTY IN ASIANS**
S. J. Lee, H. J. Kim, S. H. Kim, H. S. Jeong, I. S. Suh* (Republic of Korea)

13H40 - 13H45 **19-11-303 | OSSEOUS TRANSFORMATION WITH FACIAL FEMINIZATION SURGERY: IMPROVED ANATOMIC ACCURACY WITH VIRTUAL PLANNING**
J. P. Bradley*, J. Deschamps-Braly, N. Bastidas, S. Lu, J. Lee (United States)

DAY19 - STATION 12 - CRANIOSYNOSTOSIS/MISCELLEANOUS

13H15 - 13H20 **19-12-304-N / S12-05 | FRONTO-FACIAL MONOBLOC ADVANCEMENT WITH INTERNAL DISTRACTION IN CROUZON SYNDROME: LONG-TERM EFFECTS OF MOLAR DEVELOPMENT AND GROWTH**
L. Sicard, M. Hounkpevi, C. Tomat, S. James, G. Paternoster, R. H. Khonsari*, E. Arnaud (France)

13H20 - 13H25 **19-12-305-N / 19-9-286 | NEURAL CORRELATES OF CHILDHOOD LANGUAGE DISORDER IN CHILDREN WITH CRANIOSYNOSTOSIS: A SYSTEMATIC REVIEW**
S. Kilcoyne*, S. Overton, G. Roumeliotis (United Kingdom)

13H30 - 13H35 **19-12-307-N / S4A-18 | SING AND SAY: AN INTERACTIVE WEB-BASED RESOURCE OF LANGUAGE STIMULATION RESOURCES FOR CHILDREN WITH CRANIOSYNOSTOSIS**
S. Kilcoyne* (United Kingdom)

13H35 - 13H40 **19-12-309 | COMPARISON OF BLACK-BONE MRI AND 3D-CT IN THE PREOPERATIVE EVALUATION OF PATIENTS WITH CRANIOSYNOSTOSIS**
A. Saarikko*, L. Kuusela, E. Mellanen, J. Leikola, T. Autti, A. Karppinen, N. Brandstack (Finland)

13H40 - 13H45 **19-12-311 | IMPROVEMENT OF PERIORBITAL APPEARANCE IN APERT SYNDROME AFTER SUBCRANIAL LE FORT III WITH BIPARTITION AND DISTRACTION**
V. Chetty, S. E. Haber*, E. Arnaud (France)

EPOSTER ABSTRACTS

DAY17 - STATION 1 - NEURO/CRANIOSYNOSTOSIS

17-1-001

NEURONAVIGATION IN PLANNING SCALP INCISIONS FOR SINUS PERICRANII MALFORMATIONS

N. Limoges [1], T. D. Willson [2,*], S. Durham [1]

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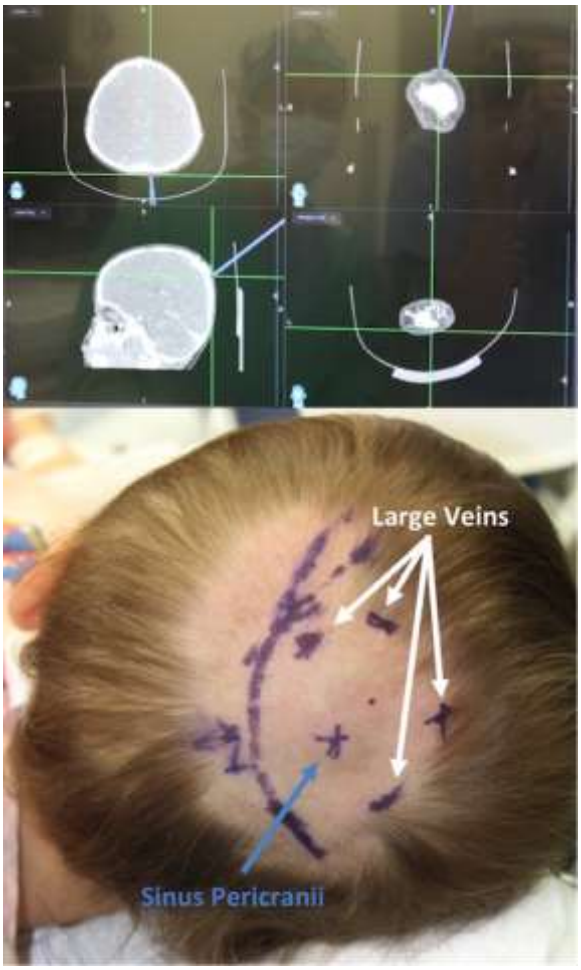
Introduction & Objectives: Sinus pericranii is a rare disorder of epicranial venous malformation of the scalp involving an abnormal communication between the intracranial and extracranial venous drainage pathways through a skull defect. Repair is usually done to prevent hemorrhage in the case of an accidental scalp laceration in the future. Sinus pericranii typically present as soft palpable masses along midline skull, which may fluctuate in size depending on body positioning. Classically, these lesions are not associated with color change of the overlying skin, such as with other vascular lesions. We present our experience using neuronavigation to assist in repair of a sinus pericranii in an 18 month old girl.

Material & Methods: Pre-operative MRI was obtained with MRV sequences to identify the malformation. A pre-operative head CT was obtained and fused to the MRI sequences in our neuronavigation system. Using the T1 weighted and MRV sequences with the neuronavigation, we were able to visualize in the operating room the area of large scalp veins draining into the sinus pericranii defect. By identifying the exact location of these veins, the scalp incision can be optimized to approach the lesion in the clearest plane, minimizing blood loss and allowing pre-incision planning of potential scalp flaps for coverage and cosmesis. We continued to use the neuronavigation intraoperatively to identify the skull defect, plan the approach and decrease operative time. The navigation system provided excellent accuracy of scalp veins and we experienced minimal blood loss.

Results: Our use of neuronavigation in a novel way to plan scalp incisions for sinus pericranii was simple and did not add significant preparation time. Intraoperatively the scalp incision was well planned and we experienced minimal blood loss. No transfusions were needed. The patient did well post operatively and had no complications.

Conclusion: Neuronavigation technology can be efficiently and successfully utilized in planning scalp incisions for vascular malformations to avoid excessive blood loss and to pre-plan potential scalp flaps to obtain optimal coverage and cosmesis.



Disclosure of Interest: None Declared

17-1-002

THE SURGICAL MANAGEMENT OF SKULL BASE TUMORS-A 18YEAR SINGLE INSTITUTION EXPERIENCE

N. Maltzaris [1,*], D. Kotoulas [1], M. Kotrotsou [2], S. Stavrianos [1]

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Introduction & Objectives: There is a wide variety of tumors that affect the skull base. The treatment of these tumors depends on the histologic type and the grade differentiation of the tumor, its location in the skull and the patient’s general status. Apart from chemotherapy and radiotherapy, surgical treatment of these tumors offers good survival rates and raises a technical challenge for the surgeon.

Material & Methods: A total of 29 patients were examined, of which 22 male and 7 female, with an average age of 51 years. In 6 patients the primary tumor was located in the anterior and middle fosae, 4 in anterior base ethmoids, in 15 patients in the orbit the maxilla and 13 patients middle fosae and in 1 pts the anterior fossa. Surgery involved billateral maxillectomy and anterior fossa resection in 3 patients, in 6 pts transfacial subcranial resection of the anterior fossa, in 1 pts anterior subcranial resection and petrosectomy, middle ear resection and petrosectomy in 5 pts, orbitectomy and maxillectomy and aterior fossa resection in 13 pts, and combined middle and anterior subcranial fosae resection in 1 pts Reconstruction performed with 3 anterolateral thigh and vastus lateralis flaps, 2 vastus muscle flaps, 3 latissimus dorsi flaps, 9 pectoralis major flaps, 4 rectus abdominis flaps, 2 radial forearm flap, 8 temporalis flaps and 2 scalp flaps. There was a variety in the histopathology, as there were 14 cases of basal cell carcinoma and 15 cases of basosquamous carcinoma.

Results: With a mean follow up of 10 years 14 patients are alive and disease free.

Conclusion: Wide surgical resection, combined with post-operative radiotherapy and/or chemotherapy when indicated, and reconstruction with microvascular techniques cαn improve prognosis and promote the quality of life of our patients.

Disclosure of Interest: None Declared

17-1-003

SERIAL VISUAL EVOKED POTENTIALS IN PATIENTS WITH CRANIOSYNOSTOSIS AND INVASIVE INTRACRANIAL PRESSURE MONITORING

M. M. Haredy [1 2,*], A. Liasis [3], V. Fu [3], A. Davis [3], I. Pollack [4], J. Losee [1], S. Saied [2], K. Nischal [3], J. Goldstein [1]
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Introduction & Objectives: This study aimed to detect the ability of pattern visual evoked potentials (pVEP) to detect visual pathway dysfunction in a cohort of patients with craniosynostosis who also had invasive intracranial pressure (ICP) measurement.
Material & Methods: A retrospective review was conducted on patients with craniosynostosis who had direct ICP monitoring or lumbar puncture (LP) and at least one pVEP test in the period between 2012 – 2017. Reversal pVEP were performed with both eyes open. The pVEP latency and amplitude were recorded and compared in patients with raised and normal ICP using Mann-Whitney test. The ability of serial VEP testing to detect visual pathway dysfunction resulting from intracranial hypertension was evaluated using Fisher exact test.
Results: The study identified 13 patients (mean age at ICP monitoring 5.7 years). Seven patients had sagittal, five had multisutural and one had metopic synostosis. Eleven patients had direct ICP monitoring while 2 patients had LP. Seven patients had high ICP, and of these, 5 (71.4%) had abnormal or deteriorated pVEP parameters on serial testing, while all patients (100%) with normal ICP had normal pVEP amplitude and latency. For patients with raised ICP, 3 had papilledema, one had unilateral pallor while the remaining 3 patients showed normal fundus examination. Four of the 5 patients (80%) with raised ICP and abnormal VEP did not show evidence of papilledema. The mean latency in patients with raised ICP (118.7 msec) was longer than in those with normal ICP (108.1 msec), although not reaching statistical significance ($p = 0.09$), while the mean amplitude in patients with raised ICP (12.4 μv) was significantly lower than in patients with normal ICP (23.3 μv) *(P = 0.03).*
Conclusion: Our results showed that serial pVEP testing was able to detect visual pathway dysfunction resulting from raised ICP in 5 of 7 craniosynostosis patients, and of these 5 patients, 80% had no evidence of papilledema, demonstrating the utility of serial pVEP in follow up of the visual function in craniosynostosis patients.

Disclosure of Interest: None Declared

17-1-004

CRANIAL VAULT EXPANSION FOR POST-SHUNT CRANIOSYNOSTOSIS: INDICATION AND OUTCOME USING A VERSATILE TECHNIQUE

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Introduction & Objectives: Following shunting for hydrocephalalus, some patients (20 to 53%) develop post-shunt slit-ventricle syndrome. From this group, craniosynostosis could be developed as a unique complication (5%). Post-shunt craniosynostosis represents a challenging problem with no clear guidelines for management. If modification of the shunt opening pressure does not improve the condition, surgery for correction of craniocerebral disproportion could be indicated. We are presenting our experience, protocol and surgical technique from reviewing our cases in the last two years.

Material & Methods: We retrospectively reviewed our patients with post-shunt craniosynostosis managed surgically in our institution since we introduced vault expansion for management of such cases in 2017. A technique included multiple tongue-in-groove pattern of expansion and increase the cranial volume. Details of the technique are described and its outcome. Also the indications for surgery are highlightened for better understanging of the problem and planning an algorithm for management.

Results: Four cases with post-shunt craniosynostosis managed by cranial vault expansion. Patients' age ranges from 16 months to 4 years at the time for surgery. All cases had hydrocephalus following intraventricular hemorrhage and prematurity. One case presented with papilledema, one with optic atrophy and symptoms of raised intracranial pressure (ICP), one with frequent shunt revisions and one case presented at earlier age with deterioration of the head growth curve. Improvement of papilledema and clinical picture were reported. Also no further shunt revisions were needed. The current surgical technique increases skull volume with satisfactory esthetic outcome. No postoperative complications were reported except one case had plate exposure due to significant amount of expansion and was managed with transposition flap and skin grafting.

Conclusion: Cranial vault expansion is an important armamentarium in management of post-shunt craniosynostosis. Indication for surgery was clinical symptoms of raised ICP with functioning shunt, papilledema, frequent shunt failures, and early presentation before age of 2 years with deteriorating head circumference growth curve with imaging suggesting cerebrocranial disproportion. Multiple tongue-in-groove expansion is a versatile technique allows vault expansion with multiple areas of bone-to-bone contact while decrease the size of left soft spots which lead to a strong construct and good functional and esthetical outcome. Many tips we have learnt as the preferred location of shunt placement in high risk patients, not to interfere with the possible vault expansion surgery if needed later an upgrading the shunt during vault expansion to help the brain to fill the new expanded volume.

Disclosure of Interest: None Declared

17-1-005

AUTOMATIC MEASUREMENT OF INTRACRANIAL VOLUME FROM THREE-DIMENSIONAL PHOTOGRAPHY

L. Tu [1], A. R. Porras [1], A. Enquobahrie [2], G. C. Buck [1], D. Tsering [3], S. Horvath [2], E. Mantilla Rivas [4], R. Keating [3], A. K. Oh [4], G. F. Rogers [4], M. G. Linguraru [1 5,*]

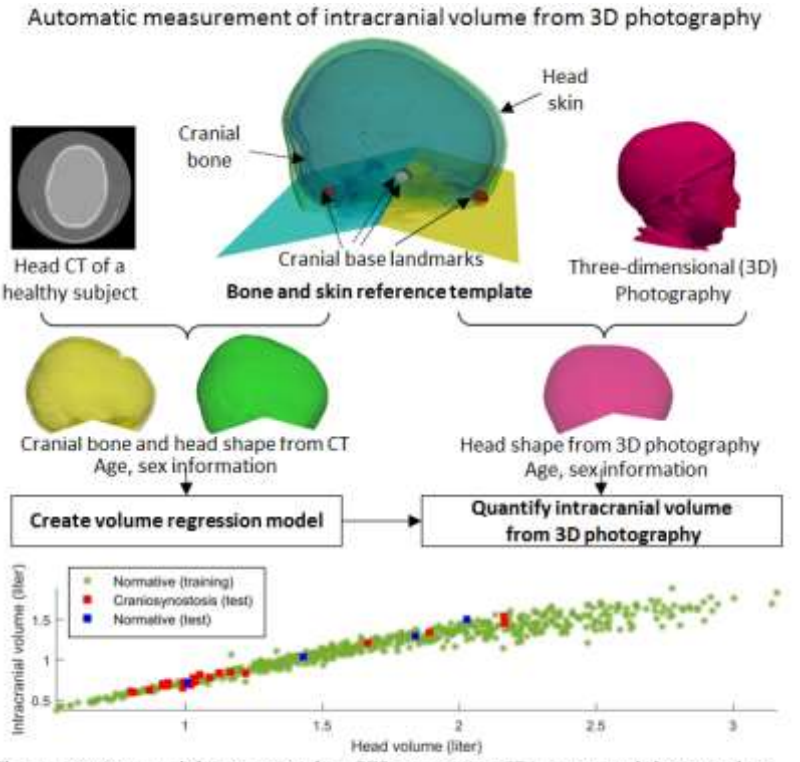
[1]Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National Health System, Washington DC, [2]Kitware Inc., Carrboro, [3]Division of Neurosurgery, [4]Division of Plastic and Reconstructive Surgery, Children's National Health System, [5]Departments of Radiology and Pediatrics, School of Medicine and Health Sciences, George Washington University, Washington DC, United States

Introduction & Objectives: Intracranial volume (ICV) is an important measurement to identify and evaluate cerebral growth abnormalities. ICV can be objectively quantified from computed tomography (CT) or magnetic resonance imaging (MRI) scans. However, CT involves radiation and MRI requires sedation or general anesthesia in young children. This study presents a radiation-free, reproducible, automatic, accurate method to measure ICV from three-dimensional (3D) photography, a fast and non-invasive imaging modality.

Material & Methods: A training dataset of retrospective head CT images was collected from 575 patients without known cranial pathology (average age 5 ± 5 years; range 0-16 years; 259 females and 316 males). A test dataset of retrospective pairs of head CTs and head 3D photographs was collected from 30 patients (average age 1 ± 3 years; range 0-9 years; 10 females and 20 males). 3D photographs were acquired using the 3dMDhead System, and were taken at an average of 10 ± 13 days from their corresponding CTs. We segmented the head skin and cranial bone from CTs and the cranial base was automatically identified via automated registration. The head volume and ICV above the cranial base were calculated from CTs to create a polynomial regression model with respect to the age and sex of the patients. Finally, the 3D photography of a patient was registered to a reference template to identify its cranial base and extract the head shape from which the head volume was calculated. The ICV was quantified using the regression model with the head volume from 3D photography, the age and sex information, and then compared to the ground truth from CT.

Results: The regression model estimated the ICV of the normative population from the head volume calculated from CT images with an average error of 3.76 ± 3.15% (p = 0.79) and a correlation (R^2) of 0.96. We obtained an average error of 4.07 ± 3.01% (p = 0.57) in estimating the ICV of the patients from 3D photography using the regression model.

Conclusion: 3D photography with image analysis provides measurement of ICV with clinically acceptable accuracy, thus offering a non-invasive, precise and reproducible method to evaluate cranial growth in young children.



The regression model was trained on 575 normative CT images and then used to quantify the ICV from 3D photography of a patient, also accounting for age and sex.

Disclosure of Interest: None Declared

17-1-006

TREATMENT OF HYDROCEPHALUS WITH VENTRICULO-PERITONEAL SHUNT ASSOCIATED WITH PREMATURE CRANIAL SUTURE FUSION

J. R. Bryant [1,*], E. Mantilla-Rivas [1], J. W. Chao [1], S. N. Magge [2], J. S. Myseros [2], C. Oluigbo [2], R. Keating [2], A. K. Oh [1], G. F. Rogers [1]

[1]Plastic and Reconstructive Surgery, [2]Neurosurgery, Childrens National Health System, Washington, DC, United States

Introduction & Objectives: Hydrocephalus during infancy is a relatively common condition, most frequently treated by cerebrospinal fluid diversion with ventriculoperitoneal (VP) shunting. Shunt-related craniosynostosis (SRC) has been reported with varying incidence in the literature. The effect of external forces on the etiology of craniosynostosis has been postulated, and decompressive forces resulting from alterations in CSF pressure may precipitate premature sutural fusion. We examined the incidence of secondary craniosynostosis after VP shunt placement for infantile hydrocephalus in order to investigate the underlying pathophysiology of SRC.

Material & Methods: We performed a retrospective review of 127 patients who underwent VP shunt for hydrocephalus in infancy, at a single institution. Demographic information, syndromic diagnoses, comorbidities, hydrocephalus etiology, timing of shunt placement, and necessity of shunt revisions were evaluated for each patient. Pre and post-operative computed tomography (CT) scans were evaluated for sutural fusion, ventricular size, and degree of ventricular decompression. A multivariate regression was performed to determine the association between these independent variables and the development of SRC.

Results: Sixty-three patients (49.6%) developed SRC within a median of 26 months after VP shunt placement. A total of 5 patients had a syndromic diagnosis, with only one (Pfeiffer syndrome) being associated with primary craniosynostosis. Older age at shunt placement and greater number of shunt revisions were found to be associated with the development of SRC. Gender, gestational age, syndromic diagnosis, degree of ventricle decompression, and etiology of hydrocephalus did not differ between the fused and non-fused groups. Whitin our cohort, 30 patients had single suture fusion, sagittal synostosis the most commonly involved. The remaining had multi-suture fusion. Over 50 % of theses patients had sagittal and bi-coronal synostosis.

Conclusion: The results of this study demonstrate that nearly 50% of patients who underwent VP shunt placement for a diagnosis of hydrocephalus in infancy developed SRC. This secondary fusion is often overlooked on routine CT interpretation and accurate diagnosis requires a high level of suspicion. Our findings support the important role that proper dural stimulation and expansion plays in maintaining cranial sutural patency. Disruption of these normal processes may be a significant factor in the development of nonsyndromic craniosynostosis, with the sagittal suture being most vulnerable to early secondary fusion.

Disclosure of Interest: None Declared

17-1-007

PRECISION MEDICINE FOR PATIENTS WITH POSITIONAL PLAGIOCEPHALY: A TOOL FOR PREDICTING ORTHOTIC HELMET TREATMENT OUTCOMES AND DURATION IN CLINIC

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Introduction & Objectives: With the initiation of the Back to Sleep campaign, the incidence of deformational plagiocephaly (DP) and brachycephaly (B) has drastically increased. Treatment for DP and/or B can involve repositioning or compliant orthotic helmet use. The purpose of this project was to develop an individualized predictive model for duration of helmet therapy for infants with deformational plagiocephaly or brachycephaly that may be used in clinic.
Material & Methods: This IRB–approved retrospective study reviewed records of children seen for abnormal head shape from 2007 to 2018. Measurement data were obtained from STARscanner images at their first visit and again at completion of helmet therapy were obtained from 541 patients. The predictors included in the model were: head circumference, cephalic ratio, oblique diameter difference (ODD), cranial vault asymmetry index (CVAI), duration of helmet therapy, gender, and age at both the start and end of treatment. A Multivariate Random Forest Model was developed using 441 patients in the training set. A five-fold cross-validation was performed to assess accuracy of prediction of head measurements with respect to the duration of helmet therapy.
Results: Our Multivariate Random Forest model can jointly predict all four head measurements accurately over any desired future time frame. The five-fold cross validation error of our model is more than twenty two percent lower than standard linear models. These results demonstrate that duration of helmet therapy can be accurately predicted using our smart machine learning method.
Conclusion: The incidence of DP and B has increased dramatically. Currently, practitioners have no objective means for reliably estimating the duration of orthotic helmet therapy based on age and severity at presentation. We have developed a model and an easy interface for real life application that can be used in a web-based platform by practitioners to obtain an accurate predicted trajectory of cranial growth to design personalized treatment protocols in real time. This resulting information can be used in combination with the practitioners expertise to educate and inform anxious families about the likely length of treatment and degree of improvement that may be expected for their individual child.

Disclosure of Interest: None Declared

17-1-008

LIMITS OF MEDICAL TREATMENT OF OSTEOPETROSIS AND ROLE OF SURGERY TO CONTROL ITS NEUROSURGICAL MANIFESTATIONS

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[1]French Referral Center for Craniosynostosis Université de Lyon Hôpital Femme Mère Enfant, [2]Neurochirurgie pédiatrique, Hôpital Femme Mère Enfant, [3]Service de l'Institut d'Hématologie et d'Oncologie Pédiatrique (IHOPe), [4]Service de Génétique, Hôpital Femme Mère Enfant, Lyon, France

Introduction & Objectives: Osteopetrosis is a heterogeneous group of rare congenital metabolic syndromes characterized by a defective osteoclastic activity. It can lead to complex synostosis but the skull base is also usually involved. Hydrocephalus, foramen magnum stenosis, ICA canal stenosis, tonsillar herniation, dural venous sinus stenosis may also be found. The most common neurological finding is visual loss with optic atrophy, as a result of optic nerve compression and demyelination due to the stenotic optic canal. Indeed, the association of the synostosis, the hydrocephalus and the optic canal stenosis put at great risk the visual prognosis.

Bone marrow transplantation (BMT) can be proposed in some form of osteopetrosis. However, its efficacy on the synostosis and on the overall visual prognosis is still unclear.

Here we present two cases of 2 years old boys with osteopetrosis treated by BMT that presented a complex synostosis, hydrocephalus and optic canal stenosis.

Material & Methods: The two boys arrived to the neurosurgeon attention presenting with severe optic atrophy at age of 1.5 and 2 years, respectively. Both children had a history of inbreeding in the family. A homozygous mutation of TCIRG1 in the first baby and one of SNX10 in the second baby were found. They also presented hydrocephalus and a cranial synostosis: left coronal suture in the first baby, metopic suture and left coronal suture in the second baby.

Results: After having treated the hydrocephalus by endoscopic third ventriculostomy in one case and ventriculoperitoneal shunt in the other, a successful bone marrow transplantation (BMT) could be performed but it was not effective to prevent the evolution to a pansynostosis in the second case. Thus in both children, a few months after the BMT, a cranial vault remodeling was needed together with an extensive bilateral extradural optic nerve decompression. Post-operative scans documented a good osseous canal decompression. The first baby developed a post-surgical right amblyopia, the other one stabilized his visual deficit, but no recovery was observed at 24 months follow-up.

Conclusion: Visual loss in osteopetrosis results from the association of several factors that need all to be treated. BMT cannot prevent the progression to a pansynostosis. In case of progressive visual loss in spite of the medical treatment an early surgical optic nerve decompression should be considered. The timing of each surgical and medical step should be discussed in a multidisciplinary team.

Disclosure of Interest: None Declared

17-1-009

POOR CORRELATION OF INTRACRANIAL PRESSURE MEASUREMENTS BETWEEN LUMBAR PUNCTURE AND INTRACRANIAL WIRE MONITORING

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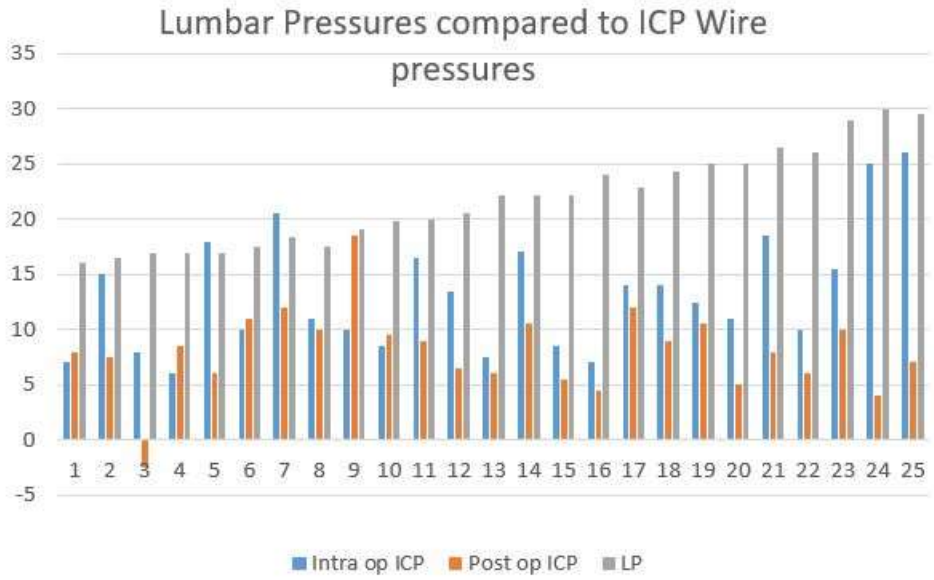
Introduction & Objectives: Patients with craniosynostosis will often undergo evaluation for cranial volume and concern for raised intracranial pressure (ICP). Lumbar puncture has long been considered a reliable method of measuring ICP. The development of the intraparenchymal pressure monitor calls the accuracy of those measurements into question. The effects of general anesthesia on LP opening pressures should not be underestimated. The flurane anesthetics, ketamine, patient's BMI, and elevated end-tidal CO2 have all been found to increase ICP.

Material & Methods: An IRB-approved retrospective review of all patients who had undergone ICP wire placement and also had prior LP measurements between 2012 and 2017 was carried out. Lumbar puncture, ICP wire pressures and end-tidal CO2 measurements were recorded.

Results: Twenty-five patients met inclusion criteria. The majority of patients were undergoing workup for chronic headache or idiopathic intracranial hypertension. Preoperative LP opening pressures were recorded in cm H2O and converted to mm Hg for comparative analysis. Mean LP opening pressure was 21.9mm Hg (Range 16-37 mmHg). Intraoperative mean ICP measured via wire was 13.2 mmHg (Range 6-26 mmHg), and postoperative mean ICP measured via wire was 8.1 mmHg (Range -2.5 to 18.5 mmHg). Results of a paired t-test demonstrated that both LP opening pressures and intraoperative ICP measurements were significantly higher by 14 and 5 points, respectively, compared to postoperative ICP measurements ($p<0.001$). End-tidal CO2 was not found to significantly correlate with intraoperative ICP ($p=0.515$).

Conclusion: Lumbar puncture pressure was not an accurate measurement of intracranial pressure in our series. As physicians often incorrectly use mmHg and cm H2O interchangeably, the discrepancy in using cm H2O for lumbar puncture and using mmHg for ICP should be accounted for by conversion to the same units for comparison. Anesthetic protocols should avoid inhalational agents and ketamine. Interventions, such as shunting, cranial vault remodeling, or medication management, should be undertaken with caution if LP measurement is the only available estimate of ICP.



Disclosure of Interest: None Declared

DAY17 - STATION 2 - SYNDROMIC CRANIOSYNOSTOSIS

17-2-010

NUMERICAL MODELLING TO ASSESS THE EFFECT OF SURGICAL PARAMETERS IN SPRING-ASSISTED POSTERIOR VAULT EXPANSION

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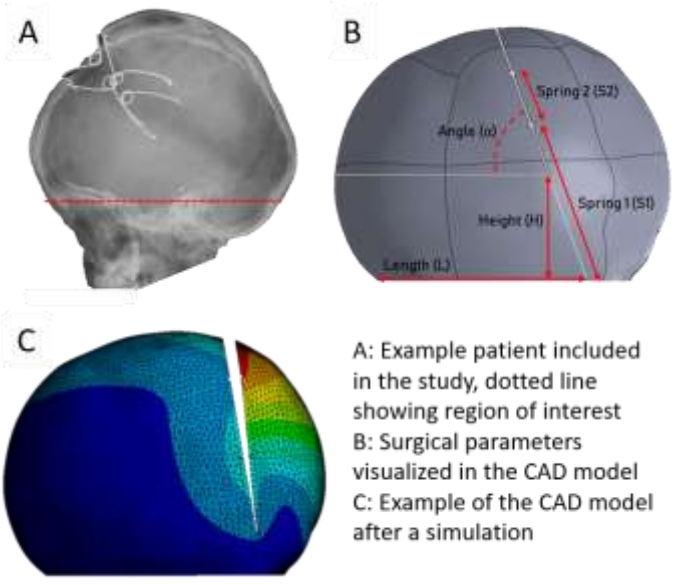
Introduction & Objectives: Surgical parameters of spring-assisted posterior vault expansion (PVE) are selected at the time of surgery and can vary substantially between patients. This poses a limit to preoperative planning. In this study we used a combined approach of statistical shape modelling (SSM) and finite element modelling to assess the effect of spring cranioplasty on an average, preoperative skull model: spring cranioplasty was virtually performed and surgical parameters were correlated with outcome variables such as increase in intracranial volume (ΔICV) and change in cranial index (ΔCI%).

Material & Methods: Preoperative CT-images of 41 PVE patients (age= 2.2±1.7 years) were retrospectively collected. Skull 3D meshes were extracted and consistently processed: a plane passing through the nasion and the upper border of the auditory canal was used to cut each skull and used as reference. Skull thickness was measured for each patient. Osteotomy location in relation to the plane (distance L, height H, angle α) as well as location of the springs along the osteotomy line (lower spring S1, higher spring S2) were measured from post-operative CT and x-rays, normalised as a percentage of the patient's dimensions and averaged. An average skull model (template) was created using SSM. A computer-aided design (CAD) model was created from the template with the average population thickness; osteotomy and spring locations were simulated using average values of surgical parameters and varied in the range mean±SD. Three models of springs (S10, S12 and S14) with increasing stiffness were simulated in all symmetrical combinations with two springs on either side.

Results: Principal component analysis showed that the first 10 principal components represent 79% of the calvarial shape variability in the model with the first statistical component having significant correlation with ICV, CI and age. Template CI was 85% and ICV 1192 cm^3. Average skull thickness was 2.9mm. Surgical parameters were L=91±16%, H=30±12%, α =63±18°, S1=50±7% and S2=32±14%. Optimal expansion was achieved with L=108%, H=17% and α=81° (ΔCI=4%, ΔICV=5%). Both springs positioned high (S1=56%, S2=46%; ΔCI=1%, ΔICV=1%) and all springs S14 showed most expansion (ΔCI=1%, ΔICV=1%).

Conclusion: In this study, we created a method of simulating spring forces for PVE-procedures and analysed principal components and surgical parameters for a population-averaged model. Pre-operatively, PVE patients differ considerably in shape, volume and size. Optimal outcomes are achieved with a posterior, caudal osteotomy and an outfacing angle. Osteotomy location has a higher impact than spring- choice and placement.



A: Example patient included in the study, dotted line showing region of interest
B: Surgical parameters visualized in the CAD model
C: Example of the CAD model after a simulation

Disclosure of Interest: None Declared

17-2-011

FRONTO-FACIAL MONOBLOC: A RARE CASE OF CENTROFACIAL MIXOMA

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Introduction & Objectives: Facial myxoma is a rare benign mesenchymal lesion. Rare cases of cutaneous localization of this tumor have been described in soft tissues of the face; we present unusual localization that mimic cystic facial lesions having different origins.
Material & Methods: The A.G patient came to our observation at the age of 4 years with difficulty in breathing the nasal and alteration of the right eye visus dx. The CT and MRI showed voluminous centrofacial mass destructing the maxillary, the nasal cavities, the orbital cavities and the basicranium with compression of the right optic nerve. In order to establish the therapeutic plan, the patient underwent general biopsy of the lesion under general anesthesia. Histological examination of the trans-oral biopsy depended for "odontogenic mixoma". For this reason, the patient underwent combined neurosurgical surgery with a trans-cranial approach using a monoblock osteotomy. In the post-operative period, the patient presented right leg motor difficulties due to arachnoiditis and dehiscence of the frontal flap resolved by subsequent surgery of temporal muscle rotation and skin grafting.
Results: Currently the patient is disease-free. In 2017, the patient underwent surgery to reconstruct frontal cranial ounces with bone chips and platelet gel.
Conclusion: The use of the monoblock osteotomy has allowed ample surgical visibility, allowing the radical removal of the mass preserving as much as possible the snow and vascular structures.

Disclosure of Interest: None Declared

17-2-012

SAND DOLLAR AND STAVES TECHNIQUE: A NOVEL APPROACH TO TREATING UNILATERAL LAMBDOID CRANIOSYNOSTOSIS

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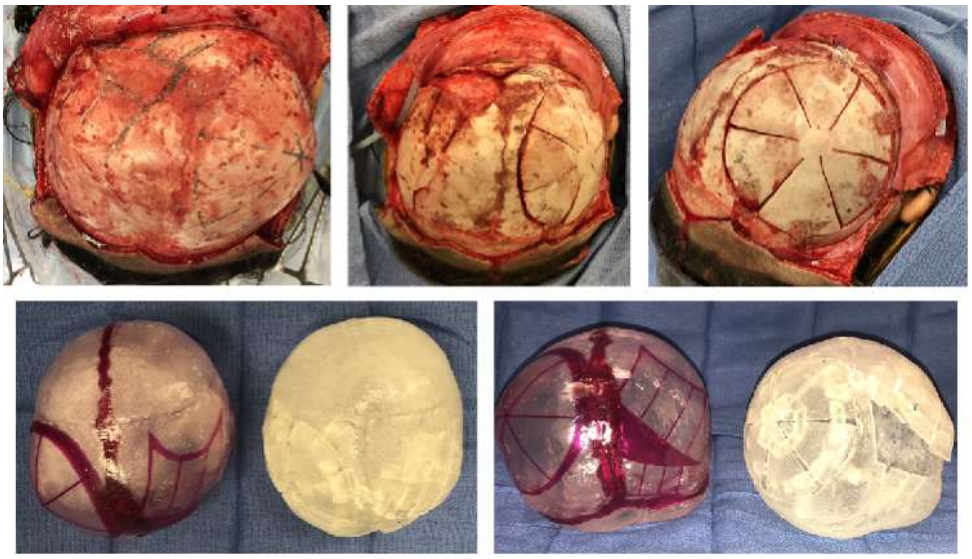
Introduction & Objectives: Lambdoid craniosynostosis is the rarest form of single suture craniosynostosis occurring in 1-4% of isolated cases. These patients often present with occipital flattening and a mastoid bulge on the ipsilateral side and a skull base tilted toward the affected side. Historically, treatment of lambdoid CS has posed a challenge because procedures such as transposition of occipital bone flaps and occipital advancement not only ultimately provide a less than ideal result but also are associated to the morbidity of a posterior cranial remodeling. We propose a novel "Sand Dollar and Staves" technique for improved postoperative results with less morbidity.

Material & Methods: Three patients (ages 10 to 17 months) with true unilateral lambdoid craniosynostosis were treated by our craniofacial team at Texas Children's Hospital using the following technique executed by our senior authors. Virtual surgical planning was utilized in all three cases. In the prone position, a coronal incision is made to expose the posterior calvarium and a posteriorly based pericranial flap is elevated. Suturectomy of the synostosis and barrel staves are performed to correct occipital flattening and allow expansion. A large circle cut out is planned and centered over the area of maximal projection overlying the bulge on the contralateral side. This is positioned between the open lambdoid and coronal sutures. Using a 3D guide, the circular piece is given the appearance of a sand dollar when barrel staved in a radial fashion leaving the center intact. This disk was then flattened, excess bone trimmed, and fixated back onto the calvarium using an absorbable plating system. When the flattened disk is fixated and gentle pressure is applied, compensatory filling of the suturectomy side with barrel staves occurs. A drain is placed, the pericranial flap redraped over the entire construct and the scalp closed.

Results: This technique revealed significant improvement of head shape through photographic analysis with decreased operative time and blood loss compared to previous experiences at our institution and literature reports. Additionally, there is no violation of open sutures, therefore virtual no risk of secondary synostosis. Finally, our families have been very satisfied with our short-term results to this point.

Conclusion: Lambdoid craniosynostosis remains difficult to treat and traditional reconstructive techniques have yielded results with significant room for improvement. One of the main challenges is the involvement of the cranial base which is not fully addressed. The "Sand Dollar and Staves" technique proposed has resulted in improved postoperative results with a shorter operative length, less blood loss and no violation of normal sutures, therefore decreased risk to the patient.



Disclosure of Interest: None Declared

17-2-013-N / 17-12-107

VIRTUAL COMPUTER PLANNING IN CRANIOFACIAL SURGERY: AN ANALYSIS OF 5 YEARS

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Introduction & Objectives: Virtual computer-based planning (VCP) in orthognathic surgery has revolutionized this speciality a lot. It avoids errors through the use of direct patient-related three-dimensional imaging data. It seems obvious that VCP will benefit our patients with craniofacial anomalies. The aim of this retrospective analysis is to monitor the precision of the patients specific implants and to evaluate per-operative handling and clinical outcome in the surgical correction of craniofacial anomalies.

Material & Methods: From Jan. 2017 to Jan 2019 all osteotomies in patients with craniofacial anomalies were planned using VCP. Planning of the movements was conducted by the same surgeons together with lab engineers from our department. Planning was further conducted together with our industrial partner to plan and fabricate the patient specific guides and plates. The precision of the products and clinical outcome were analysed. With an overlay technique the VCP was compared with the post-op scan.

Results: Fifteen patients (6 males and 9 females) with various diagnosis (craniofrontonasal dysplasia, Crouzon, Apert, Treacher Collins) undergoing bimaxillary orthognathic surgery (8), malar osteotomy (4), hypertelorism correction (1), TMJ replacement and bimaxillary surgery/distraction (2) participated in this retrospective study. In all cases the precision of the guides and plates was adequate and according to preoperative planning. All plates could be used and fitted correctly. Satisfactory facial contour and occlusion were achieved with the combination of orthognathic and orthodontic treatment. Postoperative examination results showed that VCP was accurately transferred into actual surgery. Overall the clinical outcome was satisfactory.

Conclusion: In conclusion, this study indicates that computer-based planning should be considered as an advantageous alternative in traditional orthognathic surgery planning

Disclosure of Interest: None Declared

17-2-014

COMPARATIVE ANALYSIS OF OUTCOMES BETWEEN SURGICAL APPROACHES TO LAMBDOID CRANIOSYNOSTOSIS

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Introduction & Objectives: Lambdoid Synostosis (LS) is the premature fusion of one (unilateral) or both (bilateral) lambdoid suture(s). It is the least common form of craniosynostosis (CS), with unilateral LS occurring in about 1 – 3% of single synostoses, or 1 in 40,000 births. The primary goal of surgical intervention in LS is for normal brain growth free of elevated intracranial pressure, with the secondary goal of craniofacial symmetry. Two surgical approaches are often employed to restructure the cranium: open (i.e., cranial vault remodeling) and closed (i.e., endoscopic suturectomy with helmet therapy). Relative to the more common types of craniosynostosis, very little has been published on the surgical outcomes of these two procedures in the treatment of LS. To this end, we conducted a comparative analysis of LS patients who either underwent an open or closed approach and their respective outcomes.

Material & Methods: We conducted a retrospective consecutive case-series study from a large single-institutional database of CS patients seen between 2000 and 2018. LS patients (confirmed by CT and operating surgeon) who underwent surgical correction were eligible for inclusion. Cranial growth was measured in head circumference percentile and z-score.

Results: A total of 19 patients with isolated LS were identified from 1,275 CS patients over a 19 year period. There were 11 males, 8 with isolated right-sided LS, none with isolated bilateral LS. Six underwent CVR, while 13 underwent ES. No statistical significance was noted between CVR and ESR groups with respect to suture involvement, sex, and length of available follow-up data. Age at initial presentation and of operation were significantly less for ES, averaging 3.27 and 3.88 months of age respectively, while CVR tended to present later at 11.12 months, undergoing treatment at 11.68 months of age ($p = 0.0002$, $p = 0.0007$ respectively)(**Table 1**). Helmet duration in the ES group averaged 7.03 months (median: 5.9, range: 4 – 20) and average age of helmet discontinuation was 11.13 months (median: 10, range: 7.6 – 25.5). All ES patients were helmeted for at least 4 months. Operative (191 v. 54 mins) and anesthesia (301 v. 143 mins) time, estimated blood loss (194 v. 25ml), and both ICU (0.80 v. 0.15) and total hospital (3.17 v. 1.23) days were significantly less in ES (all p values < 0.05) (**Table 2**). No statistical significance was observed in preoperative and postoperative head circumference percentiles or z-scores between the CVR and ES groups up to 12 months postoperatively (**Table 3**).

Conclusion: This work not only represents the largest population of LS patients treated with ES, but highlights ES as an important surgical approach for nonsyndromic LS with lower operative times, blood loss, total hospital stay and comparable cranial outcomes to CVR.

Disclosure of Interest: None Declared

Picture for abstract 17-2-014 :

Table 1. Patient Characteristics by Surgical Intervention

Characteristics	CVR (n=6)	ES (n=13)	p value
Age at presentation	11.12 ± 0.85	3.27 ± 1.21	0.0002
Age at operation	11.68 ± 0.93	3.88 ± 1.36	0.0007
Duration of helmet therapy	-	7.03 ± 4.30	-
Age of helmet discontinuation	-	11.13 ± 4.62	-

Data presented as mean in months ± standard deviation, unless otherwise indicated
CVR = cranial vault remodeling, ES = endoscopic suturectomy, mos = months, SD = standard deviation

Table 2. Mean Perioperative Outcomes by Surgical Intervention

Perioperative Outcomes	CVR (n=4)	ES (n=13)	p value
Operative time, mins	191.25 ± 72.5	53.85 ± 8.38	0.0038
Estimated blood loss, ml	193.75 ± 65.75	25.38 ± 23.58	0.0042
ICU length of stay, days*	0.80 ± 0.45	0.15 ± 0.55	0.0083
Total hospital length of stay, days**	3.17 ± 0.75	1.23 ± 0.60	0.0005

Data presented as mean ± standard deviation, unless otherwise indicated
CVR = cranial vault remodeling, ES = endoscopic suturectomy, ICU = intensive care unit, mins = minutes, ml = milliliters
*based on 5 CVR Patients **based on 6 CVR patients

Table 3. Head Circumference Percentiles and Z-Scores by Surgical Intervention at Various Time Intervals

Time Interval	All (HCP)	CVR (HCP)	ES (HCP)	p value (HCP)*
Preoperative, CVR (n=5), ES (n=11)	65.57 ± 35.19 (1.3-99.8)	41.73 ± 35.54 (4.4-90.7)	76.40 ± 30.65 (1.3-99.8)	0.1023
Postoperative 1 month, CVR (n=2), ES (n=10)	90.56 ± 11.63 (67.4-100)	83.15 ± 22.32 (67.4-98.9)	92.04 ± 9.76 (71.6-100)	0.6730
Postoperative 6 months, CVR (n=2), ES (n=9)	85.53 ± 13.17 (54.4-100)	73.15 ± 26.55 (54.4-91.9)	88.28 ± 9.05 (75.8-100)	0.5666
Postoperative 12 months, CVR (n=2), ES (n=9)	83.13 ± 28.60 (1.2-100)	84.88 ± 6.96 (80.0-89.8)	82.74 ± 31.86 (1.2-100)	0.8598

Data presented as mean ± standard deviation, unless otherwise indicated
*p-value comparing CVR and ES at each time interval
**Unpaired homoscedastic 2-tailed Student's t-test
CVR = cranial vault remodeling, ES = endoscopic suturectomy, HCP = head circumference percentile, Z = Z-Score

17-2-015

A RARE SYNDROMIC CAUSE OF CRANIOSYNOSTOSIS- A REPORT OF A CASE AND REVIEW OF THE LITERATURE

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Introduction & Objectives: Zhu-Tokita-Takenouchi-Kim Syndrome (ZTTK) is a very rare condition caused by a heterozygous mutation on chromosome 21q22.

It is a syndrome with severe multi-system effects, and has craniosynostosis as part of its phenotype.

We intend to describe two cases, detailing their craniofacial anomalies and extra-cranial effects, and review the literature to further inform the community on this newly described syndrome.

Material & Methods: Case one was referred from Paediatrics to the Supra-regional Craniofacial Service at Alder Hey Hospital with a left sided unicoronal craniosynostosis.

Initial microarray was normal.

They had an MRI and CT scan as part of their work-up and had no Chiari malformation and no other spinal abnormality.

They did have global developmental delay, severe epilepsy, bilateral periventricular nodular heterotopia and a multicystic dysplastic left kidney.

They were gastrostomy fed and had joint hypermobility.

They underwent a Fronto-orbital advancement and remodelling age 12 months in line with our local protocol for unicoronal synostosis and had an unremarkable post surgical recovery.

Case two was referred at 5 months of age with trigonocephaly, which was felt to be isolated at that time.They underwent fronto-orbital advancement and remodelling aged 1 year.

At follow-up he had speech delay, hyper mobility and had a normal microarray. Toilet training was challenging.

At further follow-up he had significant mid facial hypoplasia and class 3 dental relationship, and a sub-mucous cleft, which was operated on.

Results: A review of the literature reveals that out of a total of 27 other cases reported in the literature, 3 cases had previously been reported as having craniosynostosis- one metopic and two sagittal cases.

This is the first case of a unicoronal synostosis, and a second case of metopic synostosis.

Our cases had other features which were typical, including hypotonia, global developmental delay and need for gastrostomy, though our second case seemed generally less severely affected extra-cranially. They did however have significant mid facial hypoplasia, which is not commonly described.

Conclusion: With the rapid development of rapid gene sequencing in clinical practice, new genes associated with craniosynostosis are being described with increasing frequency.

Our cases have the first associated with ZTTK to have a unicoronal synostosis, and the second with a metopic synostosis.

There are now 5 cases of ZTTK with craniosynostosis in the literature out of 29 cases described so far, giving a one in six incidence.

Disclosure of Interest: None Declared

17-2-016

SPORTING ACTIVITY AFTER CRANIOSYNOSTOSIS SURGERY IN CHILDREN: A SOURCE OF PARENTAL ANXIETY

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[1]Medical School, University College London, [2]Craniofacial Unit, Great Ormond Street Hospital, [3]GOS Institute of Child Health, University College London, London, United Kingdom

Introduction & Objectives: Surgical repair of craniosynostosis requires major surgery on the skull vault in early childhood. We noted that parents of operated children expressed anxiety at follow-up appointments about sporting activity and a perceived increased risk of surgery. Despite this common concern there is no published data regarding sporting activity following craniosynostosis repair. We undertook a study to examine parental anxiety and experience of sporting activity in this patient group.

Material & Methods: Parents of children who had undergone craniosynostosis surgery were contacted either via mail or by being approached in outpatient clinic. An electronic survey was filled in using Google Forms and consisted of multiple choice questions and 5 point Likert scales. Anonymized data was collated and analyzed.

Results: 100 parents were approached, with 59 responses (20 via mail, 39 in clinic). Response rate was higher in person compared to mail (83% v 20%). The most frequent diagnosis was non-syndromic sagittal synostosis (18/59), the cohort also included unicoronal, metopic, bicoronal and syndromic (Crouzon, Muenke, Pfeiffer and Apert) synostosis. Children had undergone the following surgeries: fronto-orbital remodeling (13), spring assisted cranioplasty (13), frontofacial distraction (3), posterior vault expansion (3), total calvarial remodeling (2) and others (3). The mean age at time of survey was 8 years (range 1-22 years). 41 of 59 patients were currently involved in sports at some level. Of the 18 that were not undertaking sporting activity, 15 were too young (<4 years). 1 patient specified that they had been advised by medical professionals to avoid sports. Sports were categorized as non-contact (e.g. gymnastics), light contact (e.g. soccer), heavy contact (e.g. rugby) and combat (e.g. boxing). There were incremental increases in parental anxiety as the level of contact in sports increase (Likert 1.7/5 vs 3.6/5) for non-contact and combat sports respectively. 29/59 of had received post surgical advice regarding sporting activity. 16 of 30 participants who did not receive post surgical advice on sporting activity commented they would like to receive this information. 3 parents reported that their children had sustained head injuries during sporting activity, none of which had resulted in lasting problems or required surgical treatment.

Conclusion: Little research or information exists regarding sporting activity for children after craniosynostosis surgery. This study suggests parental anxiety remains high, particularly for high impact and combat sports, and that parents would like more information from clinicians about the safety of post-operative sporting activities.

Disclosure of Interest: None Declared

17-2-017-N / 19-1-222

ANALYSIS OF ADVERSE POSTOPERATIVE OUTCOMES AFTER CRANIOSYNOSTOSIS SURGERY

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Introduction & Objectives: Due to the highly invasive nature of craniosynostosis surgery, it is common practice in the United States to admit patients to an intensive care unit (ICU) post-operatively before being transitioned to a lower acuity setting or discharged. As a result, the hospital costs associated with surgical repair of CS can quickly become sizeable. The objective of this study is to determine how ICU admission after CS surgery improves quality of care, and conversely, how ICU deferral might negatively impact care in this population. We determine the frequency of post-operative events necessitating ICU level care after CS repair and identify the patient characteristics and variables associated with these post-operative events.

Material & Methods: A retrospective cohort study was conducted at a large tertiary referral hospital on all pediatric patients born between January 2010 and May 2016 undergoing cranial vault surgery for craniosynostosis. Patient demographics, perinatal history, type of craniosynostosis, type of repair, intraoperative and post-operative course were recorded and analyzed. Post-operative adverse events were reviewed and deemed significant by a panel of 5 blinded physicians. Statistical analysis was then conducted to determine variables associated with significant post-operative events.

Results: A total of 126 patients undergoing 136 separate procedures met the inclusion criteria for this study. The most commonly affected sutures included the unicoronal (36.6%) and sagittal (36%) sutures. Patients had an average stay of 1.57 ± 1.11 days in the ICU. One hundred fourteen postoperative events were identified with only fifteen of those events determined to be significant by the physician panel ($p < 0.0005$). These included 9 cardiorespiratory events, 3 non-surgical-site infections, 2 hematologic events, and 2 seizures. Both the number of affected sutures ($p = 0.004$) and procedure length ($p = 0.039$) were found to be predictive of postoperative complications. Patient demographics such as weight at birth, age at surgery, weight at surgery, ASA rating, perioperative RBCs/weight (kg), and estimated perioperative blood loss were not significantly associated with postoperative events.

Conclusion: This study identifies significant post-operative events and the patient variables associated with these events after craniosynostosis surgery. Longer surgeries, poor pre-operative health and fitness, and more severe disease may all contribute to significant post-operative events warranting ICU admission. By understanding the variables associated with significant post-operative events, physicians can better individualize the post-operative course for CS patients to provide safer and more efficient care.

Disclosure of Interest: None Declared

17-2-018

MANAGEMENT OF CHIARI MALFORMATION IN SYNDROMIC CRANIOSYNOSTOSIS: EFFICACY OF CRANIAL EXPANSION SURGERY

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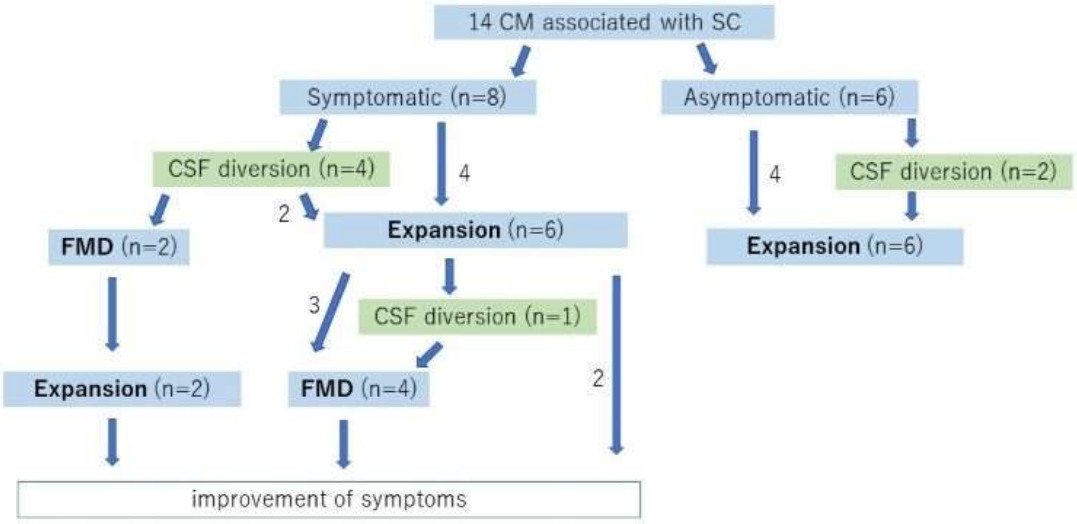
Introduction & Objectives: Although association of Chiari malformation (CM) and syndromic craniosynostosis (SC) is well-recognized, its management remains controversial. Whether foramen magnum decompression (FMD) should be conducted in addition to cranial expansion surgery, and in such case, when would be the appropriate timing are still unclear. Here, we retrospectively reviewed the clinical data at our institution to investigate the optimal management of CM associated with SC.
Material & Methods: Clinical data of 163 children with craniosynostosis who underwent surgical treatment at National Center for Child Health and Development between April 2002 and May 2018 were retrospectively analyzed.
Results: Twelve out of 119 children (10%) with non-syndromic craniosynostosis (NSC) and 14 out of 44 children (31.8%) with SC were radiologically diagnosed with CM. Median age at which CM was radiologically diagnosed was 7 months. Out of the 14 SC cases with CM, 8 (57.1%) had central sleep apnea. For symptomatic CM, cranial expansion surgery alone was conducted in 2 cases, FMD was conducted after cranial expansion in 4 cases, and FMD was conducted first and additional expansion surgery was conducted in 2 cases; in all cases, symptoms of CM improved after completing these series of surgeries. Regarding asymptomatic CM, cranial expansion surgery alone was performed and none of them showed symptoms of CM thereafter.
Conclusion: FMD was necessary in 75% of patients with symptomatic CM associated with SC in order to improve the symptoms. In 25% of patients, the symptoms of CM improved by cranial expansion surgery alone. It is considered that cranial expansion surgery had better be performed as the first treatment.

Picture 1:



Disclosure of Interest: None Declared

DAY17 - STATION 3 - CRANIOSYNOSTOSIS/SAGITTAL

17-3-019

A CRANIOMETRIC ANALYSIS OF CRANIAL BASE AND CRANIAL VAULT DIFFERENCES IN PATIENTS WITH SAGITTAL SYNOSTOSIS

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Introduction & Objectives: The emergence of newer, more powerful analytic technologies has allowed for more accurate 2 and 3-dimentional segmentation and measurements of stacked CT data. Craniofacial Surgeons have utilized this technology previously to perform detailed craniometric analysis of metopic, unicoronal, and bicoronal craniosynostosis patients, demonstrating statistically significant differences in craniometric angles and distances-from-midline measurements. We hypothesize that performing the same craniometric analysis of patients with sagittal synostosis will show significant, objective differences when compared to unaffected controls.

Material & Methods:

A retrospective case-controlled cohort analysis of patients with non-syndromic sagittal synostosis was performed. Computer tomography scans of the head were analyzed using Mimics (Materialise; Leuven, Belgium) to calculate craniometric angles, distances from midline, and cranial index. Mean measurements based on laterality were compared for each group. Absolute differences in measurements based on laterality were calculated, and averages were compared between groups. Statistical analysis was computed using Kruskal-Wallis, Wilcoxon rank sum, and paired t-tests.

Results: Twenty-two patients with non-syndromic craniosynostosis and 19 controls were identified. Cranial indices, nine landmarks from midline, and six intracranial angles were measured. Most distances and angles demonstrated no difference from controls. The Petrous Ridge Angles (PRA) were significantly larger in the sagittal group compared to control (P=0.002, P=0.0187). The Interoccipital Angles (IOC) and the Right and Left Euryon to Zygomaticofrontal suture Angles (Ezf) were significantly more acute (P=<0.001, P=0.0022, P=0.0041, respectively). Not surprisingly, the Cranial Index was significantly smaller (P=0.0001). There was no significant transverse lateralization of skull base structures relative to midline as seen with metopic and unicoronal synostosis, and the cranial base deformity was relatively symmetric around the sagittal plane.

Conclusion: Our study provides a true, objective craniometric analysis of the cranial vault and endocranial base in patients with sagittal synostosis. While there is no significant transverse lateralization of structures of the anterior skull base relative to midline, there are significant, symmetric, differences in craniometric angles including IOA, EzFA, and PRA. Further investigation is needed to determine the volumetric implications of these findings, as well as the implications of cranial vault remodeling on cranial base dimensions.

Disclosure of Interest: None Declared

17-3-020

OBJECTIVE OUTCOMES IN SAGITTAL CRANIOSYNOSTOSIS: A COMPARISON OF THREE TECHNIQUES PERFORMED AT DIFFERENT AGES

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Introduction & Objectives: Sagittal craniosynostosis is the most common form of craniosynostosis. A number of techniques have benn developed for the management of this condition. The aim of this study was to compare the outcome of three different techniques that have been performed by the Paris group with the vision to compare various techniques in a multicentre study.

Material & Methods: Patients with nonsyndromic isolated sagittal synostosis with complete preoperative (n=46) and postoperative (n=36 during the first year of follow-up, n=18 between one and five years of follow-up and n=8 after five years) CT data were included here. Twenty-five patients were operated between 4-6 months of age; 14 H craniotomy and 11 modified H craniotomy. Twenty-one were operated after 6 months of age; 11 H craniotomy and 10 total vault remodelling (TVR). An image processing software was used to quantify various parameters on all cases including skull length, width, circumference, intracranial volume and cephalic index (CI) with CI data being reported here. One-way analysis of variance (ANOVA) was carried out. The signifiance level was set at $p<0.05$.

Results: Comparing the preoperative and postoperative CT data, CI was increase by 6.5% and 3.2% respectively in the patients operated between 4-6 months and those operated after 6 months. However, there was no-statistically significant difference between the postoperative CI of any of the groups. Considering the low number of follow up data per groups in this study no statistical analysis was performed on the follow up data however no consistent pattern of relapse was present in any of the groups.

Conclusion: Considering the techniques investigated in this study, it was found that CI was higher during the first year after surgery for patients operated before 6 months of age but this was not statistically significant and requires further investigation. Further investigations are ongoing part of this study to compare the treatment techniques for sagittal synostosis in a multicentre study.

Disclosure of Interest: None Declared

17-3-021

COMPARISON OF INTRACRANIAL VOLUME AND CEPHALIC INDEX AFTER CORRECTION OF SAGITTAL SYNOSTOSIS WITH EITHER TWO OR THREE SPRINGS

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Introduction & Objectives: Correction of sagittal synostosis is currently performed with several different surgical techniques. The aim of the present study was to compare the correction in patients with sagittal synostosis who had undergone craniotomy combined with either two or three springs.

Material & Methods: All patients who had undergone surgical correction for isolated sagittal synostosis with midline craniotomy combined with two or three springs between 2008 and the end of 2014 were included. All patients had undergone a CT examination preoperatively (at approximately five months of age) and postoperatively (at three years of age). Intracranial volume was measured using a semi-automatic MATLAB program. Cephalic index was calculated as the width/length of the skull.

Results: A total of 115 patients were included, 57 patients had been operated with two springs and 58 patients with three springs. Craniotomy combined with two springs increased the intracranial volume from 790 ± 11 ml (mean ± SD) to 1292 ± 18 ml. The cephalic index increased from 72.4 ± 4.3 to 74.5 ± 4.4. Craniotomy combined with three springs increased the intracranial volume from 777 ± 13 ml to 1280 ± 14 ml and the cephalic index from 71.0 ± 4.8 to 74.8 ± 3.8.

Conclusion: Craniotomy combined with two or three springs were equally effective in correcting sagittal synostosis.

Disclosure of Interest: None Declared

17-3-022

CHANGES IN HEAD SHAPE OVER TIME AFTER ENDOSCOPIC STRIP CRANIECTOMY FOR SAGITTAL CRANIOSYNOSTOSIS

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Introduction & Objectives: Endoscopic strip craniectomy has become a relatively common treatment for nonsyndromic sagittal craniosynostosis. Cranial index (CI), while imperfect, has been used as a gross measure of scaphocephaly before and after surgery. After surgery, changes in head shape are gradual, and regression in head shape can also occur. The purpose of this study was to examine changes in cranial index and head shape that happen over time after endoscopic strip craniectomy, and to examine long term changes. CI and 3D photography were used to examine head shape.

Material & Methods: This was a retrospective study, examining patients at Childrens National Health System in Washington, DC, with nonsyndromic sagittal craniosynostosis, who were treated with endoscopic strip craniectomy. CI measurements were followed preoperatively and postoperatively and analyzed for changes over time. On a subset of patients, 3D photographs (3DMD) were analyzed with specialized software to quantify normalization of head shape after surgery.

Results: There were 75 patients with nonsyndromic sagittal craniosynostosis who were treated with endoscopic strip craniectomy. Mean age at surgery was 3.4 months, mean surgical time was 74 minutes, and mean estimated blood loss was 33cc. Mean preoperative CI was 0.69 (75 patients). Overall followup CI (for patients with more than 1 year followup) was 0.77 (61 patients with mean followup 2.3 years). In order to examine changes in mean CI over time after surgery, the patients were subdivided by age at followup (there were fewer patients with longer followup time). At one year of age, mean CI improved to 0.79 (66 patients). At 2 years of age, mean CI was 0.77 (34 patients). At 3 years of age, mean CI was 0.76 (20 patients). At 4 years of age, mean CI was 0.77 (5 patients). At 5 years of age, mean CI was 0.75 (5 patients). At 6 years of age, mean CI was 0.75 (2 patients).

Since CI is an imperfect measure of head shape, 3D photographs (3DMD) were taken on a subset of patients. Analysis showed significant normalization of head shape over time.

Conclusion: In our series, mean CI improved from 0.69 (preop) to 0.77 at a mean followup of 2.3 years. When patients are subdivided by age, peak improvement is at 1 year of age, followed by modest regression, and then relative stability out to 6 years of followup. Analysis of 3D photographs showed significant normalization of head shape over time. Further studies are needed with more patients and longer followup.

Disclosure of Interest: None Declared

17-3-023

ORBITAL SHAPE IN ADULT SCAPHOCEPHALY: A CONTROLLED 3D ASSESSMENT

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Introduction & Objectives: In this controlled study, we investigated the 3D shape of the orbital inner mould and the orbital volume in adult non-operated scaphocephaly - the most common type of craniosynostosis - and in various types of intentional deformations using dedicated morphometric methods. The skulls were sampled from the collections of the Muséum national d'Histoire naturelle, Paris and were dry specimen from the XVIIIth and XIXth century.
Material & Methods: CT scans were performed on 32 adult skulls with intentional deformations, 21 adult skull with scaphocephaly and 17 non-deformed adult skulls from the collections of the in Paris, France. The intentional deformations group included six skulls with Toulouse deformations, eight skulls with circumferential deformations and 18 skulls with antero-posterior deformations. Mean shape models were generated based on a semi-automatic segmentation technique. Orbits were then aligned and compared qualitatively and quantitatively using colour-coded distance maps and by computing the mean absolute distance, the Hausdorff distance, and the Dice similarity coefficient. Orbital symmetry was assessed after mirroring, superimposition and Dice similarity coefficient computation.
Results: We showed that orbital shapes were significantly and symmetrically modified in scaphocephaly and in intentional deformations compared with non-deformed control skulls. Antero-posterior and circumferential deformations demonstrated a similar and severe orbital deformation pattern resulting in significantly smaller orbital volumes. Scaphocephaly and Toulouse deformations had similar deformation patterns but had no effect on orbital volumes.
Conclusion: This study showed that scaphocephaly and intentional deformations significantly interact with orbital growth. Our approach was nevertheless not sufficient to identify specific modifications caused by scaphocephaly and by skull deformations.

Disclosure of Interest: None Declared

17-3-024

A SUBTYPE OF SAGITTAL CRANIOSYNOSTOSIS HAS ENHANCED BILATERAL TEMPOROPARIETAL CONSTRICTION AND FRONTAL BOSSING: POINTERS FOR SURGICAL MANAGEMENT

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Introduction & Objectives: Sagittal craniosynostosis has variability in presentation. Some patients appear to be affected more anteriorly, others more posteriorly. Some are affected bi-directionally. The aims of this paper are to describe a subtype of sagittal craniosynostosis which presents with enhanced retrocoronal temporoparietal transverse band-like constriction, and to elucidate upon reconstructive solutions.

Material & Methods: From 2015-2017, 46 patients with nonsyndromic sagittal craniosynostosis were operated upon by the authors. All patients were followed in a multidisciplinary craniofacial program including genetics. Patients routinely underwent a preoperative CT scan and serial photographs. A retrospective chart review captured the results described.

Results: 6 of these 46 patients had severe retrocoronal transverse bilateral temporoparietal band-like constrictions. 4 more patients were affected moderately. These patients had a worse initial presentation of their anterior cranial vault deformity with enhanced bitemporal narrowing and increased frontal bossing. Of the 6 severe deformities, 4 underwent a subtotal cranial vault remodeling at a mean age of 9 months (range 8-12 months). Mean follow-up was 23 months (range 13-37 months). All 4 had excellent results with 2 residual mild bitemporal constrictions. All 4 had overcorrection of transverse expansion performed at surgery as well as subtotal resection of the sphenoid bone greater wing. 2 underwent strip craniectomy with bilateral wider anterior wedge ostectomies at a mean age of 3 months, followed by postoperative helmeting. Mean followup was 13 months (range 10-16 months). 1 of these strip craniectomy patients had an excellent result, the other had mild bitemporal constriction. The 4 moderate deformities all did well with 2 treated with cranial vault remodeling both at 8 months of age, and 2 treated with strip craniectomy and postoperative helmeting at mean age of 2.5 months. 1 of these strip patients had mild frontal bossing and bitemporal constriction at 16 months postoperative. There were no peri-operative complications in these 10 patients.

Conclusion: Sagittal craniosynostosis patients with a significant retrocoronal transverse temporoparietal transverse band-like constriction have a worsened anterior dysmorphology. Principles of operative correction should include overexpansion transversely and takedown of the greater wing of the sphenoid bone bilaterally when done as an open procedure. Surgical followup of almost 2 years in the more severe patients demonstrates satisfactory outcomes. When a strip craniectomy with bilateral wedge ostectomies and postoperative helmeting is performed, the width of the anterior wedge ostectomy should be increased.

Disclosure of Interest: None Declared

17-3-025

A CUSTOM HELMET DESIGN FOR SAGITTAL STRIP CRANIECTOMY: A 3D COMPARATIVE STUDY

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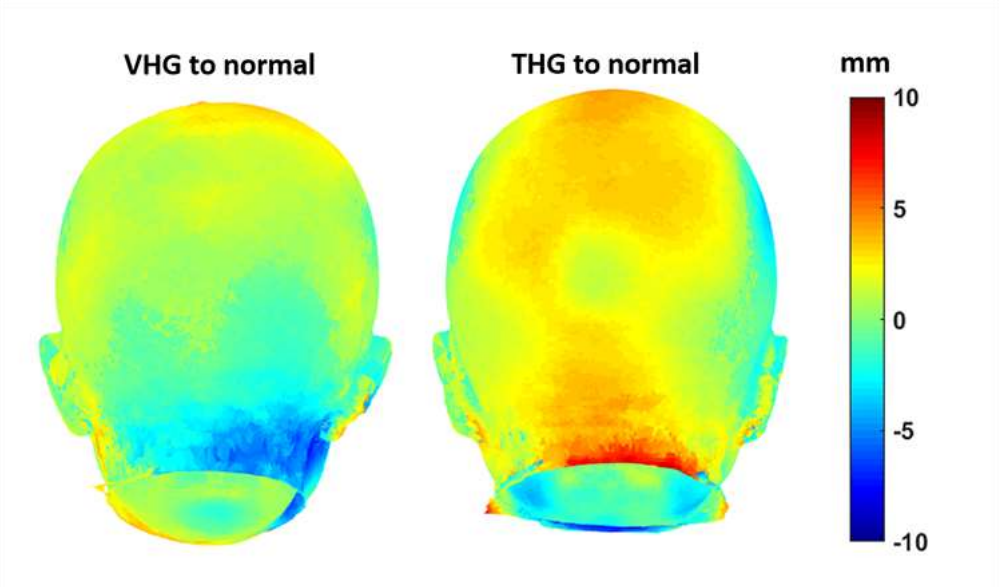
Introduction & Objectives: Postoperative helmet therapy is commonly used to facilitate passive reshaping of the cranial vault after sagittal strip craniectomy. Traditionally, helmets are designed by an orthotist based on 3D laser surface scans obtained 1 week after surgery. This study compares 3D head shape outcomes obtained from a virtual helmet design protocol and a traditional helmet design protocol.

Material & Methods: Upon IRB approval, 24 patients who underwent extended sagittal strip craniectomy with wedge ostectomies performed by one surgeon and post-operative helmets produced by one orthotist were recruited to this study. The traditional helmet design is based on STARscanner (Orthomerica) laser images and treatment goals indicated verbally by the surgeon. The virtual helmet design protocol utilizes images from a low-radiation protocol CT scan and 3D photo (3dMD,) obtained after surgery. An overlay of a 3D volume rendering of the CT and 3D photo was produced to demonstrate where the strip craniectomy and wedge cuts are in relation to the soft tissue landmarks. Eleven patients received a traditional helmet design and 13 patients received a virtual helmet design. Three-dimensional images were obtained 1 week after surgery and longitudinally at 3, 6, 9, and 12 months post-operatively. Helmet therapy ended 12 months after surgery. Three-dimensional images of 24 age-matched normal subjects were used as a control. Whole head shape analyses were performed and compared to age-matched healthy controls. In addition, cephalic index (CI) and vertical height measurements were recorded from 3D photos.

Results: The mean CI pre-operatively was 73.71 for the virtual helmet group (VHG) and 72.39 for the traditional helmet group (THG). Twelve months post-operatively, the mean CI was 83.7± 2.3 for VHG and 81.1± 3.4 for THG. When compared to the CI of age-matched controls (83.5 ± 2.4), VHG exhibited no significant difference ($p>0.05$), whereas THG showed statistically significant CI ($p<0.05$). The VHG and THG mean vertical heights 12 months post-operatively were 119.03 mm (± 4.73) and 122.88 mm (± 4.78), respectively. For age-matched controls, the mean vertical height was 118.27 mm. 3D image analysis (Figure) demonstrated a greater biparietal correction and normal vertical dimension in the VHG, when compared to age-matched controls. THG yielded less biparietal correction and greater vertical dimension to the cranial vault.

Conclusion: The VHG had a greater increase in CI and notably, the end-treatment data correspond to the data for age-matched controls. THG yielded a greater vertical dimension to the cranial vault.

Picture 1:



Disclosure of Interest: None Declared

17-3-026

MULTIPLE OSTEOTOMIES WITH COMBINED DISTRACTION OSTEOGENESIS FOR NON SYNDROMIC SCAPHOCEPHALY

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Introduction & Objectives: To evaluate a new technique of multiple osteotomies with combined distraction osteogenesis in the application of non-syndromic scaphocephaly.

Material & Methods: Retrospective analyses eight non-syndromic scaphocephaly clinical cases from January 2017 to October 2018. According to the types of scaphocephalic deformities, different osteotomy methods and distraction directions were designed. The cranial vault was multiply osteotomized by piezosurgery osteotomy. Meanwhile, the dura do not separate from the cranial flap, and the internal distractors were installed subsequently. Since the 5th day after operation, combined distraction was performed at the rate of 0.4—0.6 mm/d, twice a day. After a 10- to 15-day activation period and 6 months consolidation period, all the distractors were removed.

Results: Follow-up ranged from 6 to 14 months (average, 10 months). The average cranial index of 8 cases before and after operation was 63.2 and 78.25, respectively. Postoperatively, the average anteroposterior compression was 12.63 ± 3.47 mm and the bitemporal distraction was 15.4 ± 4.18 mm, and the scaphocephalic deformities were improved significantly. There were no serious complications such as skull necrosis or intracranial infection.

Conclusion: By means of various types of multiple osteotomy methods with combined distraction osteogenesis, different scaphocephaly cases can be better treated. It's suitable for younger patients, especially for severe scaphocephalic deformity.

Disclosure of Interest: None Declared

17-3-027

THE THUNDERBIRD APPROACH FOR NASOFRONTAL OSTEOTOMIES ENHANCES NASOFRONTAL AESTHETICS IN SAGITTAL CRANIOSYNOSTOSIS

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Introduction & Objectives: There are a variety of open vault reconstructive techniques described for sagittal craniosynostosis. When anterior vault remodeling is performed as part of a total or subtotal cranial vault procedure, osteotomies for sagittal craniosynostosis repair typically end cephalic to the nasofrontal junction. Residual abnormally angulated bone is therefore left in-situ, leading to abnormalities in the nasofrontal angle (NFA) centrally. Minor to moderate deformities in the NFA detracts from the aesthetic appearance of the nose long-term. Acute naso-frontal deformities are extremely difficult to correct secondarily. The aim of this paper is to present longer-term follow-up of a series of patients who underwent sagittal craniosynostoisis repair with concomitant nasofrontal osteotomies.

Material & Methods: 8 consecutive infants aged 7-12 months who underwent cranial vault remodeling with concomitant nasofrontal osteotomies, the so-called “thunderbird” approach, were reviewed. All patients had preoperative CT scans, photographs, and NFA measurements taken. At one year post-operative, all patients underwent physical examination, photographic analysis, and NFA measurements. All charts were reviewed for complications.

Results: All patients had an abnormal NFA preoperatively by Gunter numeric criteria. All patients returned to normalcy postoperatively. There were no complications and no cranial or bony defects in the naso-frontal-glabellar regions. Nasofrontal aesthetics were improved for all.

Conclusion: Nasofrontal osteotomies (the Thunderbird technique) at the time of cranial vault remodeling in sagittal craniosynostosis patients enhance nasofrontal aesthetics post-operatively.

Disclosure of Interest: None Declared

DAY17 - STATION 4 - CRANIOSYNOSTOSIS/MISCELLEANOUS

17-4-028

COMPLICATIONS RELATED TO CRANIOSYNOSTOSIS SURGERY– EXPERIENCE FROM A NEWLY ESTABLISHED NATIONAL CENTRE

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Introduction & Objectives: The Uppsala Craniofacial Centre has been one of two Swedish centres for licenced paediatric craniofacial care in Sweden since 2012. The unit had started treating craniosynostosis just a few years before and has since then evolved to > 30 operations/year. The objective of this study was to evaluate peri-operative outcomes in a newly established centre by analysing complications.

Material & Methods: Patients with craniosynostosis treated with transcranial and/or facial advancement procedures from 2012 to 2018 were included in the study. Complications were identified in the unit's quality database and verified against all chart notes. The complications were graded according to the Oxford scale (1-5), which has been adopted by the ERN CRANIO working group on craniosynostosis for auditing purposes.

Results: There were 164 operations: 76 H-craniectomy, 51 frontoorbital remodelling (FOR), 28 cranial vault remodelling, 4 posterior expansion, 3 Le Fort 3, 1 frontofacial advancement and 1 early re-operation. There were 28 complications related to 24 (14.6%) operations. 27 complications occurred within one month of surgery. There were 7 (4.3%) dural tears, 5 (3%) minor wound healing delays, 2 (1.2%) urinary catheter related complications, 2 (1.2%) superficial pressure sores, 1 central line infection, 1 unclear extended pyrexia leading to antibiotic treatment, 1 infectious conjunctivitis, 1 laryngospasm, 1 post-extubation stridor and 1 delayed extubation due to edema from excessive crystalloid administration2/2 facial advancements were complicated by intraoperative inferior orbital rim fracture necessitating plating. There was one early re-operation of a FOR due to osteosynthesis plate fracture. There were no deep infections or neurological injuries. Oxford score distribution was 24 grade 1 complications, 1 grade 2, 2 grade 3 and 0 grades 4 or 5. Thus, there were no deaths or complications leading to long-term sequele.

Conclusion: The rate and type of complications compare favourably with published reports indicating a high level of patient care and safety.

Disclosure of Interest: None Declared

17-4-029

CRANIOSYNOSTOSIS AND RECONSTRUCTION OF THE AESTHETIC TEMPORAL SUBUNIT

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Introduction & Objectives: For generations of craniofacial surgeons, the primary focus of craniosynostosis correction has been stable advancement of the frontal orbital bar. Despite enhancements such as overcorrection and rigid fixation, up to 50% of these patients still present with post-operative bitemporal constriction or temporal hollowing. We postulate that inadequate attention to normalizing the temporal fossa contour predisposes to these temporal deformities. For the past 30 years at the University of Michigan, attention to reconstruction of the temporal region has been an essential component of each reconstructive plan, resulting in exceedingly low rates of post-operative temporal deformity. Here, we define the temporal aesthetic subunit and emphasize the necessity of attaining anatomic norms within this region.

The primary focus of craniosynostosis correction has been stable advancement of the frontal orbital bar. Despite evolving reconstruction techniques, 50% of these patients still present with post-operative bitemporal constriction. For the past 30 years at the University of Michigan, attention to reconstruction of the temporal region has been an essential component of each reconstructive plan, resulting in exceedingly low rates of post-operative temporal deformity.

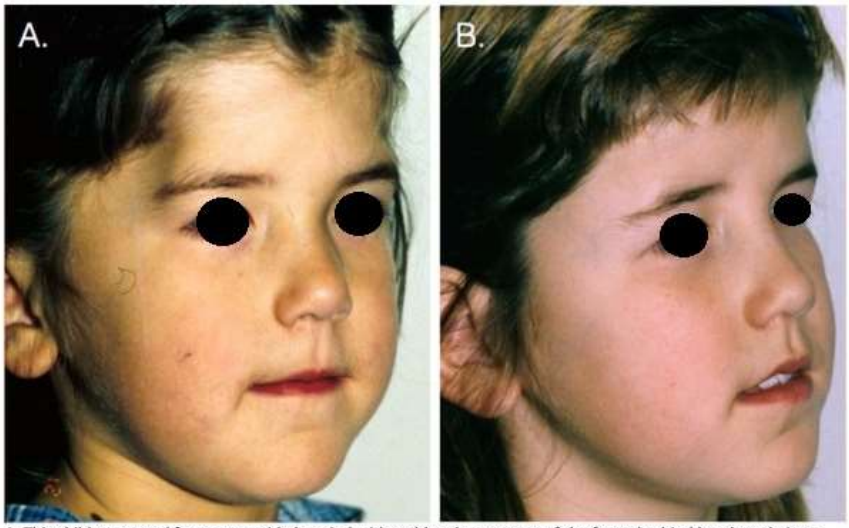
Material & Methods: A retrospective review of all cranial vault cases at the University of Michigan was undertaken from 1996-2016. We focused our attention on the temporal aesthetic subunit, defined anteriorly by the lateral orbital rim, superiorly by the lateral pupillary line, posteriorly by the hairline, and inferiorly by the zygomatic arch (Figure 1). Long term follow-up assessing temporal fullness was extracted from standard photographs and 3DMD images.

A retrospective review of all cranial vault cases at the University of Michigan was undertaken from 1996-2016. We focused our attention on the temporal aesthetic subunit. Long term follow-up assessing temporal fullness was extracted from standard photographs and 3DMD images.

Results: A total of 562 cranial vaults were evaluated, all of which included temporalis flap mobilization for contouring of the temporal region. We were able to achieve good symmetry, contour and volume in the nearly all cases (Figure 2), with long term follow-up of over 20 years.

A total of 562 cranial vaults were evaluated, all of which included temporalis flap mobilization for contouring of the temporal region. We were able to achieve good symmetry, contour and volume in the nearly all cases (Figure 1), with long term follow-up of over 20 years.

Conclusion: Long-term outcomes using Michigan modifications demonstrate improved temporal contour with a minimal revision rate.



A. This child presented from an outside hospital with stable advancement of the frontal orbital bar, but obvious deformity of the temporal aesthetic unit. B. Temporal hollowing was corrected with a temporalis muscle turnover flap, which is routinely used at our institution as part of the initial procedure, thereby restoring normal contour to the region.

Disclosure of Interest: None Declared

17-4-030

THE EFFECT OF FRONTO-ORBITAL ADVANCEMENT ON FRONTAL SINUS DEVELOPMENT AND FUNCTION IN NON-SYNDROMIC AND SYNDROMIC CRANIOSYNOSTOSIS

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Introduction & Objectives: Fronto-orbital advancement surgery involves cuts made through the frontal bone & sinus at an early age, while these structures are still growing. The frontal sinus normally develops from age 2 yrs, increases in size gradually and reaches 80% of adult size by age of 12 yrs. This study was undertaken to assess the extent of development of Frontal sinus after FOA in non-syndromic & syndromic craniosynostosis & to calculate the incidence of Frontal sinus complications after this surgery.

Material & Methods: This was a retrospective case-control study of patients with non-syndromic & syndromic craniosynostosis who had undergone FOA surgery & had atleast one form of imaging(X-Ray/CT scan) beyond the age of 12 years. The controls were 20 age-matched trauma patients above 12 years of age. The X-rays were assessed for presence/absence of frontal sinus(Pneumatisation above the level of supraorbital margin). The exact volume of frontal sinuses will be calculated using CT scan data(in progress). Complications related to frontal sinus were documented after review of case notes & imaging.

Results: 57 patients(M:F-28:29) were included. Among them, 26 were nonsyndromic(10 coronal, 12 metopic, 4 multisuture) & 31 were syndromic(7 Crouzon, 12 Apert, 3 Pfeiffer, 4 Saethre-Chotzen, 5 Muenke) craniosynostosis. The mean age at first FOA surgery for non syndromic group was 10.23 months & mean age at imaging was 17.73 yrs. The mean age at first FOA for syndromic group was 18.72 months & mean age at imaging was 20.96 yrs. The mean age at imaging for control group was 20.25 yrs. The average number of FOA surgeries (before 12 years of age) was 1.26 for non-syndromic & 1.51 for syndromic group. One out of 26 in non-syndromic and 7 out of 31 in syndromic group had 'absent' frontal sinuses in comparison to absence of 1 out of 20 in the control group. Four patients each in non syndromic & syndromic group had evidence of Frontal sinusitis on CT scan. One syndromic patient had Frontal bone osteomyelitis. Seven non syndromic & 10 syndromic patients underwent cranioplasty for forehead contour deformities.

Conclusion: Early results indicate no difference in frontal sinus development between non-syndromic group & controls. There appears to be a significant difference in development of frontal sinuses in syndromic group when compared to non syndromic group & controls. The reason for the attenuated development cannot be directly attributed to the surgery and might be a virtue of the syndromic disease itself. We await the volumetric & statistical analysis before coming to a final conclusion. There are significant frontal sinus complications that can arise due to the surgery in the frontal region & this needs to be emphasised in the consenting process.

Disclosure of Interest: None Declared

17-4-031

THE SYNOSTOSIS RESEARCH GROUP (SYNRG) OUTCOMES STUDY: EARLY RESULTS FROM A MULTI-CENTER, PROSPECTIVE CONSORTIUM FOR THE STUDY OF CRANIOSYNOSTOSIS

L. A. Dvoracek [1,*], J. R. Kestle [2], A. Lee [3], R. C. Anderson [4], B. Gociman [2], K. B. Patel [5], M. D. Smyth [5], C. Birgfeld [3], I. F. Pollack [1], M. Tamber [6], T. Imahiyerobo [4], F. A. Siddiqi [2], J. A. Goldstein [1]

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Introduction & Objectives: Craniosynostosis (CS) treatment is complex and varies widely. Large-scale outcome studies are difficult given the practice variation, low incidence of disease, and long time between intervention and final outcome. Established in 2016, the Synostosis Research Group (SynNRG) is the largest multi-center consortium focused on prospectively evaluating the diagnosis and management of patients with CS. Here we present a preliminary analysis of these data.

Material & Methods: Institutional review board at each SynRG institution approved this study prior to data collection. Patients diagnosed with CS who presented to any of 5 institutions from 2017 to present were enrolled in this study. Clinical data in 276 categories including history, diagnosis, radiographic imaging, intra-operative details, hospital course, and follow-up were recorded prospectively and stored in a REDCap database.

Results: Of 298 patients registered, 62.7% were male. Average age at registration was 10.4 months. Single suture CS accounted for 80% of patients and multisutural 20%; 3% of patients were syndromic. Mean age at surgery was 11.3 months. 46% underwent open vault reconstruction, 43% underwent strip craniectomy, and 11% underwent other types of reconstructions. Of those who underwent open reconstructions, 50.1% were fronto-orbital advancements. Of those who underwent strip craniectomy, 66.2% were sagittal, 16.9% metopic, and 13.6% coronal.

Drains were used in 40% of patients. Antibiotics were given before incision in 98% of patients and continued post-op in 25% for a mean of 25 hours post-op. Tranexamic acid was used in 46% of patients and steroids in 60.5%. Intraoperative transfusion occurred in 42% of patients (80% in vault reconstructions and 11% in strip craniectomies). Postoperative hematocrit was on average 27.0, and 4.6% of patients required post-op transfusion.

In-hospital complications were hematoma in 2.3%, early wound breakdown in 0.5%, seizure in 0.5%. No CSF leaks, infections, or deaths were reported. Early reoperations were necessary in 1.9% of patients. Mean length of stay was 2.7 days. Narcotics were prescribed at discharge for 73% of patients.

Conclusion: Large, prospective, multicenter studies of CS treatment have the potential to identify opportunities to optimize care and improve outcomes. This preliminary analysis of the SynRG data reveals clear trends in treatment of CS and will be useful in improving outcomes moving forward as the consortium continues.

Disclosure of Interest: L. Dvoracek: None Declared, J. Kestle: None Declared, A. Lee: None Declared, R. Anderson: None Declared, B. Gociman: None Declared, K. Patel Conflict with: Stryker CMF, Conflict with: Speaker: Hanger Orthotics, M. Smyth: None Declared, C. Birgfeld: None Declared, I. Pollack: None Declared, M. Tamber: None Declared, T. Imahiyerobo: None Declared, F. Siddiqi: None Declared, J. Goldstein: None Declared

17-4-032

OPTIMIZING RECONSTRUCTION IN CRANIOSYNOSTOSIS: A 12-YEAR REVIEW OF 162 NON-SYNDROMIC PATIENTS TREATED WITH A NOVEL TECHNIQUE

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Introduction & Objectives: Open cranial vault remodeling (CVR) with autologous split calvarial bone grafts redistributes and recontours an abnormal calvarium to create an expanded cranial vault in patients with craniosynostosis. We report a 12-year retrospective review of 162 non-syndromic patients who underwent operative repair using our previously-described technique which portends excellent surgical outcomes and can be applied to patients of any age group and with any variety of suture fusion.

Material & Methods: Data was gathered on patients who underwent cranial vault remodeling from 2005 to 2016. Surgical records for each patient were analyzed and included operative time, estimated blood loss, and intraoperative transfusion volumes. Intraoperative and post-operative complications, the need for revision surgery, post-operative length of stay and follow-up records were also reviewed. Syndromic patients were excluded, as well as patients with incomplete data sets. Patients who underwent either anterior or posterior vault remodeling were compared.

Results: A total of 162 patients were included in this case series. Patients undergoing anterior CVR were significantly older than those undergoing posterior CVR (13.3 vs. 11.0 months, $p<0.015$) and also had significantly greater intraoperative red blood transfusion volumes (20.3 vs. 15.3cc/kg, $p<0.0207$) and longer operative time than posterior CVR patients (274.9 vs. 216.7 minutes $p<.0001$). There were no significant differences between groups with regards to revision rate and complications. Calvarial bone was successfully split in 100% of cases.

Conclusion: This surgical approach to CVR results in good surgical outcomes with a low recurrence rate, while also maximizing operative efficiency, and minimizing total blood loss and transfusion volume. This technique can be applied to any affected suture in a patient with craniosynostosis and in patients of any age group.

Disclosure of Interest: E. Uppal: None Declared, H. Rudy: None Declared, S. Herman: None Declared, C. Stern: None Declared, D. Staffenberg: None Declared, K. Dowling: None Declared, J. Goodrich: None Declared, O. Tepper Conflict with: 3D Systems, MirrorMe 3D

17-4-033

FRONTO-ORBITAL ADVANCEMENT & VAULT REMODELING FOLLOWING PRIMARY STRIP CRANIECTOMY

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Introduction & Objectives: Normalization of the calvarial shape using variations of vault remodelling and fronto-orbital advancement remain the gold standard for treating patients diagnosed with cranisynostosis. Although standard strip craniectomy lost its support long time ago with the introduction of cranial vault reconstruction, patients whom received this older form of treatment are still encountered occasionally & seek cosmetic improvement. Uncertainty remains in regards to rates & nature of possible complications when considering secondary reconstruction for this category of patients. The aim of this work is to present the outcome of patients with different suture involvement at variable ages who underwent vault remodelling and fronto-orbital advancement following primary strip craniectomy.

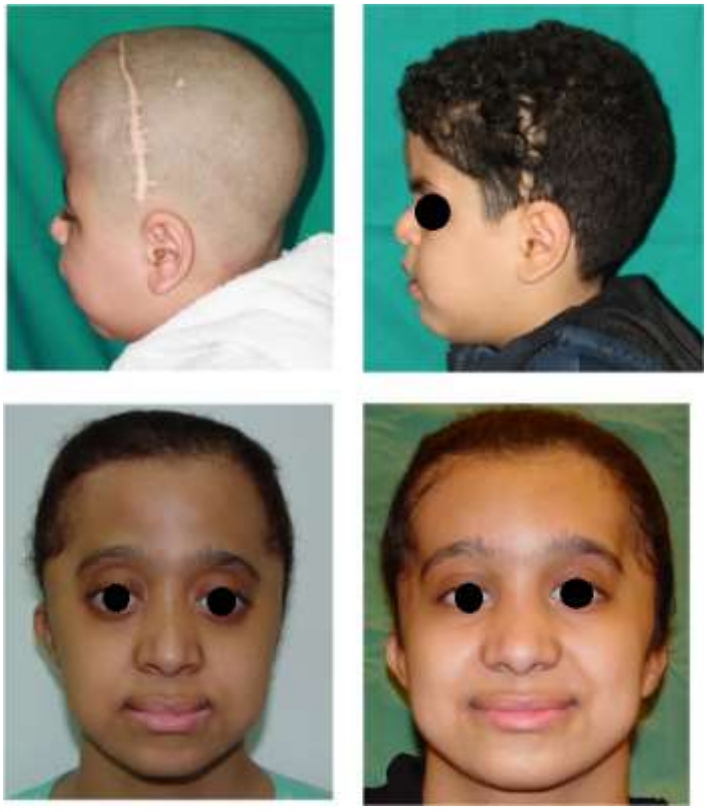
Material & Methods: All patients underwent in-depth clinical evaluation including anthropometric craniofacial measurements. CT scans were done preoperatively along with genetic counseling, ophthalmologic evaluation inclusive of fundus & intelligence quotient (I.Q) test. Surgical planning and osteotomies, including monoblock distraction, were designed to meet the specific goals for each patient according to the site and number of sutures as well as patients' age. Any intraoperative or postoperative complications including hospital readmissions and reoperations were recorded.

Results: Thirteen patients were included; 9 with isolated single suture synostosis & 4 with multiple suture synostosis. The average age at the time of the second operation was five years and four months (range: 15 months to 18 years). The minimum time that elapsed between the two surgeries was twelve months.

Intelligence quotient (I.Q) values ranged from 74 to 115. These values did not show significant changes from the preoperative to the minimum of six months postoperative values for each patient. Ophthalmological examination confirmed mild papilleodema in only two cases that warranted urgent surgical interference. The operative time was in average an hour longer than similarly performed primary procedures.

Normalization of the cranial shape and the cephalic index was achieved in all cases. Minor dural tears occurred intraoperatively in 5 cases. They were repaired prior to fixing the osteotomized segments and passed uneventful in the postoperative period. Partial disruption of the coronal wound occurred in 1 case and was managed by secondary sutures. In 2 patients, the metal hardware outline was visible under skin and removed upon request. Neither meningitis, sinus hemorrhage, brain cortical damage, bone loss occurred nor morbidity related to intraoperative blood loss.

Conclusion: Based on results of this study, fronto-orbital advancement & vault remodeling can be safely performed following primary strip craniectomy to restore the overall craniofacial balance with minimal complications.



Disclosure of Interest: None Declared

17-4-034

SPRINGS FOR NON-SYNDROMIC CRANIOSYNOSTOSIS: AN APPRAISAL OF THE CEPHALIC INDEX, THE FUNCTION AND THE AESTHETIC AT 12 YEARS OF CLINICAL AND RADIOLOGICAL FOLLOW-UP

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Introduction & Objectives: The use of springs after sinostotic pathological bone resection from the metopic, sagittal and hemicoronal sutures to modified function, aesthetics and cranial growth in patients with nonsyndromic craniosynostosis are presented

Material & Methods: This clinical series includes 16 patients aged between 6 months to 5 years of age, 11 female and 5 male. 8 trigonocephaly, 6 scaphocephaly and 2 hemicoronal. Using a a bicoronal incision, the entire length of the sinostotic bone is resected and 3 to 6 springs are inserted. In trigonocephaly, a “green stick” interorbital fracture is added. The strength of the wires produces bone gaps between 15 and 28 mm. and in trigonocephaly, the interorbital distance 5 to 9 mm is increased during the first 6 weeks. Then into the bone gap, 10 to 12 weeks later, a layer of new bone over the periosteum can be radiologicaly observed. Usually springs are removed in a seconf surgical procedure after 4 months. Radiological controls at 3, 6 and 12 months show absence of intracranial dead space and the sinostotic bone is replaced with a bicortical cranial bone with a solid and healthy appearance. In children initially treated 3 to 5 y/old, we make sure radiologically that the temporo-parietal and parieto-occipital suture are still open and then they can function as a hinge when expanding the skull. Equally in these patients 6 to 8 strengther and larger in size springs were used.

Results: The results show a very clear and satisfactory correction of the frontal deformity and hypotelorism in trigonocephaly, a correction of the A-P dimension of the skull after increasing the cranial transverse dimension in scaphocephaly and a regular and symmetric frontal region in plagiocephaly. The initial cephalic index varied between 64 and 79 (mean 71.5), at twelve months between 67 and 83 (75.0) and finally after 5 years between 71 and 84 (mean 77.5). In fact the cephalic index increased by 14 %. Our largest follow-up is 12 years, a boy with scaphocephaly associated with left plagiocephaly and unilateral CLP. Nowadays his cephalic index, as well as the head circumference shows measures within normal. His neurological and intellectual development has been normal, as well as his performance in school activities

Conclusion: This is a minimal invasive experience of non-syndromic craniosynostosis correction. The technique is effective and very safe when compared to other techniques reported in the medical literature

Disclosure of Interest: None Declared

17-4-035

TRANEXAMIC ACID USE IN INFANT CRANIOSYNOSTOSIS SURGERY: FRIEND OR FOE?

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Introduction & Objectives: Anti-fibrinolytics (AF) have been promoted, studied, and clinically utilized in order to mitigate blood loss and improve the safety profile of infant craniosynostosis surgery. Use of these medications, most often tranexamic acid (TXA), remains debated in craniofacial surgery. The purpose of this study is to examine national trends in utilization of these medications and associated outcomes.
Material & Methods: A query was developed within the Pediatric Health Information System (PHIS) for the years 2010 to 2018. This is a large administrative database of tertiary pediatric hospitals in the United States. Search criteria included patients less than 2 years old, presence of billing data, primary diagnosis code of craniosynostosis (ICD9 756.0, ICD10 Q75.0), and CPT code for craniotomy for craniosynostosis (61550-61559). PHIS records were examined for the use of AF (TXA, aprotinin, and aminocaproic acid) as well as the use of blood products. Outcomes of interest included all surgical complications, length of stay, and transfusion. Statistical analysis was performed using t-test, chi-square and Mann-Kendall trend test, univariate regression, and multivariate regression.
Results: A total of 1,345 patients fit inclusion criteria. Mean age was 7.6 (±4.8) months. 454 (33.7%) patients received TXA. There was a significant trend of increasing TXA use from 13.1% in 2010 to 86.2% in 2018 ($p=0.002$). There was no significant difference in mean length of stay between the TXA group and non TXA group (3.7 vs 3.3 days, $p=0.17$). No significant trend was identified in percentage of patients receiving blood products, which changed from 65% in 2010 to 59% in 2018 ($p=0.76$). Receiving TXA was associated with increased total number of blood products on univariate and multivariate analysis (1.76 units vs. 1.18, OR=2.03, $p<0.001$).
Conclusion: This national study of infant craniosynostosis surgery reveals that the use of TXA has rapidly increased. Despite this trend and national efforts to decrease blood loss, administration of TXA is associated with increased blood product usage in the entire cohort, single suture, and FOA. Additional research about the impact of TXA on craniosynostosis is warranted.

Disclosure of Interest: None Declared

17-4-036-N / 18-12-213

CRANIOFACIAL FELLOWSHIP TRAINED SURGEONS: WHERE ARE THEY NOW?

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Introduction & Objectives: There are currently 29 craniofacial surgery fellowship training programs in the United States and Canada endorsed by the American Society of Craniofacial Surgeons and participating in the San Francisco Match. This number has increased over the last decade despite limited demand. The authors sought to evaluate the practice types and patterns of craniofacial fellowship trained surgeons.

Material & Methods: After IRB approval, a 20-question survey was designed to evaluate craniofacial surgeons and their practice patterns. The survey was sent to surgeons who completed accredited craniofacial fellowships in the United States or Canada from 2010-2018. The survey was created and distributed electronically through a private survey research center.

Results: There were 61 respondents (26.5% response rate), 68.8% male, and 85.2% aged 36-45 years old. 54.1% trained in integrated plastic surgery residency prior to fellowship, and 39.1% trained in general surgery followed by plastic surgery fellowship. Some had previously completed fellowships: 8 (13.1%) pediatric plastic surgery, 5 (8.2%) microsurgery, 4 (6.6%) aesthetic surgery, 3 (4.9%) hand surgery, 2 (3.3%) burn surgery. 45 surgeons (75%) have been in practice ≤5 years. Practice profiles were academic (49.2%), private (23.0%), and hospital employed (9.8%) with 18% in various hybrid practices. Percentage of practice dedicated to craniofacial surgery was <25% for 21 (34.4%), 25-50% for 10 (16.4%), 51-75% for 13 (21.3%) and >76% for 17 surgeons (27.9%) with 63.8% desiring an increase in craniofacial case volume. Surgeons' patient populations are 14.8% pediatric only, 6.6% adult only, and 78.7% combined. They perform craniofacial trauma reconstruction (88.5%), general plastic surgery reconstruction (83.6%), cleft lip and palate repair (75.4%), craniosynostosis reconstruction (68.9%), breast surgery (54.1%), microtia reconstruction (50.8%), orthognathic surgery (50.8%), cosmetic surgery (50.8%), microsurgery (45.9%), hand surgery (36.1%) and facial reanimation (32.7%). 46 (75.4%) work as members of a craniofacial team. 26 (42.6%) do not have any craniofacial trained partners. 12 surgeons (19.7%) had jobs secured prior to beginning craniofacial fellowship and 44 (72.1%) were able to find jobs in their desired geographical area. 41 (67.2%) would recommend completing a craniofacial fellowship.

Conclusion: Craniofacial surgeons trained within the last decade are primarily in academic practice, operate on adults and children, and perform a variety of procedures. Limitations include low response rate and likelihood that surgeons who do not perform craniofacial surgery did not respond. Respondents were able to find employment in their desired location, work on a craniofacial team, and would recommend a craniofacial fellowship.

Disclosure of Interest: None Declared

DAY17 - STATION 5 - CRANIOSYNOSTOSIS/CORONAL

17-5-037

DISPARITIES IN ACCESS TO HEALTH CARE IN 2018 FOR UNITED STATES CRANIOSYNOSTOSIS PATIENTS: THE INFLUENCES OF PRIVATE INSURANCE AND RURAL RESIDENCY

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Introduction & Objectives: One of the goals of recent US healthcare reform is to increase access for all citizens. The aim of this study is to assess disparity in access for craniosynostosis surgery at a single Midwestern United States craniofacial center in 2018 with an emphasis upon patient insurance status and urban versus local residence.
Material & Methods: The charts of all patients who underwent primary craniosynostosis repair in 2018 at our institution were reviewed for demographic factors, age at time of consultation, and surgical technique (open versus endoscopic).
Results:
54 patients, ages 2 to 22 months, underwent primary craniosynostosis surgery at our institution in 2018. 34 underwent an open procedure, while 20 underwent a strip craniectomy, followed by helmeting. 47 of these patients were non-syndromic. 28 patients had private insurance (52%); 24 patients had state-funded medicaid insurance (44%), and 2 were without insurance (4%). 29 patients lived in an urban environment (54%); 25 resided rurally (46%). Further results include:
1. While 52% of patients had private insurance; 75% of patients who underwent strip craniectomy were privately insured. 25% were Medicaid or not insured
2. 44% of patients who underwent open vault reconstructions were privately insured. 56% were medicaid or uninsured.
3. While 54% of patients were urban-based, 74% of patients who underwent strip craniectomy were urban-based. 26% were rural.
4. 45% of patients who underwent open vault procedures were urban-based. 55% were rural.
5. For strip craniectomy patients, those with private insurance were first seen in consultation at 42 days of age. With medicaid or uninsured, it was a mean of 58 days of life.
6. For insured urban-based strip craniectomy patients, mean age at time of first consultation was 37 days. If insured and rural-based, the mean was 57 days.
Conclusion: Disparities in 2018 health care access for US craniosynostosis patients exist with delayed presentation in clinic for less-insured and/or rural patients as well as fewer strip cranectomy/helmeting procedures in these patients.

Disclosure of Interest: None Declared

17-5-038

UNUSUAL COMBINED CRANIOSYNOSTOSIS: CHALLENGES OF DIAGNOSIS AND TREATMENT

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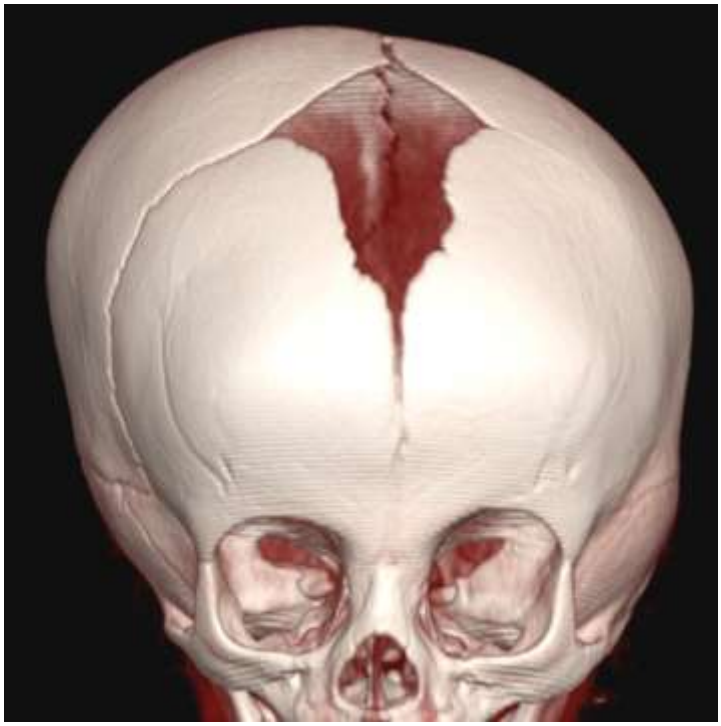
Introduction & Objectives: The classification of craniosynostoses depends on the combination of some characteristics: 1) when the sutural disease is part of a syndrome; 2) patient's morphological appearance; 3) the sutures involved and 4) the progression of the disease. From these criteria, it is possible to classify most of the craniosynostoses. However, some patients with non-syndromic craniosynostosis present an uncommon and difficult classification phenotype, and investigation with cranial tomography is necessary to determine the early fusion of sutures. The aim of this study is to describe a rare form of unclassified craniosynostosis and to determine its clinical and radiological characteristics and the surgical treatment and its challenges.

Material & Methods: Retrospective study of 3 cases of patients with non-syndromic combined craniosynostosis of uncommon phenotype. We analyzed the CT scans with 3D reconstruction, age at presentation, skull shape, signs of intracranial hypertension, genetic tests and types of surgical correction.

Results: The 3 patients presented the rare early ipsilateral synostosis of the coronal and lambdoid sutures, determining atypical craniosynostoses. No genetic mutations were identified. Due to the balanced dysmorphism of this form of craniosynostosis, CT scan was necessary for the diagnosis of all patients. All patients underwent 2-steps surgical correction: posterior expansion and fronto-orbital advancement).

Conclusion: Synostosis of two sutures is an objective and treatable condition with standardized techniques in the literature. However, children with combined craniosynostosis of unusual phenotype are difficult to diagnose and surgical treatment can be challenging. According to our knowledge, the ipsilateral fusion of the coronal and lambdoid sutures is rare, with only few cases described. This condition should be studied and treated early in order to avoid late diagnoses that may lead to cognitive impairment, sometimes irreversible.



Disclosure of Interest: None Declared

17-5-039

PAPILLEDEMA IN UNICORONAL SYNOSTOSIS: A RARE FINDING

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Introduction & Objectives: Unicoronal synostosis results in frontal plagiocephaly and is preferably treated before 1 year of age to prevent intracranial hypertension (ICH). However, data on prevalence of ICH in these patients is currently lacking. This study aims to establish the prevalence of preoperative and postoperative signs of ICH in a large cohort of unicoronal synostosis patients and to test whether there is a correlation between papilledema and occipitofrontal head circumference (OFC) curve stagnation in unicoronal synostosis patients.
Material & Methods: The authors included all patients with unicoronal synostosis treated before two years of age at a single center between 2003 and 2013. The presence of ICH was evaluated by routine fundoscopy. The OFC growth curve was analyzed for deflection and related to signs of ICH.
Results: In total, 104 patients were included in this study, 84 (81%) of which were considered to have non-syndromic unicoronal synostosis. Pre-operatively, none of the patients had papilledema determined by fundoscopy (mean age at surgery 11 months). Post-operatively, 5% of syndromic patients and 3% of non-syndromic patients had papilledema and this was confirmed by Optical Coherence Tomography. Raised intracranial pressure was confirmed in 1 patient with syndromic unicoronal synostosis. Six of 78 patients had OFC stagnation, which was not significantly related to papilledema ($p = 0.22$). One child with syndromic unicoronal synostosis required repeated surgery for ICH (0.01%).
Conclusion: Papilledema is not found in unicoronal synostosis patients when operated before the age of 1, and is very rare during their follow-up. There was no relationship between papilledema and OFC stagnation.

Disclosure of Interest: None Declared

17-5-40-N / S6A-06

ABNORMAL EXTRA-OCULAR MUSCLE POSITIONS IN ANTERIOR PLAGIOCEPHALY AND THE MECHANISM OF V-PATTERN STRABISMUS

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Introduction & Objectives: Strabismus in anterior plagiocephaly (AP) due to unicoronal synostosis raises management challenges. Two extra-ocular muscle (EOM) anomalies are reported in AP: (1) malposition of the trochlea of oblique superior muscle and (2) excyclorotation. Here we aimed to assess the positions of the EOM in AP, using geometric morphometrics based on magnetic resonance imaging (MRI) data and estimate the modifications in EOM positions after fronto-orbital advancement.
Material & Methods: Patient files were listed using the DrWareHouse application. We included all patients with AP managed between 2013 and 2018, with an available digital pre-operative MRI. MRIs from age-matched controls without craniofacial conditions were also included. We defined 16 orbital and skull base landmarks in order to model the 3D position of the EOM. Cephalometric analyses and geometric morphometrics with Procrustes superimposition and principal component analysis allowed to define a specific AP pattern for the EOM.
Results: We included 15 pre-operative and 7 post-operative MRIs from patients with AP and 24 MRIs from age-matched controls. Cephalometric analyses, Procrustes superimposition and distance computations showed a significant shape difference for the position of the trochlea of the superior oblique muscle and an excyclorotation of rectus muscles.
Conclusion: Our results suggest that functional anomalies of the superior oblique muscle are due to a malposition of its trochlea in the roof of the orbit, and that fronto-orbital advancement tends to correct these anomalies. MRI imaging is central in the surgical management of strabismus in patients with AP.

Disclosure of Interest: None Declared

17-5-041

CORONAL BAND SYNDROME: PREVIOUSLY NOT CLASSIFIED PHENOTYPE OF CRANIOSYNOSTOSIS

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Introduction & Objectives: During the past 30 years, over 230 cases of craniosynostosis and related syndromes have been treated in our unit. We have encountered more and more atyipical and subtle form cases that is not typically diagnosed in the recent decade.

The purpose of this observational study is to document one of these groups; the rare entity has the combination of sagittal and metopic synostosis without scaphocephaly.

Material & Methods: Since 2005, nine cases of mildly small cranium had been treated so far, on the pretence of above diagnosis, and the characteristic feature appeared in all patients were; 1) bi-coronal belt-shaped constriction and pteryonal excavation, can be called,"coronal band", 2) and this concaved line is seen in posterior to (not on) a coronal suture, 3) mild trigonocephaly with metopic keel, 4) sagittal synostosis without dolicocephalic distortion.

As a surgical treatment, the osteotomy was done on the abnormal constriction band and the lateral end of sphenoid ridges were widely removed to release, and a cranial expansion was performed by a distraction or wider suturectomy, and ICP was monitored to be increased intra-operatively in most of the cases.

Three of all, bone re-generation had been occurred rapidly, in a few months on the bi-temporal area, in spite of wide bone defect, and further broader ostectomy was needed. Functional symptoms such as delay in speech, hyperactivity of all the cases seemed to be improved and SPECT image proved to be better vasculature on the released temporal area after surgery.

Results: The operations ware performed all in rather older than optimal timing for typical cases because of later diagnosis by late first visit, of that the reason was thought to be distortion was too mild to notice, at first, but the suture fusion in late on-set may not cause predictable changes in cranial shape. One of the cases, who could be followed from the age of 14 months, showed us the fact.

The notable points are that mild form synostosis with coronal bands might be have a increased ICP, because compensative deformation could not occur after around 2 years of age when the delayed fusion is completed.

Conclusion: That is why the earlier surgical management is recommended, even though this entity is not clarified to be around for a long time or recently, as some experienced surgeons' related reports, such as metopic with sagittal synostosis(Domesheck 2010), sagittal synostosis without scaphocephaly(Morritt 2010), metopic associate with sagittal synostosis(Domeshek 2011), atypical scaphocephaly(Vinchon 2012), Combined metopic and unicoronal synostosis(Sauerhammer 2014), trigonoscaphocephaly(Dobbs 2016), metopic-sagittal synostosis(Shimoji 2017).

Disclosure of Interest: None Declared

17-5-042

UNICORONAL SYNOSTOSIS ORBITAL DYSMORPHOLOGY CORRECTION BY 3D PRINTING GUIDED FRONTOORBITAL ADVANCEMENT

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Introduction & Objectives: Restoration of all abnormal features of unicoronal synostosis considers a challenge for craniofacial surgeons. The main purpose of this presentation is to evaluate the usage 3D mirror image models in guiding of the Fronto-Orbital Advancement in Unicoronal synostosis.
Material & Methods: A retrospective analysis of **12** consecutive **patients** who underwent surgical correction of unicoronal Synostosis at Al Azhar university hospitals between 2012 and 2017. Patients with syndromic craniosynostosis or associated craniofacial anomalies were excluded from the analysis. In all cases, a 3D mirror image models for guiding unilateral Fronto-Orbital Advancement were done. Cranial volumes of all cases were calculated by CT pre and post operative and compared with Lichtenberg normative cranial volume growth curves. orbital volume in the diseased side and normal side Pre and postoperative were measured from CT scan and compared it with a similar age control group from normal patients doing CT craniofacial bones as a scan for a further cause. Results were statistically assessed.

Results: The study included five males and seven females. The mean age of the patients at the time of the operation was 18 months (range 10–34 months). The mean follow-up duration was 36 months (range one to four years). No patients exhibited a relapse of uni-coronal plagiocephalic characteristics that required surgical correction. there were a significant difference between both orbits when compared with the controls. The mean ipsilateral orbital volume preoperative was 16.3, the mean controlateral orbital volume preoperative was 17.4. Frontoorbital advancement increases the ipsilateral volume to a near normal value, the mean ipsilateral orbital volume postoperative was 22.09, the mean ipsilateral orbital volume postoperative was 22.18. There were improvements in the orbital volume to be near equal to the normal side. cranial volumes reached to more than +1 in a Lichtenberg normative cranial volume growth curves.
Conclusion: Our study demonstrates that patients who undergo uni coronal plagiocephaly correction with a 3D mirror image models for guiding unilateral Fronto-Orbital Advancement achieved satisfactory improvement. Our results suggest that the surgical technique used in the correction of unilateral coronal synostosis is strongly associated with near equal in both orbital volumes.

Disclosure of Interest: None Declared

17-5-043

LONG TERM FOLLOW-UP OF PATIENTS WITH BRACHYCEPHALY: LESSONS LEARNED

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Introduction & Objectives: Several surgical techniques have been developed to treat brachycephaly. The objectives were: 1. Demonstrate the facial features presented by pts over a long period of time, the persistent abnormalities and its treatment. 2. Document and analyze a series of pts operated by the same surgeons at a single center. 3. Determine which technical steps and modifications might contribute to a better long-term outcome.
Material & Methods: A retrospective chart review was performed. Inclusion criteria for patients were as follows: (1) bicoronal synostosis treated with BFOA procedure, (2) previously unoperated skull, (3) follow-up period of at least 10 years, (4) informed consent, (5) treated at a single medical institution. The demographic information, clinical-morphologic data, postoperative-surgical complications and reoperation rate were analyzed according to age at surgery (BFOA) based on three groups: 0-6, 6-12, >12 months. Complications were analyzed in consonance with the surgical aspects (i.e. dural tears, hematomas, etc.), the Whitaker, Sloan and Clavien-Dindo classifications. Reoperation was reported based on functional or morphological aspects.
Results: 16 patients met the inclusion criteria; 10 female, 6 male; 7 had a family member affected. Age at operation was 2—62 months (average 10). The advancement distance was 10—24 mm (average 17.6). Groups according to age at surgery were: 0-6 (n=10), 6-12 (n=3), >12 months (n=3).The complication rate or reoperation rate was not associated with the distance advanced. 11 pts had dural tears but none had a persistent CSF leak; 1 patient had a hematoma (treated effectively with punction and drainage) and 1 patient had a partial wound dehiscence that required reintervention. According to the Whitaker classification, 3 pts were class II and two pts were class III, requiring additional procedures. All pts were considered to have an adequate morphological result on the surgical table; deficient morphology was encountered: between 2 and 5 years of age in 7 pts, 2 of these pts required reoperations (lesser bone contouring revisions); between 5 and 10 years of age in 3 pts, all required reoperation; 2 pts between 10 and 15 years of age, none of these required reoperation.
Conclusion: The craniofacial surgeon must consider that brachycephaly is a condition where multiple factors play a role, before, during and after surgery. Although immediate postoperative results might be satisfactory, the craniofacial region will continue to demonstrate changes that may affect the outcome in a period that may last up to 15 years from the initial surgery. The use of adjuvant procedures (i.e. fat grafting, bone grafts and implants) may help achieve an adequate final result.

Disclosure of Interest: None Declared

17-5-044

ANTERIOR POSITIONAL PLAGIOCEPHALY EXPLAINS THE PHENOTYPE OF FRONTOSPHENOIDAL SUTURE SYNOSTOSIS

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Introduction & Objectives: Plagiocephaly can be secondary to positional forces or synostosis. Anterior plagiocephaly distinct from unicoronal craniosynostosis (UCS) has been described with a flattened forehead, slit like palpebral fissures, inferior displacement of the ipsilateral orbit, and posterior positioning of the ear. This clinical presentation has been attributed to deformational and more recently frontosphenoidal synostic (FSS) forces.

Material & Methods: Following institutional review board approval, a retrospective review of the craniofacial archives at Necker Hospital in Paris, France was performed from 1972-2017. All patients with a clinical phenotype of anterior plagiocephaly distinct from UCS were identified. The diagnosis was confirmed by multidisciplinary assessment and imaging. Clinical information including clinical course, imaging and operative records were reviewed.

Results: Among over 5000 confirmed synostotic cases, 16 patients were identified with anterior plagiocephaly distinct from UCS. Three patients were excluded for incomplete records, and 2 patients were excluded, as imaging demonstrated multisuture synostosis. Eleven patients were found to have anterior plagiocephaly distinct from UCS. The earliest patient in our series was identified in 1983 and was diagnosed with “anterior plagiocephaly nonsynostic”. The FSS appeared clearly open in 6 patients, and appeared either partly fused or closed in 4 patients. Patients presented from 3 weeks-3.5 years. There were 6 patients with right sided and 7 patients with left sided anterior plageiocephaly. Nasal tip deviation was not appreciated. Chin point deviation was noted in two patients. The skull base was deviated away from the affected side in all patients. The ipsilateral ear was more posterior than the contralateral side in all patients. The average age at surgery was 1.6 years, and average follow up was 3 years, with a range of 1- 9 years. One patient required revision surgery at age 4.6 years.

Conclusion: The clinical distinction between positional anterior plagiocephaly and UCS is not challenging. In cases of synostotic plagiocephaly, the skull base deviation is towards the side of the affected suture, and the ear tends to be pulled towards the site of the affected suture. Conversely, in positional plagiocephaly, the skull base deviation is away from the affected side. CT imaging in some of these patients suggest fusion, but is inconsistent and unpredictable, and may be associated with overlap of the frontal and sphenoidal bones. In recent years, the phenotype of anterior positional distinct from UCS has been attributed to FS synostosis. We believe that this clinical phenotype is more consistent with deformational rather than synostotic forces.

Disclosure of Interest: None Declared

17-5-045

CRANIAL VAULT ASYMMETRY AFTER DISTRACTION OSTEOGENESIS IN PATIENTS WITH UNICORONAL CRANIOSYNOSTOSIS

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Introduction & Objectives: Unilateral fusion of the coronal suture in patients with anterior plagiocephaly distorts normal calvarial anatomy. There has been no volumetric assessment of cranial vault asymmetry, or the effect of distraction osteogenesis (DO), in these patients. This study aims to characterize cranial vault asymmetry in patients with unicoronal craniosynostosis before and after DO.

Material & Methods: Retrospective review identified patients with unilateral craniosynostosis treated with open cranial vault reconstruction (CVR) and internal DO. Pre- and post-DO CT scans were analyzed using ITK-SNAP volume segmentation. These 3D reconstructions were bisected into hemispheres by a midsagittal plane from nasion to occipital crest, and into anterior and posterior quadrants based on a coronal plane between the anterior take off of the petrosal ridges (Image 1). Quadrant and hemispheric volumes were compared pre-DO and post-DO using paired student's t-tests.

Results: 17 patients underwent CVR with DO (4 males, 13 females, age 6-32 months). Prior to DO, the synostotic AQ (SAQ) contained 4.3% less volume than the non-synostotic AQ (NSAQ) (19.6% vs. 23.9%, *p*=0.0019). Likewise, the synostotic PQ (SPQ) had 1.9% less volume as compared to the non-synostotic PQ (NSPQ) (27.3% vs 29.2%, *p*=0.039). There was no significant difference in the proportion of synostotic vs. non-synostotic hemispheric volumes before or after surgery (48.5% vs 51.4%, *p*=0.2; 43.5% vs. 51.5%, p=0.1).

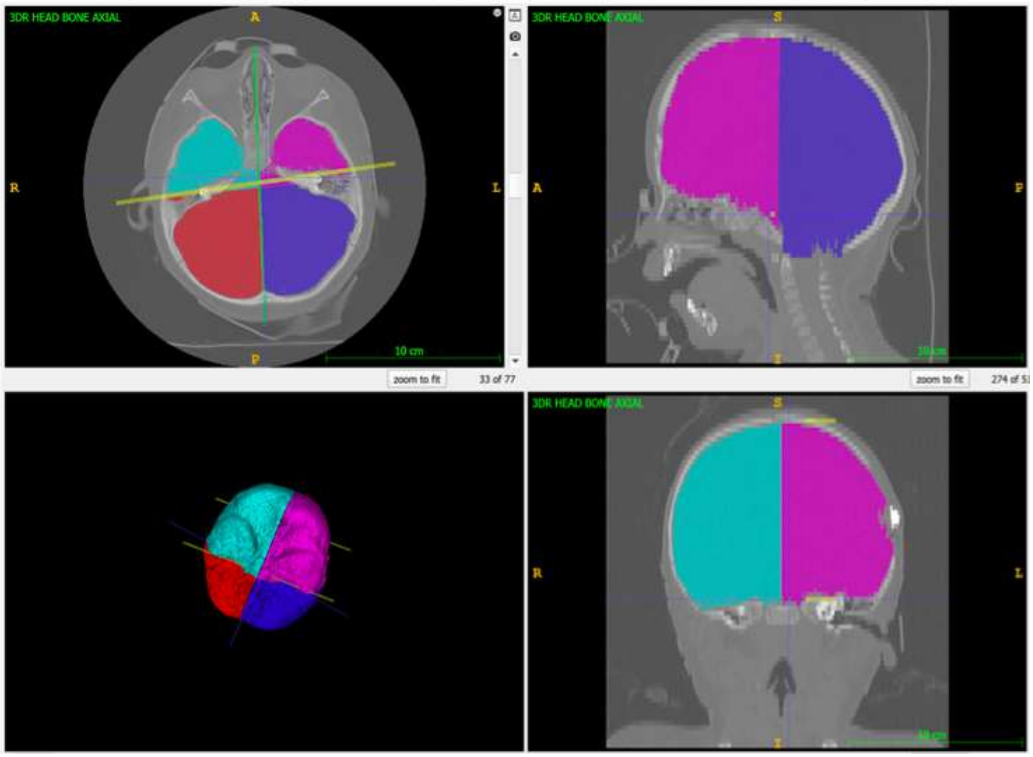
Following DO, ICV increased by 27.5% with an absolute mean volume increase of 216.5 cm^3 (848.5 vs. 1065cm^3). Pre and post-DO volumes as a proportion of ICV are shown in **Table 1.** Post-distraction, the SAQ and SPQ contained 1.8% (21.8% vs. 23.9%, *p*=0.15), and 1.3% (26.6% vs 27.7%, *p*=0.26) less volume than the NSAQ and NSPQ respectively. ICV change after distraction was more significant in the SAQ (mean 34.8%) than the other quadrants (SPQ 27.6%, NSAQ 18.3%, and NSPQ 19.4%).

Table 1: Volumes as a Proportion of Total ICV Before and After Distraction Osteogenesis

	Preoperative % of Total ICV	**Postoperative % of Total ICV**	**Relative Change (Absolute Change)**	***p*-value**
Synostotic Hemisphere	48.5	48.5	0% (0%)	0.97
SAQ	19.6	21.8	11.2% (2.2%)	0.036*
SPQ	27.3	26.6	-2.5% (-0.7%)	0.57
Non-Synostotic Hemisphere	51.4	51.5	0.2% (0.1%)	0.95
NSAQ	23.9	23.6	-1.3% (-0.3%)	0.81
NSPQ	29.2	27.9	-4.5% (-1.3%)	0.21

Conclusion: Unilateral premature fusion of the coronal suture results in ICV asymmetry with less ICV in the anterior and posterior quadrants on the side of synostosis. After DO, there is an increase and redistribution of ICV and an improvement in cranial vault symmetry. The most significant volume expansion following surgery occurs in the quadrants ipsilateral to the fused coronal suture.

Image 1: Division of three-dimensional reconstruction of endocranium into quadrants



Disclosure of Interest: None Declared

DAY17 - STATION 6 - IMAGING/PLANNING

17-6-046

ANALYSIS OF THE ROLE OF CT DATA IN THE DIAGNOSIS AND TREATMENT DESIGN OF CONDYLAR OSTEOCHONDROMA

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Introduction & Objectives: The diagnosis of condylar osteochondroma was made with the help of two-dimensional CT image and its three-dimensional reconstruction, and the classification of facial asymmetry deformity was evaluated to guide the operation.
Material & Methods: Eighty-two cases of mandibular condylar osteochondroma treated in the Department of Oral and Craniomaxillofacial Surgery of the Ninth People's Hospital affiliated to Shanghai Jiaotong University School of Medicine from 2005 to 2016 were selected. We evaluate their imaging data and the evaluation indicators included the size of the condyle, the extent of the lesion, and the soft and hard tissue changes around the lesion. At the same time, the three-dimensional reconstruction was acquired. The height of the mandibular ramus and the degree of chin deviation were measured for making the optimizing surgical plan.
Results: Of the 82 cases, 12 showed a clear boundary between the tumor and the condyle, while other70 cases showed no significant boundary; the peripheral tissue density of the tumor was usually higher than the center; there was a thin layer of soft tissue surrounding the tumor. Of the 82 cases, 11 cases had only vertical hyperplasia, which was hemimandibular hyperplasia(11/82); 7 cases had only horizontal extension, which was hemimandibular elongation(7/82); the other 64 cases showed vertical and horizontal hyperplasia of the mandible, which was hybrid form(64/82).
Conclusion: CT scan can effectively provide the range of lesions and its surrounding soft and hard tissue, which can serve as a basis for the diagnosis of condylar osteochondroma. In addition, the three-dimensional reconstruction of CT image can reflect the degree of facial asymmetry deformity, and provide a reference for the establishment of the optimizing orthognathic surgical plan.

Disclosure of Interest: None Declared

17-6-047

ANALYSIS OF NORMAL KOREAN ORBIT MEAN SHAPE MODEL FOR STANDARD PREFORMED IMPLANT

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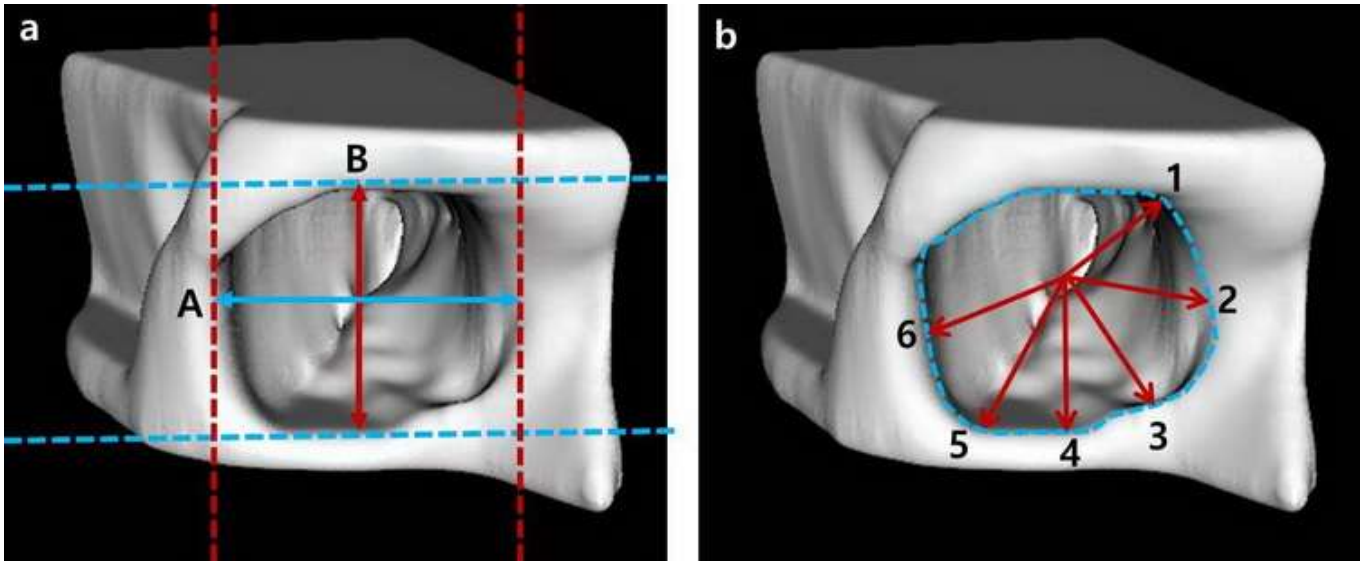
Introduction & Objectives: With advancements in preoperative computer simulation in medical science, many techniques for analyzing the orbital cavity have been developed. However, these technologies are limited to a few large hospitals. Cost and time considerations lead to the use of prefabricated orbital implants in reconstruction surgery. The widely used orbital implants are not designed specifically for the Asian orbital anatomy. Thus, we analyzed a Korean orbit mean shape model and compared parameters with the calculated average value, thereby providing a standard value for manufacturing orbital implants.

Material & Methods: We developed orbit-specific computer software (AMC-SWU®) for the production of an orbit mean shape model. The production steps included semi-automatic segmentation, shape reconstruction, statistical shape model generation, and mean shape and variance model production. Three-dimensional facial bone computed tomography (CT) was performed for 96 normal Korean patients. The data obtained were used to produce a representative mean shape model. We compared numerically collected measurements with the obtained mean shape measurements in the aspects of sex, age, and ethnic differences.

Results: We analyzed the vertical, horizontal, and rim dimensions as orbital parameters. From our orbit mean shape model, we validated the mean value for standardization in the Korean population. The mean models had vertical dimensions of 36.93 and 35.11 mm, horizontal dimensions of 38.49 and 36.79 mm, and rim dimensions of 45.76 and 42.90 mm for males and females, respectively. The distribution of each orbital parameter according to age showed that the vertical dimension did not vary with age (p=0.069), but the horizontal and rim dimensions decreased significantly with age (p=0.025 and p=0.040, respectively, in males). Age differences were analyzed among the following age groups: <29, 30–49, and ≥50 years. Six Korean mean shape models each were generated for men and women. Our model showed better accuracy in women than in men. For ethnic comparison, horizontal dimensions showed a significant difference between the two populations (p=0.000).

Conclusion: We developed a realistic, visualized three-dimensional Korean orbit mean shape model and compared its parameters with calculated values. As we classified only three age groups, our data will contribute to the manufacture of a highly marketable product based on our model.



Disclosure of Interest: None Declared

17-6-048

3D COMPUTER-ASSISTED TWO-LAYER AND THREE-LAYER MODELS OF THE FACE AND AR TECHNOLOGY

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Introduction & Objectives: Recently simulation surgery is progressively being introduced into surgical training in plastic surgery. However, there are few reports showing its usefulness. The models on which we developed and performed simulation surgery were realistic three-dimensional(3D), computer-assisted, two-layer elastic models(PRS 2017), three-layer models (PRS 2018) and separable two-layered elastic models (2018 PRSGO). On the other hand, our studies confirmed that AR technology using HoloLens from Microsoft Corporation with existing software is useful for evaluating body surface in several clinical applications (PRSGO 2017). Furthermore, we devised a new software to align surgical fields and holograms to perform precise simulation (PRS 2019). Our aim is to confirm the usefulness of these models in clinical cases and further explore how to utilize these 3D models and AR technology together in simulation surgery.

Material & Methods: The two-layer elastic model has the surface layer with polyurethane for skin and the inner layer with silicone for subcutaneous tissue and both the layers adhere to each other. The separable models can be detached the surface layer from the inner layer. The three-layer model has one more layer representing bone. HoloLens which is a head-mounted mixed reality device can display a precise 3D model stably on the real visual field as hologram. In the simulation surgery of many clinical cases including facial fracture, congenital anomaly, orbital tumor etc., we attempted HoloLens to display holograms of skin surface, facial bone, angiography on these models using our reported method.

Results: Since our models could show 3D movement, distortion, and deforming by simulation surgery, the two-layer elastic models contributed to teach residents and young doctors how to make several typical local flaps and to perform cheiloplasty. And the three-layer models of facial multiple fracture cases led us to understand simulation of effective approaching method to the fracture site. Additionally, the residents and young doctors wearing HoloLens could perform the typical flap design and simulation surgery on the separable two-layer models while viewing of holograms displayed on the models. Especially three-layer models of congenital anomaly cases enabled us to estimate the volume and size of bone and cartilage graft and to recognize the soft tissue profile change after osteotomy and bone grafting.

Conclusion: These 3D models were very useful of the simulation surgery in clinical cases. Moreover, we showed that the simulation surgery can be performed more effectively in many clinical cases using these 3D models and AR technology. The possibility of collaboration of the simulation surgery with these 3D models and AR technology will be further explored in the future.

Disclosure of Interest: None Declared

17-6-049

EVALUATION OF THREE DIMENSIONAL SIMULATION ON OSTEOTOMY FOR JAW DEFORMITY

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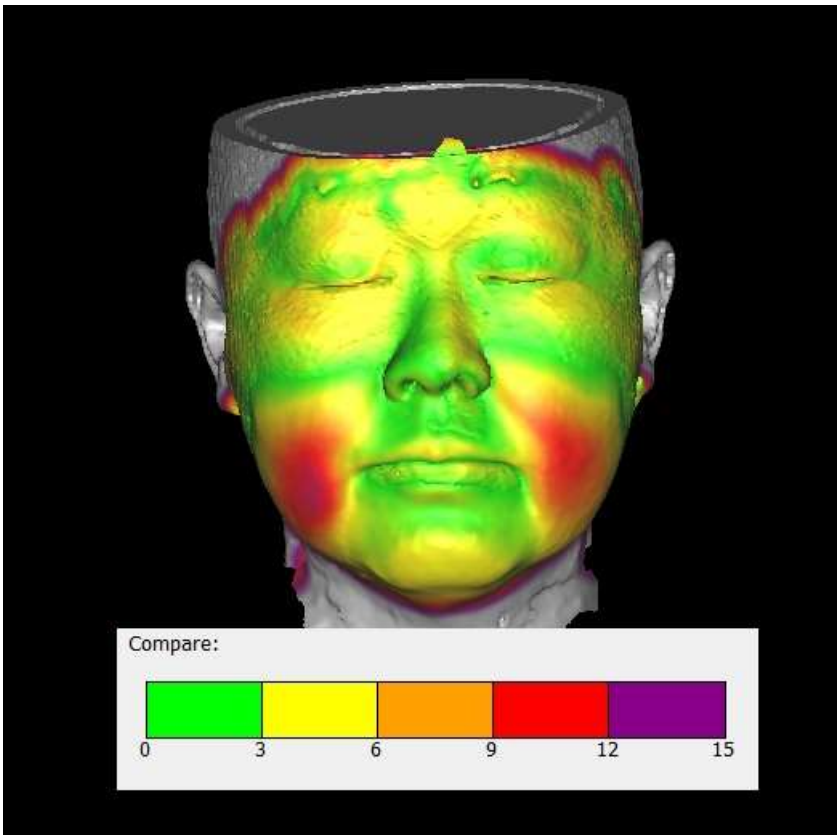
Introduction & Objectives: In our facilities, we perform 3D simulation to all patients with jaw deformities before osteotomy based on CT bone images, using 3D analysis software (Mimics®; ©Materialise, inc.). This 3D simulation is very useful when explaining operative procedures and showing the expected outcome of the operation to our patients. It is also very helpful to receive their informed consent.
With Mimics software, the simulation of soft tissues is also possible, however, a dissociation with the actual facial impression could not be cleared away. Therefore, in this study, we used non-contact type 3D shape measurement device (VECTRA®H1; ©Canfield Scientific, Inc.) and its new 3D analysis software (ProPlan CMF; ©Materialise, Inc.) to build 3D images of the facial impression to verify how precisely the operational outcome could be predicted.
Material & Methods: 3D simulation was performed to 12 patients with jaw deformities who underwent both maxillectomy and mandibulectomy or mandibulectomy only. We used preoperative CT images and pictures taken with VECTRA®H1 to build up 3D facial images predicting patients' post-operative facial impression. Also, postoperatively, 3D facial images were structured from the pictures taken with VECTRA®H1. The predictive 3D facial images were then compared with the actual postoperative 3D facial images.
Results: The facial impression showed difference in almost all facial parts, especially in cheeks, chins, and upper lips. On the other hand, difference was small in lower lips and nasal tips. These difference may have been affected by muscle tonus and physical position of the patients when pictures were taken.
Conclusion: Using VECTRA®H1 and its new 3D analysis software, ProPlan CMF, we tried to verify how precisely the surgical result of the soft tissues can be predicted. The facial impression differed largely between predictive 3D images built pre-operatively and those built postoperatively. However, only small difference were seen in lower lips and nasal tips. Patients muscle tonus and physical posture and thought to be affecting these results. In this study, it is revealed that our 3D simulation method still needs improvement. We will continue to collect more data and standardize the method when taking pictures with VECTRA®H1.

Disclosure of Interest: None Declared



17-6-050

ZEBRA STRIPING AND MOIRÉ MAPPING ASSESSMENT FOR HEMIFACIAL DEFORMITY

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Introduction & Objectives: We have tried a new method of osteotomy enabling the 3D expansion of volume in maxilla and/or mandible as well as using the expanding devices in both upper and lower jaws so that the expansion can be expected in multi angles.

In addition to the bone expansion, we have done lipoinjection to correct the soft tissue asymmetry.

To assess the surface symmetry, we have tried two new analytical methods, Zebra striping and Moiré mapping, which will give place to Moiré Topography.

Material & Methods: We have analyzed 12 facial asymmetry patients using the image processing analysis techniques. In all cases, we have done 3D facial bone expansion procedure and lipoinjection method.

Zebra striping

For the examination of the surface symmetry, we have created surface model of the skin then local curvature was compared using Zebra striping. The surface is assumed to be a mirror and reflection of black and white stripes is calculated using ray-tracing method

Moiré mapping

Moiré mapping describe contour lines just like Moiré topography.

To make Moiré mapping, we prescribe laminated plates which are positioned at regular intervals, then Boolean operation is done between facial mass and laminated plates.

Results: In Zebra striping, black and white sprite lines make it clear to recognize the nasal dorsi and the chin top. Therefore, we can easily determine the symmetric center line of a each face.

The contour of Moiré mapping makes it easy to infer the curvature of facial plane and the volume of the cheek soft tissues.

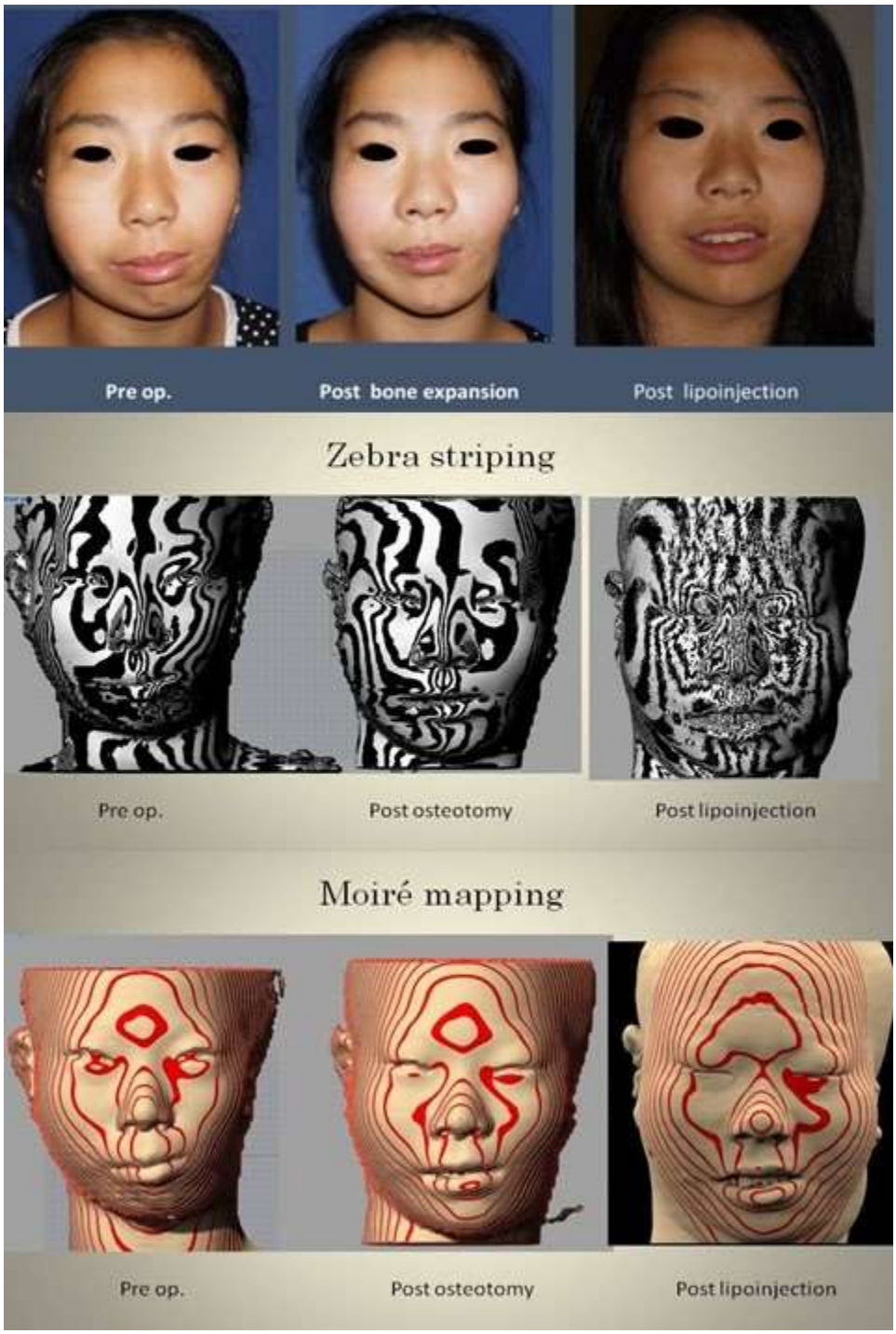
Conclusion: In bone expansion cases, we can obtain the skeletal symmetry using 3D facial bone expansion procedure, but the soft tissue volume can't be increased by this procedure. To correct the soft tissue defect, we inject fat tissue at buccal region.

Moiré mapping is useful to analyze the symmetry of facial plane. The contour of Moiré mapping can describe three dimensional volume of a face, especially in a cheek region.

We usually recognize a nasal dorsi by optical reflection. Zebra striping method emphasizes this optical reflection effect. The surface is assumed to be a mirror and reflection of black and white stripes is calculated using ray-tracing method. Zebra striping is useful to determine the symmetric center line of a face.

These techniques, Zebra striping and Moiré mapping, support human spatial perception of facial surface. They are very useful tools to the hemifacial disorders for plastic surgeons

Picture for abstracts 17-6-050:



Disclosure of Interest: None Declared

17-6-051

INTEGRATED DIGITAL DESIGN ASSISTANCE AS AN ADDITIONAL MODALITY IN CRANIOFACIAL SURGERY (CASE REPORT)

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Introduction & Objectives: Craniofacial surgery is one of the most challenging reconstructive operations because of the high expectations of the patient with the aim that the face returns to normal as before. The face has an important role to recognize identity. Damage to the face can cause an identity crisis. Integrated Digital Design (IDD) workflow is one way to achieve reconstruction goals. We report the case of reconstructive craniofacial surgery using IDD assistance, hoping to become an additional modality in the management of craniofacial disorders, especially in Indonesia.

IDD-based computer-aided design and manufacturing (CAD/CAM) technology, is now a standard in the manufacturing industry. While in Indonesia it is still in the initial stages to begin, especially in medical applications. The aim of this study is to develop and obtain workflows for patient-specific medical implant production involving 3D modeling and additive manufacturing (AM) that are suitable for application in Indonesia. The comprehensive workflow consists of four steps: reverse engineering (RE) based medical imaging; 3D modeling; AM or rapid prototyping (RP); and clinical application. The resulting implants are used to reconstruct bone damage or defects caused by trauma or disease. Traditionally, implants have been manually bent and formed, either before surgery or intraoperatively, with the help of a solid anatomical model. The proposed workflow removes manual procedures and can produce implants that are more accurate and cost-effective.

Material & Methods: Reporting 2 cases underwent reconstructive craniofacial surgeries. First case, 8 years old female with Meningo encephalocele r. frontal and Facial dysmorphy already underwent excision and frontal reconstruction using mesh. Second cases, 31 years old male with unilateral microtia's. Both patients underwent reconstruction using Integrated Digital Design for Craniofacial Surgery.

Results: Post-operative result showed an acceptable facial appearance. Both patients were satisfied with post operative results. Reconstruction using IDD assistance obviates the manual procedure and may result in more accurate and time-effective procedure.

Conclusion: Reconstruction using IDD assistance increased accuracy in reconstructive craniofacial surgeries. IDD assistance technology is a promising tools which can be explored so that can give birth to new techniques that can support the success of the reconstructive surgeries.

Disclosure of Interest: None Declared

17-6-052

DEEP LEARNING APPLICATIONS IN CRANIOFACIAL SURGERY

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Introduction & Objectives: Recent advances in medical imaging and machine learning may enable new quantitative, data-driven methods to improve craniofacial diagnoses and surgical outcomes. The emerging field of deep learning can provide new tools for screening, scoring, visualization, and projection that are more robust against patient and input noise and that can automatically learn accurate hierarchical features in the data without time-consuming and bias-inducing manual feature selection. New machine learning tools extract the underlying data trends to provide better surgical insight and accurate diagnostic classification.

Material & Methods: Deep learning models are most commonly trained using supervised versus unsupervised traning. The supervised and unsupervised models will be described.

Results: Deep learning systems have the potential to provide quantitative, comprehensive methods for diagnosing patient condition severity and surgical intervention success. Deep models can also be used to provide insight for surgeons by autonomously landmarking features, visualizing key regions of concern, predicting future outcomes based on data trends, and generating new 3D scan examples for targeted conditions. All of these potential tools will be discussed: 1. Diagnosing and scoring; 2. Localization and visualization; 3. Projection and generation. For craniofacial surgery, patient data from visual photographic sources should be sufficiently rich in information and free of bias. Standard two-dimensional photographs are likely the most commonly available data on patients, but multiple photographs are needed to capture all of the patient's geometric data. 3D scan data is also available at a growing number of institutions, taken from standardized systems like 3dMD that can accurately capture facial surface data with sufficient resolution. This 3D surface data can be analyzed by the machine learning system to determine features based off of curvatures, distances, and other geometric information. Using deep learning models like convolutional and capsule networks, the system can detect these spatial features and learn the necessary relations between them to convert patient scan data into comprehensive patient metrics and visualizable or generative models.

Conclusion: With the introduction of new machine learning methods from the domain of computer science, the craniofacial medical community may be able to develop new tools to improve patient outcomes. New deep learning methods are well-suited for developing comprehensive metrics for patient diagnosis, severity scoring and outcome assessment that directly map from raw facial scan data to intuitive comprehensive classifications.

Disclosure of Interest: None Declared

17-6-053

THE 3D EVOLUTION OF THE NORMAL CRANIUM DURING THE FIRST 2 YEARS OF LIFE

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Introduction & Objectives: During the first years of a newborn's life, the cranium changes very rapidly. Insight in this development is essential to monitor normal cranial development of new-borns, identify cranial abnormalities and to evaluate the shape change of the head in the follow up of craniosynostosis surgery. This study is the first to present the three dimensional (3D) evolution of the normal cranial shape during the first two years of life by the use of 3D stereophotographs.
Material & Methods: A total of 150 3D stereophotographs of new-borns without abnormalities were used to evaluate cranial evolution. All 3D photos were acquired between 3 and 24 months of age with a fixed interval of 3 months. This dataset was used to calculate the cranial length, cranial width, cranial index, cranial circumference and volume. Distance maps of the complete 3D morphology were produced to create a 3D perception of the cranial evolution
Results: Circumference of the head measured on 3D photographs increased from 412 to 502mm (22% increase). Cranial index showed a small decrease, from 78 to 77 (2% decrease). Volume increased from 982 to 1715 ml (75% increase). Evaluation of the 3D distance maps revealed a more prominent growth of the anterior part of the skull between 3 and 12 months. The posterior part of the skull developed more rapidly between 12 and 15 months compared to the rest of the skull and an almost uniform growth was seen between 15 and 24 months.
Conclusion: This 3D analysis of the normal cranial shape provides a valuable insight of the evolution of the cranium during the first 24 months of life. This study is the first study that presents 3D data which can be used for monitoring cranial development and for the follow-up of craniosynostosis surgery.

Disclosure of Interest: None Declared

17-6-054

GUIDANCE TEMPLATES OF THE NORMAL FOREHEAD FOR USE IN CRANIAL VAULT REMODELING

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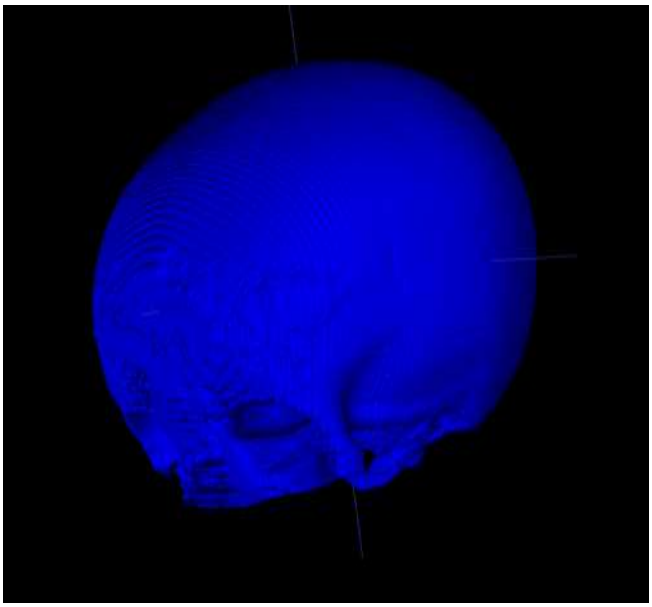
Introduction & Objectives: Craniosynostosis is often characterized by abnormal cranial shape and treated with open remodeling procedures. Due, in part, to the subjective nature of intraoperative bone remodeling, error can lead to inconsistent results with undesirable aesthetics. The forehead is particularly difficult given its visibility and guidance templates for the "normal" forehead are not in widespread use. The aim of this study is to produce Computed Tomography (CT)-based forehead templates for the average 9-month-old infant.

Material & Methods: Imaging was identified for individuals in each age group. Indications and results of the imaging (per radiologist) were recorded. CT scans were excluded if pathology was present affecting the forehead or if imaging quality was poor. Advanced Neuroimaging Tools (ANTs, Univ. of Pennsylvania, Philadelphia, PA, USA) software was used to create a skull template image using the included CT scans. Template creation utilizes an image registration pipeline to warp subject images to a collective space and generate an average image. To assess the number of CT scans needed to form an accurate template, a series of templates were generated using n=5, n=8, n=11, n=14, and n=17 CT scans. Craniometric data (interparietal distance, forehead depth, and radix-forehead breakpoint length) were measured four times for each template. The averages of each measurement were plotted to determine the number of scans needed to result in minimal change in the forehead measurements with the addition of subsequent scans (template stability). The final templates were manually segmented to isolate the frontal bone and models were made.

Results: 147 scans were identified for the 9-month age group. 100 scans were excluded due to pathology and 8 had unavailable imaging resulting in 39 normal scans. Twenty-two scans were excluded based on poor image quality yielding a total of 17 included CT scans. The differences between templates for each craniometric measurement were less than 3 mm demonstrating forehead image stability at n=17 CT scans. A guidance template for 9-month old individuals was created from 17 normal, high resolution CT scans from the included cohort. (Figure 1)

Conclusion: Successful creation of a guidance template for the average 9-month-old infant forehead has been achieved. This average is reliable due to craniometric measurement stabilization with 17 scans. Creation of additional templates for a 6 and 12-month-old infant are being produced to accommodate the common time points of cranial vault remodeling.



Disclosure of Interest: None Declared

DAY17 - STATION 7 - ORTHOGNATHIC

17-7-055

HEMIPALATAL DISCREPANCY IN TESSIER 7 FACIAL CLEFT RECONSTRUCTION: A PREVIOUSLY UNREPORTED PHENOMENON

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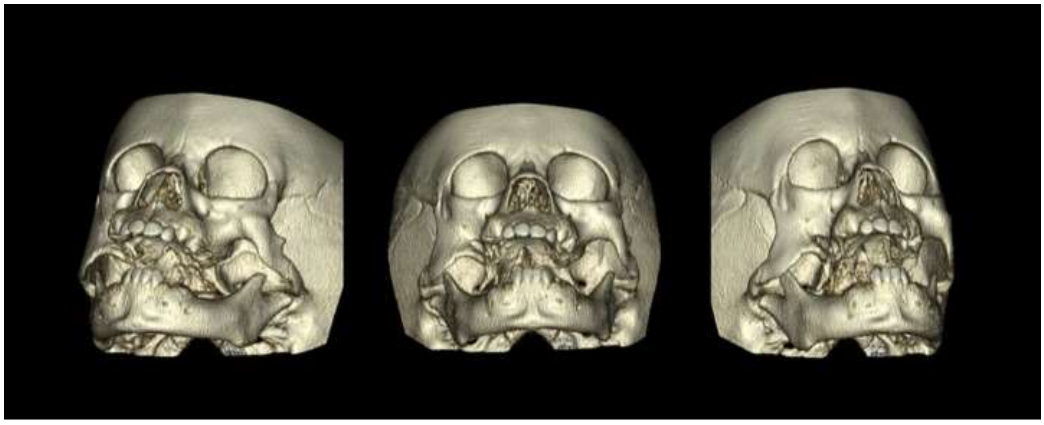
Introduction & Objectives: Tessier 7 cleft is the most common craniofacial cleft. When unilateral Tessier 7 cleft occurs in conjunction with the common cleft palate, the asymmetry results in differing palatal lengths. This hemipalatal discrepancy serves as a complicating factor in cleft palatoplasty. To date, no papers have described the specific findings of cleft palate with the Tessier 7 cleft. Therefore, the purpose of this case series is to provide a descriptive report of the expected findings of this rare combination and detail techniques to address it.
Material & Methods: IRB approval was obtained for review of relevant patients. The authors report two cases of pediatric patients with Tessier 7 facial clefts and cleft palate. Additionally, a Pubmed search was performed using the MeSH terms "tessier 7", "macrostomia," cleft palate", and "hemipalatal discrepancy". The relevant literature was identified and reviewed.
Results: Both patients had Tessier 7 facial cleft and Veau 2 palatal cleft. In Patient 1, the palatal lengths were 5.8cm and 3.8cm. In Patient 2, the palatal lengths were 6.3cm and 4.1cm. The resultant discrepancy was 2.0cm between the hemi-palates in Patient 1 and 2.2cm in Patient 2. Intraoperative findings for both patients revealed that the hemi-palate on the side affected by the Tessier 7 cleft demonstrated discrepant uvular lengths and atrophic and fibrotic speech musculature. Modified Furlow double opposing Z-plasties were designed in such a way to take the shorter arc of rotation into account for the affected palatal side. For Patient 1, the mean length of the two hemi-palates was 4.8cm and the postoperative palatal length was 4.3cm. For Patient 2, the mean length of the two hemi-palates was 5.2cm and the postoperative palatal length was 6cm. While Patient 2 has been undergoing speech therapy with improving intelligibility, Patient 1 expired shortly after surgery due to airway issues. Literature review yielded two relevant papers in which the palatal clefts were oriented obliquely with a central hypoplastic uvular structure. Hemipalatal discrepancy secondary to Tessier 7 facial cleft was not found.
Conclusion: Hemipalatal discrepancy secondary to cleft palate occurring with a craniofacial cleft lends unique challenges to cleft palate repair. This phenomenon is rare and not yet reported in the literature. In this small cohort of patients, the severity of the shortening directly impacted the ease of repair and ability to gain palatal length, more so than the absolute degree of discrepancy. A larger cohort of patients is required to determine the long-term efficacy of this technique, the rate of fistula formation, and speech outcomes.



Disclosure of Interest: None Declared

17-7-056

SPECIAL DISTRACTION OSTEOGENESIS PERFORMED SEPARATELY FOR EACH BONE SEGMENT IN PATIENTS WITH BILATERAL CLEFT LIPS AND PALATES

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Introduction & Objectives: Patients with bilateral cleft lips and palates have premaxillary protrusion and characteristic jaw deformities involving three-dimensional malposition of the premaxilla and bilateral maxillary bone segments. This study examined patients with bilateral cleft lips and palates who had deviation and hypoplasia of the premaxillas and bilateral maxillary segments. Before bone grafting, the patients were treated with special distraction performed separately for each bone segment using a halo-type external device. This report describes this novel treatment method which produced good results.

Material & Methods: The subjects were five patients with severe jaw deformities due to bilateral cleft lip and palate. They were treated with maxillary Le Fort I osteotomy and subsequent distraction performed separately for each bone segment using a halo device. In three of five patients, premaxillary osteotomy was not performed, and osteotomy and distraction were performed only for the right and left lateral segments with severe hypoplasia.

Results: All patients achieved distraction close to the desired amount. The widths of the alveolar clefts were narrowed, and satisfactory occlusion and maxillary arch form were achieved. After the surgery, three of five patients underwent bone grafting for bilateral alveolar cleft defects and the bone graft survival was satisfactory.

Conclusion: This method had many benefits, including narrowing of alveolar clefts, improvement of maxillary hypoplasia, and achievement of a good maxillary arch form. In addition, subsequent bone grafting for alveolar cleft defects was beneficial, dental prostheses were unnecessary, and frequency of surgery and surgical invasiveness were reduced. This method is a good surgical procedure that should be considered forpatients with bilateral cleft lips and palates who have premaxillary protrusion and hypoplasia of the right and left lateral segments.

Disclosure of Interest: None Declared

17-7-057

FACTORS INFLUENCING RELAPSE IN LEFORT I SURGERY IN THE CLEFT POPULATION

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Introduction & Objectives: This was a retrospective review of patients with cleft lip and/or palate who underwent Lefort I procedure. Factors including age, gender, cleft type, original skeletal position, surgical technique, advancement, end occlusion, time of surgery and follow up were considered in relation to degree of relapse.

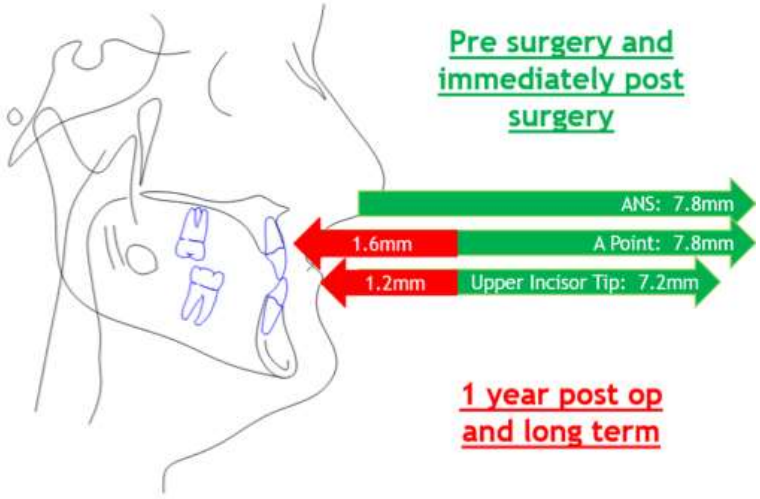
Material & Methods:

76 patients with diagnosis of non-syndromic cleft lip and/or palate were identified who had a Lefort I procedure. 32 patients had adequate radiographs and follow up time for assessment of relapse. All cephalograms were digitally traced by one author (L.M.) and analysed. 10 percent of images were retraced to ensure intra-rater reliability.

Results:

Eighty five percent of patient has unilateral cleft lip and/or palate. Average age at Le Fort I surgery was 17 years. The average number of surgeries on the palate completed prior to the Le Fort I surgery was 2.64(1-5). The mean horizontal and vertical movements were 7.8mm and 2.6mm respectively. On average one year post operatively, A point moved -1.57mm. One patient experienced major relapse and underwent redo surgery. Factors associated with increased risk of relapse included bilateral pathology and degree of advancement. There were no associations with age, gender, surgical technique, bone graft or number of procedures prior to surgery.

Conclusion: There is a degree of minor relapse in majority of cleft patients after Lefort I advancement. A degree of overcorrection is useful in all cases but particularly in patients with bilateral cleft, or shallow postoperative overbite.



Disclosure of Interest: None Declared

17-7-058

SINGLE-SPLINT TECHNIQUE IN ORTHOGNATHIC SURGERY FOR PATIENTS WITH CLEFT LIP AND PALATE

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Introduction & Objectives: The single-splint technique is an alternative to the conventional two-splint technique in bimaxillary orthognathic surgery (Yu CC et al., 2009). We present our experience with this versatile procedure for jaw deformity in patients with cleft lip and palate.
Material & Methods: Between 2011 and 2018, 18 patients with cleft lip deformity underwent bimaxillary orthognathic surgery using the single-splint technique at Kanazawa Medical University. The procedure was performed under general anesthesia with exposure of the whole face. Bilateral sagittal split osteotomy using Hunsuck's lingual short cut was performed first. Next, Le Fort I osteotomy was completed, and the maxillomandibular complex was fixed with the occlusal splint. The maxillomandibular complex was repositioned conservatively according to preoperative planning and the maxilla was fixed temporarily with metal wires. With careful confirmation of the intraoperative checkpoints, as described by Yu, both jaws were fixed with titanium plates and screws in an ideal position.
Results: The mean patient age was 18.1 years (range 15 to 33 years), with a male predominance (n=11; 61.1%). The mean operative time was 5 hours (range 3 hours 30 minutes to 7 hours 22 minutes) and the mean intraoperative blood loss volume was 610 ml (range 240 ml to 1600 ml). No major complications were observed and all patients were successfully treated with satisfactory aesthetic results.
Conclusion: Patients with cleft lip and palate often have soft tissue deficits and a more asymmetrical face than non-cleft patients, thus there are limitations of the conventional two-splint technique based on skeletal cephalometric analysis alone. Even for patients with cleft lip, the single-splint technique in bimaxillary orthognathic surgery is useful to maintain or improve facial asymmetry.

Disclosure of Interest: None Declared

17-7-059

EN-BLOC U-SHAPED OSTEOTOMY OF THE MANDIBLE AND CHIN FOR THE CORRECTION OF A PROMINENT MANDIBULAR ANGLE WITH LONG CHIN

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Introduction & Objectives: Lower face contouring surgery has become a popular aesthetic surgery in East Asian countries. Various surgical methods have been used to improve lower face aesthetics. When a patient has a wide as well as long lower face, procedures like chin polishing or T-type osteotomy are traditionally performed, but these surgical methods have several disadvantages. The authors devised a simple and reliable method to correct the wide and long lower face, without the complications associated with the traditional methods.

Material & Methods: From July 2015 to January 2018, 30 patients with a prominent mandibular angle, long chin, and no malocclusion underwent en-bloc mandibular U-shaped osteotomy through an oral incision, in order to shorten the mandibular angle, body of the mandible, and the chin, and to improve the facial contour. The authors assessed the effectiveness of surgery through comparisons between pre- and postoperative radiographs, patient satisfaction, and surgical complications in the postoperative period.

Results:

It was observed that all oral incisions healed by primary intention, and did not develop hematoma, infection, or osteonecrosis. Lower lip numbness occurred in 16 patients. After 6 to 12 months, all patients showed complete recovery from the numbness. All the patients were satisfied with their appearance after surgery.

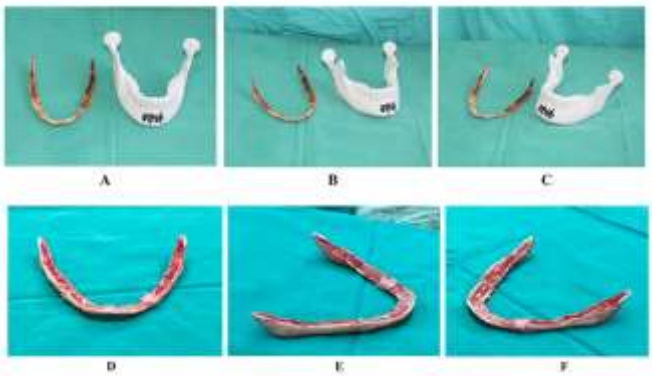
Table Preoperative and postoperative patients' Thirds ratio

'Equal Thirds' means the ratio of the trichion to the subnasale distance, the subnasale to the stoms distance and the stoms to Mes distance was similar to 1:1:1. The Chinese regard the rule of equal thirds to be "ideal" in terms of aesthetics, and follow it while designing the osteotomy line for a patient. The rule of 'equal thirds' was regarded as the most harmonious ratio among us.

Patients	Pre-op thirds ratio	Post-op thirds ratio
1	1.00:1.02:1.41	1.00:1.00:1.20
2	1.00:1.00:1.25	1.00:1.02:1.08
3	1.00:0.88:1.34	1.00:0.88:1.12
4	1.00:1.02:1.67	1.00:1.05:1.20

The table showed pre-op measurement ratio and post-op measurement ratio of some patients who were performed en-bloc U-shaped osteotomy of mandible and chin. There was statistical difference significance in thirds ratio between pre-op and post-op (Wilcoxon Rank sum test).

Conclusion: En-bloc mandibular U-shaped osteotomy is animproved form of mandibular surgery. The osteotomy lineinvolves the whole mandible, which makes the length and widthof the mandible considerably smaller. This surgery can effectivelycorrect a prominent mandibular angle with long chin.



Disclosure of Interest: None Declared

17-7-060

PLASTIC SURGERY RESIDENT MILESTONE ACHIEVEMENT IN ORTHOGNATHIC TECHNICAL SKILLS: A TWO-SITE VALIDATION OF EDUCATIONAL MODELS

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Introduction & Objectives: Plastic surgery evaluates residents on milestones, and there is limited data on optimal resident education of orthognathic and craniofacial surgical principles. This study defines a model of education including pre and post-test assessments paired with didactics, with the intention of evaluating and educating residents in the unique technical skills of craniofacial surgery.

Material & Methods: At the first institution, instrument identification, and time/accuracy of burr hole placement, craniotomy, and plating on Saw Bones™ Craniofacial Models were tested before and after a 7.5 hour craniofacial orthognathic surgery workshop. At the second institution, this was refined, removing plating, eliminating assessment of timing, and shortening didactics to standard osteotomies, instrument names, and common surgical approaches. The study population consisted of junior, mid-level, and senior residents on two different University craniofacial services. IRB was obtained for both sites.

Results: Participant performance was analyzed by level of training: junior, midlevel and senior resident. In the first iteration, resident performance time improved significantly for all four tasks (instrument identification p=0.008, burr hole placement p=0.035, square craniotomy p=0.035, plating p=0.016). Resident accuracy only improved significantly for instrument naming (p=0.003). Except for instrument naming, resident year did not impact improvement (timing: p=0.062, 0.310, 0.125, 0.334; accuracy: p=0.029, 0.664, 0.717, 0.306). In the second iteration, resident accuracy improved for all tasks (instrument naming p=0.00002, burr holes p=0.0031, craniotomy p=0.08). There was no difference in rate of improvement between resident cohorts.

Conclusion: Our proposed educational model on basic craniofacial surgery skills, standard osteotomies, and instrument names directed resident learning and assessed resident knowledge. Suspecting time lead to sacrifice of accuracy, time was removed as a metric at the second site and at the second site there was improvement in accuracy for all tasks. Plating was further removed due to belief it hindered efficiency, as well as educational overlap with orthopedic educational programs. The craniofacial skills task-based assessment successfully evaluated resident milestone attainment in a reproducible model consisting of specific task-based pre and post-assessments with a focused workshop didactic.

Disclosure of Interest: K. Grunzweig: None Declared, J. Son: None Declared, A. Kumar Conflict with: Polarity TE

17-7-061

INFORMATION NEEDS OF CHINESE PATIENTS WITH ORTHOGNATHIC SURGERY IN DIFFERENT STAGES OF TREATMENT：A QUALITATIVE RESEARCH

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[1]Oral & Crania-maxillafacial Surgery, [2]General Office, Shanghai Ninth People's Hospital, College of Stomatology, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Introduction & Objectives: The content and mode of delivery in which information is available to patients varies before undergoing orthognathic surgery. Ideally these resources should meet the identified needs of the patients' in order to achieve the greatest benefit. Lack of adequate information may lead to a decrease in patients' satisfaction. The aims of this study were to explore the diverse information needs of Chinese orthognathic surgery patients in different stages of treatment, including surgical program design, preoperative and rehabilitation, and to provide basis for future implementation of targeted information support strategies.

Material & Methods: Purposive sampling was undertaken amongst Chinese patients who had undergone orthognathic surgery in the past 12 months. Semi-structured interviews were carried out with 12 participants approximately 8 weeks before surgery, the day before the operation and 12 weeks after surgery. The interviews were transcribed and contentanalysis was undertaken using a framework approach.

Results: Participants identified a need for information that was limited or absent in several existing resources. Several main themes were identified: the choice of surgical program design, preoperative preparation, complications and side effects of surgery, information needs of post-operation care. Participants preferred to use information from digital media sources, including internet video, and establishing contacts through social networks, such as wechat, QQ, and internet discussion forums. Information sharing from peers undergoing similar treatment was considered to be more highly reliable.

Conclusion: This study demonstrates that Chinese orthognathic surgery patients look to seek various information about their surgery. This may suggest a possible gap in the provision of information by clinicians. However, it is clear that patients need more information to engage the treatment and decision-making. Therefore, there is a need for health care professionals to ensure that patients have access appropriate and relevant information support throughout the entire treatment process.

Disclosure of Interest: None Declared

17-7-062

DIGITAL OCCLUSION SET UP OF ORTHOGNATHIC SURGERY FOR UNILATERAL CLEFT PATIENTS: COMPARISON WITH DENTAL MODEL APPROACH

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Introduction & Objectives: Surgical planning for orthognathic surgery (OGS) using 3D program is getting popular due to its accuracy and convenience. However only few studies has been published about the method of surgical occlusion set up using 3D digital program, especially for the cleft patients. This study is to figure out the reproducibility of surgical occlusion set up using digital approach comparing with those of dental model approach and suggest the general principles of surgical occlusion set up especially for unilateral cleft lip and palate patients

Material & Methods: This study is a reverse engineering study.Thirty consecutive patients who diagnosed unilateral cleft lip and palate and underwent OGS were enrolled. Retrospective quantitative analysis was performed to figure out the characteristics of the surgical occlusion using a dental model approach (Control group). Then principles and standardized sequences for surgical occlusion set up were established through the retrospective study and applied it to the digital approach occlusion set up using a 3D program (Study group). The results of two groups were compared through quantitative analysis and root-mean-square difference (RMSD) of distance between superimposed images of two groups.

Results: The dental midline discrepancy was larger (1.2 mm) and dental collision occurs more frequently (40%) in control group than those of study group (0.3mm, 0%). The average RMSD of surgical occlusion images between the two groups was 0.45 mm, indicating acceptable relationship.

Conclusion: Digital occlusion set up has many advantages and can be applied especially for unilateral cleft patients who have irregular dentition with asymmetry.

Disclosure of Interest: None Declared

17-7-063

VALUE-BASED MEDICINE: A RETROSPECTIVE EVALUATION OF VIRTUAL VS. TRADITIONAL SURGICAL PLANNING FOR ORTHOGNATHIC SURGERY

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[1]The Children's Hospital of Philadelphia, [2]Division of Plastic and Reconstructive Surgery, The University of Pennsylvania, Philadelphia, United States

Introduction & Objectives: In orthognathic surgery, virtual surgical planning (VSP) is gaining popularity over traditional surgical planning (TSP) with physical models. However, concerns about cost of VSP have slowed adoption of this technology. The authors investigate the value, patient outcomes per unit of cost, of VSP vs. TSP over the entire cycle of surgical care.

Material & Methods: Clinical outcomes and cost from surgical planning to transition to non-permanent retainers were compared for patients undergoing bimaxillary surgery between 2005 and 2016. Outcomes and charge information were analyzed by independent *t*-test, Mann-Whitney U tests, and 2x2 contingency tables using Fisher's exact test.

Results: The VSP (n=19) and TSP cohorts (n=10) had similar hospital LOS, rates of complications, readmissions, and duration of postoperative orthodontic treatment ($p>0.05$ for all). VSP bimaxillary procedures trended towards shorter operative times ($p=0.052$). Mean total hospital charges for VSP patients were similar to mean charges for the TSP cohort ($p=0.160$). Mean charges for medication, laboratory and testing, and room and board were also statistically similar between TSP and VSP ($p=0.169$, $p=0.953$, and $p=0.196$ respectively).

Conclusion: In this retrospective cohort analysis, measured patient outcomes are similar between the use of TSP or VSP in the setting of similar hospital-specific charges. The findings suggest that VSP may provide similar patient outcomes and cost compared to TSP in planning bimaxillary orthognathic surgery. Additional prospective, multi-center analysis is warranted to provide healthcare systems and insurers with the most accurate data to make rational economic and clinical decisions regarding the value of VSP.

Disclosure of Interest: None Declared

DAY17 - STATION 8 - HEMIFACIAL MICROSOMIA/ROBIN

17-8-064

PI3K-AKT SIGNALING PATHWAY WAS INVOLVED IN HEMIFACIAL MICROSOMIA BY INHIBITING BONE MODELING

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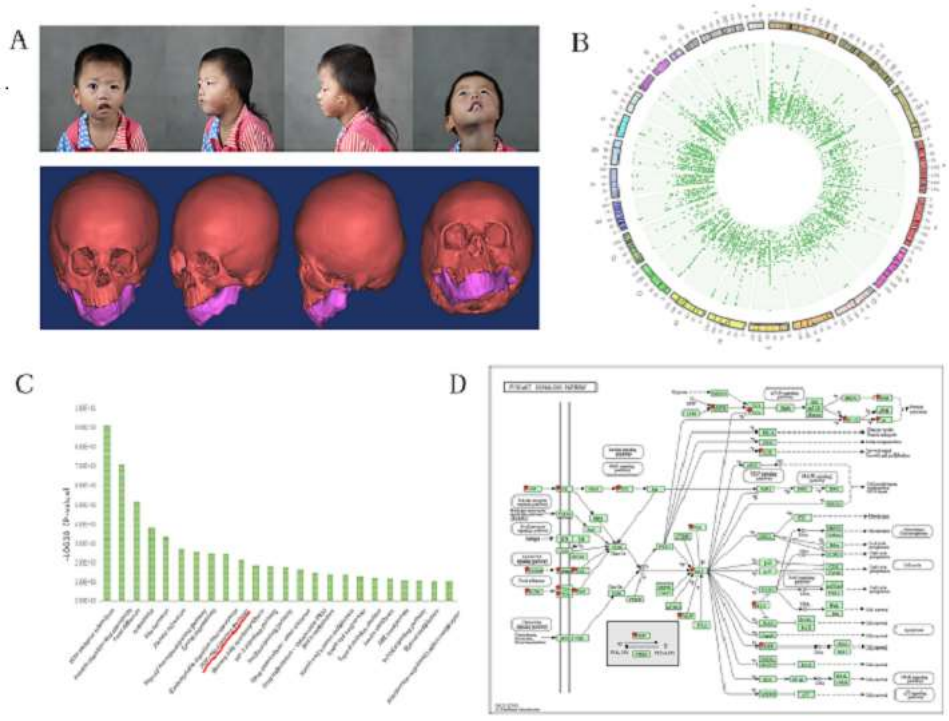
[1]Plastic and Reconstructive Surgery, Shanghai Ninth People's Hospital, Shanghai JiaoTong University School of Medicine, Shanghai, China

Introduction & Objectives: Hemifacial microsomia corresponds to a spectrum of rare congenital malformations characterized by unilateral hypoplasia of the mandible and surrounding soft tissues. While the specific etiology and mechanism remains unknown, environmental factors and substantial evidence for genetic involvement have been recognized as contributing to the development of hemifacial microsomia. We intended to further explore the pathogenesis of hemifacial microsomia in this study.

Material & Methods: by whole exome sequencing, we identified potential hereditary factors in thirty-four sporadic hemifacial microsomia patients and the possible molecular pathways involved in hemifacial microsomia pathogenesis. As the disease is characterized by of mandibular hypoplasia that could be attributed to localized abnormalities in bone modeling/remodeling, we investigated the effect of the candidate pathway in the context of osteogenesis (bone formation by osteoblast) and osteoclastogenesis (osteoclast formation and bone resorption).

Results: We identified the PI3K-Akt signaling pathway as an excellent candidate pathway for further investigations through gene functional pathway analysis. Gene knockdown of Akt by small interfering RNA downregulated both osteogenic and osteoclastogenic processes. Similarly, LY3023414, a pan-PI3K inhibitor, attenuated the Akt/GSK3 dependent activation of β-catenin and NFATc1 during osteogenesis and osteoclastogenesis, respectively. Local injection of LY3023414 into the mandibular area of mice resulted in mandibular deformity reminiscence of hemifacial microsomia, providing further evidence for the involvement of PI3K-Akt in the pathogenesis of hemifacial microsomia in vivo.

Conclusion: Collectively, our study have identified the PI3K-Akt signaling pathway as a contributor towards the pathogenesis of hemifacial microsomia.



Disclosure of Interest: None Declared

17-8-065

WHOLE-EXOME SEQUENCING FOR MONOZYGOTIC TWINS DISCORDANT FOR HEMIFACIAL MICROSOMIA

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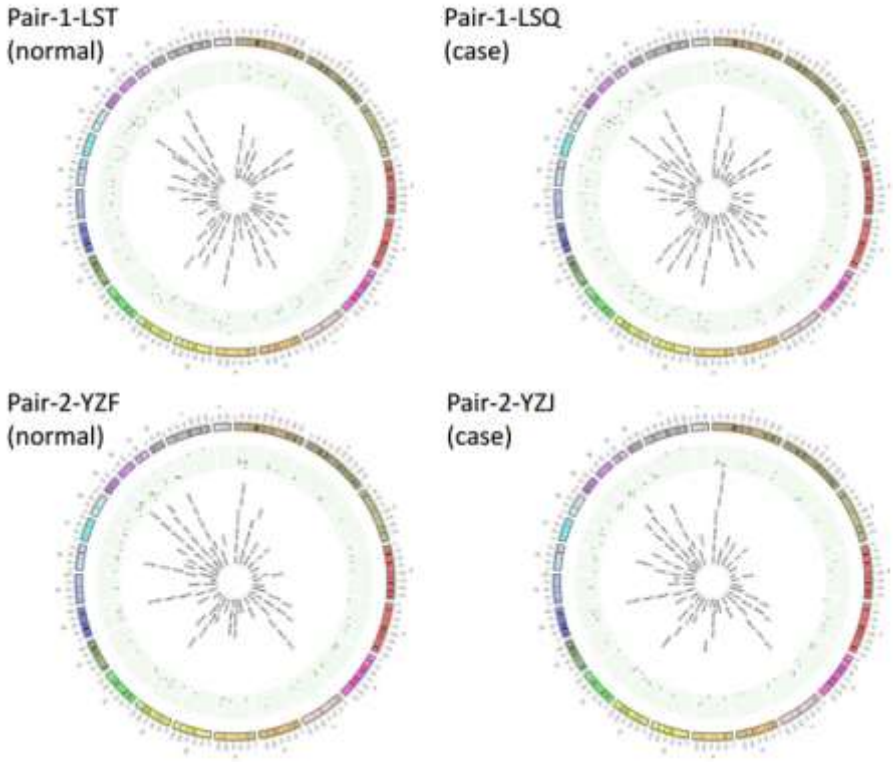
Introduction & Objectives: Hemifacial microsomia is the second most common congenital craniofacial malformation. Although many sporadic and familial cases have been studied to explore the etiology and pathogenesis of hemifacial microsomia, no common understanding has been reached. We aimed to further probe into the etiology of hemifacial microsomia through studying monozygotic twins.

Material & Methods: We reported two cases of pairs of monozygotic twins discordant for hemifacial microsomia, and performed single nucleotide polymorphism arrays and whole-exome sequencing. The sequencing reads were then mapped to the human genome (hg19) and germline mutations were called using the following parameters: minimum coverage, 20; minimum variant frequency, 0.08; p-value, 0.05. Finally, we applied the following criteria to filter the identified germline mutations: (1) depth of alternative alleles > 5; (2) allele frequency of the alternative allele in the population < 0.001; (3) mutation ratio of the alternative allele > 0.3; (4) impact severity = “HIGH” or “MED”; (5) prediction result of POLEPHEN2 was not “benign” and prediction result of SIFT was not “tolerated”.

Results: We identified 93 and 83, and 101 and 104 genes containing rare germline mutations in the twins of the two pairs, respectively. No positive gene candidates were found among the samples, and none of the analyses results revealed a clear intersection with previously reported gene candidates.

Conclusion: The pathogenesis of hemifacial microsomia twin pairs does not appear to be related to single nucleotide variants or small insertions/deletions. Thus, hemifacial microsomia may be caused by structure variations, epigenetic alterations, and/or instability of short repeat sequences, which requires further investigation in a larger cohort with sequencing technology for verification.



Disclosure of Interest: None Declared

17-8-066

TREATMENT STRATEGIES FOR HEMIFACIAL MICROSOMIA IN FUJITA HEALTH UNIVERSITY SCHOOL OF MEDICINE

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Introduction & Objectives: Hemifacial microsomia is the second most frequent congenital facial disorder, the most common one being the cleft lip and palate, but it indeed is a very complex disorder, and it does not have the standard treatment yet. Facial asymmetry tends to be more pronounced as children grow up so the treatment is best started early in the childhood. When we treat these patients, we carefully take into consideration the degree of mandibular deformity in individual patients and postoperative control of the occlusal plane. Today, how we treat Pruzansky grade I, II and III patients at our institution, is presented.

Material & Methods: There are several different kinds of classification methods for hemifacial microsomia, and the classification we use, is the Pruzansky classification. There are Grade I, II, and III. Just to review, in grade I, there is a condylar deformity. In Grade II, the maxillar condyle is not formed, and in Grade III, almost the entire remus is not formed. From our experience, elongation of the affected ramus needed is always less than 15mm in grade I. So we do vertical osteotomy and a one-stage elongation, rather we do downward distraction of the maxilla with orthodontics treatment. In Grade II, since deformity affects maxilla as well as mandible, we select Gradual distraction of both the mandible and maxilla. This will prevent the destruction of occlusal plane and therefore, early postoperative relapse is extremely rare. In grade III, During the growth spurt, in an attempt to achieve Centralization of chin and to make occlusal plane tilt horizontal, the hypoplastic remus of the mandible is mobilized to perform costochondral graft. Anticipating the osteotomy of the maxilla and mandible in the future, we don't perform osteotomy at this point, but rather we do downward distraction of the maxilla with orthodontics like Grade I.

Results: For Grade I, Grade II and Grade III with Two-stage treatments during and after growth spurt greatly improved facial asymmetry and the stability of occlusion.

Conclusion: When the operation is done on patients in their adolescent years, we need to stabilize occlusion as soon as possible in order to prevent early relapse. On the other hand, once recurrence of deformity due to growth spurt occurs, we certainly need to encourage occlusion exercise, additional traction and even operation if indicated to keep the occlusal plane intact. It is probably impossible to completely prevent the recurrence of deformity during the growth spurt, but we think we can keep it to the acceptable level with our treatment methods.

Disclosure of Interest: None Declared

17-8-067-N / S6B-13

TRANS-FACIAL MINIMAL-DISSECTION MANDIBULAR DISTRACTION OSTEOGENESIS FOR NEONATAL AIRWAY OBSTRUCTION FROM PIERRE ROBIN SEQUENCE

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Introduction & Objectives: Mandibular distraction osteogenesis (MDO) has been demonstrated to be effective for correction of tongue-based severe obstructive sleep apnea in infants with Pierre Robin sequence. The most commonly used technique involves an extraoral submandibular approach to allow an inverted-L osteotomy, and placement of partially-buried devices. This approach has a 15% rate of facial nerve damage, and 48% rate of 1st molar injury. This study seeks to provide a detailed description and long-term complication profile to an alternative technique, transfacial minimal-dissection external MDO.

Material & Methods: A retrospective review of medical record data and dental images was performed for all consecutive neonates (<1 year old) treated with this technique at a single institution from 2004-2014.

Results: 100 consecutive patients (male = 50, 50%) treated by two-pin trans-facial mandibular distraction were identified, including both those treated primarily (n = 68), and secondarily with MDO following initial tracheostomy (n = 32). Peri-operative complications requiring unplanned surgical revision (n = 14, 14%) included hardware failure (n = 8) and early consolidation (n = 6). Significant long-term complications included limited mouth opening in 2 patients, marginal mandibular nerve weakness in 1 patient, and TMJ ankylosis in 2 patients, both of whom were syndromic (Mansky-Catel and Cornelia de Lange syndromes). No patients required scar revisions. 42 patients in the age of mixed dentition (6 -12 years) had dental x-rays available. Of 84 mandibular 1st molars examined, 9 were missing, 36 were normal, and 39 were deformed.

Conclusion: Transfacial minimal-dissection MDO is an alternative tool to the traditional external approach for MDO, with equivalent perioperative complications, but with a significantly decreased incidence of facial nerve injury. 1st molar deformation is essentially equivalent between the two methods, and may be attributed to the tooth bud lying within the intended osteotomy line using the transfacial minimal dissection MDO-technique. We don't believe pin placement causes any teeth injury, since the upper pin is placed well above the site of the developing tooth buds, meanwhile the lower pin is placed below the canine roots.

Disclosure of Interest: None Declared

17-8-068

ADVANCED GENIOPLASTY OSTEOTOMY FOR AIRWAY CONSTRICTION IN THE UPPER RESPIRATORY TRACT

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Introduction & Objectives: Corrective jaw surgery is performed to correct conditions of the jaw and face related to factors such as structure, growth, and movement. In particular, advancement genioplasty osteotomy (also called horizontal osteotomy of the chin) is used to correct airway constriction conditions such as sleep apnea. The purpose of this presentation is to report our experience with four advancement genioplasty osteotomy cases performed in our department.

Material & Methods: In the four cases reported below, the preoperative airway constriction was compared with the postoperative constriction.

Case 1: A 23-year-old female diagnosed with sleep apnea with micrognathia due to Treacher-Collins syndrome. An interposition genioplasty and segmental osteotomy of the mandible were performed.

Case 2: A 16-year-old male with Treacher-Collins syndrome. The patient had undergone bilateral mandibular body distraction in childhood, which had improved his sleep apnea. However, the sleep apnea recurred after orthodontic treatment. Hence, sliding genioplasty was performed.

Case 3: A 23-year-old male diagnosed with severe sleep apnea due to Crouzon syndrome. The patient had previously undergone Le Fort Ⅲ advancement osteotomy (twice), tongue reduction, and sliding genioplasty. The airway constriction had improved after the previous genioplasty. However, it was reactivated with an increase in bodyweight, and so nighttime CPAP management was resumed. Hence, distracting genioplasty was performed to obtain enough anterior movement.

Case 4: A 9-year-old female with micrognathia due to Goldenhar syndrome. The patient underwent tracheostomy to correct airway obstruction at 2 months of age, and had recently undergone bilateral mandibular body distraction and reconstruction of the right temporomandibular joint by a rib and costochondral complex graft. Interposition genioplasty was then performed by adding a rib bone graft to create further airway expansion.

Results: Airway constriction was improved postoperatively in all cases. The patient in case 4 no longer had respiratory distress when attaching the speech cannula.

Conclusion: The method of genioplasty osteotomy with geniohyoid muscle advancement as a treatment for sleep apnea was first reported by Riley et al. in 1989. We confirmed the usefulness of this method not only for cases of upper airway constriction without maxillary hypoplasia, but also for sleep apnea syndrome that had recurred after achievement of dental articulation.

Disclosure of Interest: None Declared

17-8-069

DISTRACTION OSTEOGENESIS IN MANDIBULAR DEFORMITIES IN HEMIFACIAL MICROSOMIA

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Introduction & Objectives: The reconstruction of severe mandibular deformities in patients with hemifacial microsomia (HFM) is difficult. Mandibular distraction osteogenesis has gained popularity as a technique for managing patients with mandibular hypoplasia. The purpose of this report is to present our early findings with the clinical application of mandibular distraction osteogenesis in HFM.
Material & Methods: It is a retrospective study about six patients treated in maxillofacial department of Sahloul hospital for hypoplasia mandibular in HFM. In selected patients, mandibular distraction osteogenesis can be beneficial by improving overall facial symmetry and balance
Results: Six patients affected by types I, II and III hemifacial microsomia were operated on at an average age of 7 years. The distractor was posed after bi-cortical osteotomy in the mandible angle in five cases and in the Ramus in one case. Occlusal plane was reduced on average following distraction osteogenesis, showing good dentoalveolar plasticity. Mandibular vertical changes showed a gradual return of the asymmetry, with growth in all patients.
Conclusion: Although aesthetic and psychological advantages of distraction osteogenesis are well accepted it should only be applied after careful patient selection and honest explanation of the long-term recurrence by genetically determined craniofacial growth patterns.

Disclosure of Interest: None Declared

17-8-070

UTILITY OF THREE-DIMENSIONAL EVALUATION OF UPPER RESPIRATORY TRACT IN SEVERE CASES OF MICROGNATHIA THROUGH MANDIBULAR DISTRACTION

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Introduction & Objectives: We have performed mandibular distraction at an early stage of congenital micrognathia with airway obstruction in order to avoid or wean tracheostomy and obtained good results. On the other hand, it is often difficult to shoot cephalogram images with high-reproducibility in those child patients with severe micrognathia. In this report, we propose that the three-dimensional analysis of CT image through mandibular distraction is a useful evaluation method in patients with micrognathia.

Material & Methods: The subjects were the ten patients with micrognathia who underwent mandibular distraction at our hospital. The details are; 2 cases of Pierre Robin sequence, 2 cases of Treacher Collins syndrome, 1 case of Nager syndrome, 1 case of bilateral craniofacial microsomia, 1 case of hypoglossia-hypodactylia syndrome, 1 case of Goldenhar syndrome, 1 case of CHARGE syndrome and 1 case is unknown. The 3DCT images of these patients were reconstructed using a three-dimensional analysis software (Proplan CMF ver.3, Materialize NV, Belgium). The airways were defined with the space volume, where the palatine bone was set as the upper edge, the tip of the uvula as the front edge, and the bottom of the fifth vertebra as the lower edge. The lower end of the sella turcica was defined as the origin point. The intersection line of the plane passing through the origin and parallel to the Frankfurt plane and the sagittal plane passing through the anterior nasal spine was set as the x-axis, while the intersection line with the coronal plane passing through the origin and perpendicular to the sagittal plane was set as the y-axis. The moving distance of the bone was calculated with a vector on the x - y axes. The correlation between the volume change of upper respiratory tract and moving distance of mentum and hyoid bone was examined.

Results: Among the bone movement parameters measured in two dimensions and three dimensions, the strongest correlation was found between the moving distance of mentum and the increase rate of airway volume in three dimensions ($p < 0.01$, $r = 0.718$).

Conclusion: In recent years, a remarkable development has been seen in image analysis, and the evaluation method is shifting from two-dimensional to three-dimensional. The main purpose of mandibular distraction is the improvement of respiratory disorder by expanding upper respiratory tract, where an objective evaluation and establishment are required. The effect of mandibular distraction was clarified with the three-dimensional analysis in this study. It seemed to be a useful and excellent method for evaluation. In the future, we would like to perform the analysis in consideration of the growth and investigate the difference by disease and the comparison with polysomnography.

Disclosure of Interest: None Declared

17-8-071

EFFICACY OF MANDIBULAR DISTRACTION FOR OSAS: A RETROSPECTIVE ANALYSIS OF 10 YEARS

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Introduction & Objectives: Mandibular Distraction Osteogenesis (MDO) can be effective in the treatment of tongue-based airway obstruction and in the prevention and/or resolution of a tracheostomy in patients with isolated or syndromic Robin Sequence (RS) and syndromic craniosynostosis (SCS). The (oro)pharyngeal airway volume can be increased by gradually lengthening of the mandible. However, there is debate about the timing and efficacy of MDO, and data on the long-term follow-up and complications is limited. The aim of this study was to retrospectively evaluate the efficacy and successfulness of this treatment of the last decade.

Material & Methods: A retrospective study was conducted on children with isolated or syndromic RS and SCS, who underwent MDO between 2005 and 2018. Outcome parameters were: results of sleep disordered breathing based on polysomnographic parameters, decannulation ratio of tracheostomy, complications.

Results: 21 patients with isolated (n= 2) and syndromic (n=15) Robin Sequence and syndromic craniosynostosis (n=4) were included. The mean age at first MDO was 3.70 (±2.49 SD) years, mean follow up time was 4.79 (±4.31 SD) years. After the first MDO, the airway obstruction resolved in 7 out of 8 (87.5%) patients without a tracheostomy. Three of the 13 patients with a tracheostomy acquired sufficient airway after the first MDO and were decannulated. Long term follow-up showed that 4 out of 10 remaining tracheostomy-dependent patients transubstantiate a second MDO procedure later in life (mean age 6.61 (±2.22 SD) years). After this second MDO, 2 patients were decannulated, which resulted in a final decannulation rate of 5/13 (38.5%), including 2 isolated and 3 syndromic RS patients. Reasons for failed decannulation were remaining multilevel functional and anatomical problems of the upper airway. During follow up, technical correction of the distraction device was necessary in 4 patients. Besides 9 patients, all with initially a tracheostomy, remained tube feeding dependent. However, one syndromic RS patient deceased unexpectedly 2 years after decannulation due to swallowing problems.

Conclusion: Mandibular Distraction Osteogenesis was effective in creating a sufficient airway in almost all (87.5%) patients without tracheostomy. However, in most patients with a tracheostomy, MDO was unsuccessful (61.5%) in relieving obstructive airway symptoms, even after a second MDO.

Disclosure of Interest: None Declared

17-8-072

FINITE ELEMENT MODELING OF THE NEONATAL HYPOLASTIC MANDIBLE

L. S. Humphries [1,*], R. R. Reid [1], C. F. Ross [2], J. M. Collins [3], A. B. Taylor [4], A. R. Freire [5], A. C. Rossi [5], F. B. Prado [5]
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Introduction & Objectives: Biomechanical characteristics of the hypoplastic pediatric mandible are not taken into account when planning osteotomies and mandibular distractor placement to treat patients with Pierre Robin Sequence. Better understanding of strain regimes in pediatric mandibles is crucial for mandibular distraction osteogenesis (MDO) planning. We hypothesized that the strain regime of hypoplastic pediatric mandibles with anterior dental loading would resemble that of adult humans and non-human primates, showing high strain magnitudes in the condylar neck and the internal mandibular angle.

Material & Methods: We constructed finite element models of 6 pediatric pre-MDO hypoplastic mandibles: CT scans were segmented to obtain three-dimensional surfaces, which were converted into tetrahedral finite element meshes and assigned material properties of human cortical bone (Fig. 1). To estimate loading forces, the jaw-elevator muscles were segmented from the CT scans to calculate volumes. These were divided by fiber lengths estimated from published fiber/muscle length ratios, and the resulting estimated anatomical cross-sectional areas were converted to muscle forces using a specific tension of 22.5 N/cm^2. The model was loaded bilaterally with estimated masseter, temporalis and medial pterygoid forces applied on the muscle insertion sites. Analyses simulated incisor “biting” by constraining the incisor alveolar margin against all displacements and rotations and the tops of the condyles against vertical and anteroposterior translation only; the condyles could translate along a transverse axis. Equivalent von Mises stresses in the bones were used to evaluate results.

Results: All simulations resulted in non-uniform distributions of von Mises stresses. In all models, low stress magnitudes characterize the parasymphyseal region and corpus, with relatively higher stresses along the alveolar process and anterior and posterior edges of the ramus. In all models, aside from modeling artifacts at constrained points, the highest stresses are found at the internal angle or external oblique ridge (junction of ramus and corpus) and the lingual side of the condylar neck.

Conclusion: The high stress areas of the FEMs of the pre-MDO pediatric mandible are those where distractor plates are commonly attached, and include the head and neck of the mandible where growth occurs. Future research should investigate the effect of osteotomies and distractor placement on mandibular stress/strain patterns. Comparisons with age-matched controls will provide insight into the degree to which mandibular hypoplasia affects mandibular strain patterns before and after distraction.

Disclosure of Interest: None Declared

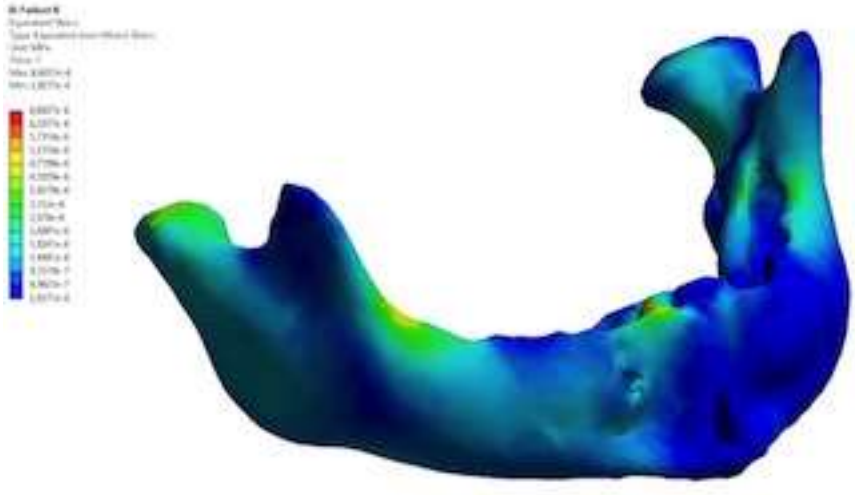

Figure 1. Von Mises stress regime in pre-operative Patient 8.

DAY17 - STATION 9 - RESEARCH

17-9-073

OSTEOPROTEGERIN REDUCES OSTEOCLAST RESORPTION ACTIVITY WITHOUT AFFECTING OSTEOGENESIS ON NANOPARTICULATE MINERALIZED COLLAGEN GLYCOSAMINOGLYCAN

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Introduction & Objectives: Characterization of the instructive capabilities of extracellular matrix (ECM)-inspired materials for osteoprogenitor differentiation has sparked questions on the interactions between such materials and the host microenvironment. In this work, we combine an adenoviral-mediated expression of osteoprotegerin (AdOPG), an endogenous osteoclast inhibitor against the receptor activator of nuclear factor-κB ligand (RANKL), in primary human mesenchymal stem cells (hMSCs) with a highly osteogenic nanoparticulate mineralized collagen glycosaminoglycan (MC-GAG) scaffold to understand the role for osteoclast inactivation in augmentation of bone regeneration.

Material & Methods: Primary bone marrow-derived hMSCs were transduced with control or AdOPG and seeded onto non-mineralized control scaffolds (Col-GAG) or MC-GAG. Osteogenic differentiation was assessed with gene and protein expression as well as histologic and radiologic detection of mineralization. Resorptive activities of primary human osteoclasts were assessed in the direct and indirect co-cultures.

Results: hMSCs expressed lower ratios of endogenous RANKL/OPG protein on MC-GAG compared to Col-GAG, which was further reduced when transduced with AdOPG. In co-cultures, hMSCs augmented hOC-mediated resorption and hOCs augmented hMSC-mediated mineralization suggesting that stimulatory effects exist between the cell types when both are in the process of undergoing differentiation. While AdOPG-transduction diminished hOC-mediated resorption, the stimulatory effects of hOCs on hMSC-mediated mineralization were unaffected. Notably, AdOPG-transduced hMSCs reduced the resorptive activity of osteoclasts with a greater effect on MC-GAG compared to Col-GAG.

Conclusion: The addition of osteoprotegerin to MC-GAG-mediated hMSC osteogenic differentiation simultaneously inhibits osteoclast resorptive activity without affecting the positive paracrine effects on osteogenic differentiation. These results suggest new possibilities for material development utilizing strategies that capitalize on transient disturbances in osteoclast resoprtion to allow for the establishment of a critical mass of regenerated bone.

Disclosure of Interest: None Declared

17-9-074

APPLICATION OF MODIFIED RNA IN CRANIAL BONE REGENERATION

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Introduction & Objectives: This study aims to explore the role of human BMP-2(hBMP-2) modified RNA (modRNA) and human VEGF (hVEGF) modRNA in bone regeneration as for a new gene therapy method in treating craniofacial bone defects.

Material & Methods: The rat derived bone mesenchymal stem cells (BMSCs) were transfected with modRNA in vitro, followed by enzyme linked immunosorbent assay and alizarin red staining, ALP activity detection, qRT-PCR and Western-blot analysis of the osteogenic potential of modRNA. A biodegradable collagen scaffold and as seeded with BMSCs were applied to repair rat cranial bone defects. 4 and 12 weeks post-surgery, Micro-CT and histological examination were performed, and the relative expression of osteogenesis related gene was analyzed by qRT-PCR.

Results: Alizarin red staining and ALP detection showed that calcium deposition and ALP activity in the modRNA transfection group were higher than those in the control group in vitro, and the expression of osteogenic proteins in the transfected groups was higher than that in the control group by qRT-PCR and western blot ($p<0.05$). And Micro-CT, histological examination, qRT-PCR confirmed the modRNA transfected groups achieved better effect ($p<0.05$). The combined transfection of two modRNAs in vivo significantly improve the cranial defect repairment.

Conclusion: In this study, BMSCs transfected with modRNA (hBMP-2 and hVEGF) were demonstrated significantly higher osteogenic potential, which combined with collagen could achieve favorable repair in cranial bone defects with less side effect.

Disclosure of Interest: None Declared

17-9-075

EFFECT OF STRONTIUM CITRATE ON BONE CONSOLIDATION IN A RABBIT MODEL OF MANDIBULAR DISTRACTION OSTEOGENESIS

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Introduction & Objectives: Mandibular distraction osteogenesis (MDO) involves a lengthy consolidation phase where complications can occur. Strontium is an element that has been shown to improve bone healing. The objective of this study was to determine if strontium citrate can be used enhance bone healing during MDO in a rabbit model.

Material & Methods: In this prospective animal study, custom-made MDO devices were placed on 20 New Zealand white rabbits. After a 7-day latency period, distraction was performed at 1 mm/day for 5 days. The study group rabbits (n = 10) received oral strontium citrate; the other 10 rabbits served as controls. Mandibles were removed at the end of the consolidation period (4 weeks). Formation and healing of new bone was evaluated with micro-computed tomography, histology, and three-point bending mechanical test.

Results: New bone formed in all animals, but the consolidation process was enhanced in rabbits that received strontium. The histological analysis showed that study group rabbits had more mature bone. Micro-computed tomography images revealed that bone mineral density in the strontium treated samples expressed as a percentage of normal untreated bone (85.1 ± 0.7) was significantly higher than that in control bony regenerates (72.7 ± 3.7; $p = 0.030$). Three-point bending test results demonstrated that the maximum load of the study group (270 ± 15 N) was higher than that of the control group (199 ± 10 N, $p = 0.0028$).

Conclusion: Strontium citrate improved the formation of new bone in the current rabbit model of MDO. The prolonged consolidation period may be shortened with strontium citrate, which may also have the potential to reduce complications.

Disclosure of Interest: None Declared

17-9-076

VIABILITY OF DICED CARTILAGE GRAFT WITH PERICHONDRIUM WRAPPING AND ATTACHED ONE SIDED, COMPARED TO WITHOUT PERICHONDRIUM: AN EXPERIMENTAL STUDY

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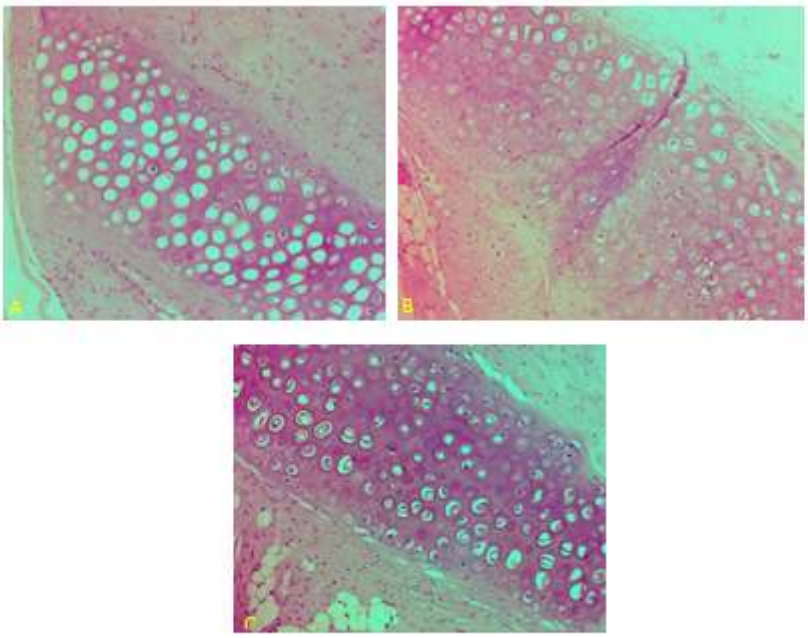
Introduction & Objectives: In long-term follow up of correctional autologous cartilage graft, no atrophy of graft and preservation cells viability is expected, therefore avoid irregularities form possibility. Regarding factors that determine viability of diced cartilage graft such as preservation of perichondrium, and wrapping agent, this study investigate relationship between cartilage regeneration and degeneration in diced cartilage graft with perichondrium wrapping, perichondrium attached one sided and without perichondrium.
perichondrium in macroscopic and microscopic aspect.

Material & Methods: 18 diced cartilage graft harvested from conchal auricular Hycole rabbits and each sample implanted in between subcutaneous pocket in dorsum of each rabbit. Cartilage graft divided into perichondrium attachment diced cartilage, diced cartilage wrapping perichondrium, diced cartilage graft without perichondrium. After 12 weeks implantation, diced cartilage graft were analyzed in macroscopic and microscopic through Hematoxylin and Eosin, and Mason Trichrome stains. The results were compared among three sample groups.

Results: Gross examination revealed no significant different from the preimplanted diced cartilage graft in term of color, texture and consistency with appearance if capsule surrounding tissue. Group with perichondrium attached one sided and wrapping perichondrium showed chondrotic proliferation and form collage content in matrix slightly higher than diced cartilage graft without perichondrium.

Conclusion: Intervention of perichondrium as wrapping and attach one sided resulted no different macroscopically, however there is significant difference of cells viability marked by degeneration and regeneration of cartilage cells in microscopically view.



Hematoxylin-eosin staining in three group marked viability of chondrocytes, spurt of chondroblast in periphery (A and C), and in cleft side (B).

Table 1:

Comparison ratio thickness changes between new cells formation and old cells from three group of autologous cartilage graft after 12 weeks implantation

Evaluation	Group 1(n=6)	Group 2 (n=6)	Group 3 (n=6)	p
Thickness ratio	1.823	1.435	1.2033	<0.005

Table 2: Comparison ratio thickness changes between new cells formation and old cells from three group of autologous cartilage graft after 12 weeks implantation

Evaluation	Group 1(n=6)	Group 2 (n=6)	Group 3 (n=6)	p
Thickness ratio	1.823	1.435	1.2033	<0.005

Disclosure of Interest: None Declared

17-9-078

NEXT GENERATION DNA SEQUENCING APPLICATION IN DIAGNOSIS OF FIBROUS OSSEOUS DISPLASIA OF SCULL BONES

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[1]Moscow State University of Medicine and Dentistry named after A.I. Evdokimov, Moscow, [2]Ryazan State Medical University named after I.P. Pavlov, Ryazan, Russian Federation

Introduction & Objectives: This study launched to improve diagnostics and genetically-based prognosis of development and treatment of fibrous osseous displasia of jawbones. Revealing genetic bases of development of this disease with model of our study potentially may be developed to a model applyable for many types of tumours.

Material & Methods: We perform DNA extraction from a fibrous osseous displasia tissue of the jaw with following next generation DNA sequencing. We compare sequence data with blood DNA sequence data revealing all types of DNA disorders. Basing on bioinformatics of full-exom sequencing we analysed nucleotide base sequence revealing mutations.

Results: Data received during ongoing study allows to reveal genetic predictors of fibrous osseous displasia in different morphological types. Results of bioinformatic imaging allows to reveal most frequent genetic mutations relevant to fibrous osseous displasia of jaws and scullbones. Creation of multigene diagnostic panel for tumours and tumour-like lesions of jawbones seems possible basing on this data. Creation of this panel is the step on the way of target therapy and personalised treatment of tumours and tumour-like lesions. It gives an opportunity for studying this pathology in every clinical case personally and also make highly effective prognosis of disease.

Conclusion: Next generation DNA sequencing can be used in maxillo-facial surgery as a highly effective tool for diagnostics and prognosis of development and clinical features of tumours and tumour-like lesions of jawbones.

Disclosure of Interest: None Declared

17-9-079

THE OPTIMAL DURATION OF THE PERIOSTEOFASCIA IMPLANTATION FOR THE PREFABRICATION OF THE PRELAMINATED PERIOSTEOFASCIAL FLAP

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Introduction & Objectives: This study was designed to investigate the potential of neovascularization in prelaminated flap and the optimal period of periosteum implantation beneath target vessels for induction of prelaminated periosteofascial flap.

Material & Methods: After harvesting periosteofascial tissue from the calvarium in twenty-four Sprague-Dawley rats, 1.5 x 0.75 cm sized rectangular pouches were fabricated by folding the harvested tissue in half with the cambium layer as the inner lining, and bone conductive material was injected into these pouches. Prelamination was prepared by implanting the periosteofascial pouch into the gracilis muscle of the right inner thigh with the outer surface directly in contact with the saphenous pedicles just above. At 2, 4, 6, and 8 weeks after implantation, the periosteofascial pouches were elevated as island flaps based on the saphenous pedicles. The extent of periosteofascial flap(pouch wall) revascularization was evaluated and assessed quantitatively with microangiographic findings, histologically counting the number of new vessels developed in the periosteofascia and the thickness of the cambium layer, and evaluating any changes in the injected osteoconductive material. Six conventional calvarial periosteum were used as a control.

Results: Microangiographic findings displayed new vessels starting to develop around the implanted pedicle at 2 weeks after pedicle implantation, but overall vascularization of the flap itself was accomplished at the 8th week. Flap survival area increased in proportion to the length of the pedicle implantation period, with 92.8% survival in group V, 92.3% in group IV, 78.4% in group III, and 69.7% in group II. The number of new vessels counted was 29.6 in group V, 22.8 in group IV, 16.7 in group III, and 15.1 in group II, compared to 29.7 in group I(control). The flaps with implantation periods of 8 and 6 weeks showed statistically significantly higher survival rates and more new vessels. The thickness of the cambium layer(μm) was 15.9 in group V, 12.4 in group IV, 10.5 in group III, and 8.3 in group II, compared to 16.0 in group I; only group V (8 weeks implantation) showed similar thickness with the control. Evaluation of the injected osteoconductive material presented more mature lamellar bone formation adjacent to the cambium layer with longer implantation periods.

Conclusion: Prelaminated periosteofascial flap can be induced by imbedding periosteal tissue into vascular territory, and the optimal duration of implantation to obtain adequate flap survival was more than 8 weeks for use of axial patterned flap.

Disclosure of Interest: None Declared

17-9-080

INDIRECT ADENOSINE A2A STIMULATION PROMOTES OSTEOGENIC DIFFERENTIATION OF HUMAN PEDIATRIC OSTEOPROGENITOR CELLS

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Introduction & Objectives: A2A receptor (A2AR) signaling has been shown to significantly enhance osteogenesis in several animal studies, without negative effects on skeletal suture fusion. However, there have not been any studies to date performed on human osteprogenitor cells. Hence A2AR stimulation in human cells can potentially provide a safe and effective therapeutic strategy for regenerating pediatric craniofacial skeletal tissues.

This study compares the effects of the indirect A2AR agonist dipyridamole with BMP-2 for the differentiation of pediatric human mesenchymal stem cells.

Material & Methods: Pediatric osteoprogenitor cells were isolated from human iliac and calvarial bone in accordance with Institutional Review Board approval. Osteoprogenitor cells were cultured at early passage (n=3) for 3 weeks in one of 7 experimental conditions: control (10% FBS, 1% Antibiotic-Antimycotic, DMEM); osteogenic (control media + 100mM β-glycerophosphate, 0.1 µM dexamethasone, 100µg/mL L-ascorbic acid); osteogenic media + 200ng/mL BMP-2; osteogenic media + 10, 100, or 1000µM dipyridiamole.

Cells were harvested after 3 weeks and immunofluorescently stained with phalloidin, collagen 1, and osteocalcin to verify extent and maturity of osteogenic differentiation. *ImageJ* was used to quantify osteocalcin expression whilst Alizarin red staining was used to quantify mineral matrix formation.

One-way ANOVA with Tukeys post-hoc correction and multiple t-test comparison of means were used for statistical analysis.

Results: : Cells cultured in 1000µM dipyridamole demonstrated more osteoblastic morphology and extensive collagen 1 deposition compared to BMP-2 or control (fig 1), and significantly greater osteocalcin expression (29.0% vs 18.6% vs. 13.6%; $p < 0.05$). Alizarin red staining showed significantly greater mineralization in 1,000µM dipyridamole (4.3±0.6) compared to osteogenic media alone (1±0.08, p<0.01) but not compared to BMP-2 (2.4±0.2, p=0.08).

Conclusion: *In vitro,*1000µM dipyridamole significantly increases osteogenic differentiation of pediatric human osteoprogenitor cells compared with standard osteogenic media and BMP-2 as evidenced by cytoskeletal arrangement, matrix deposition, and osteocalcin expression.

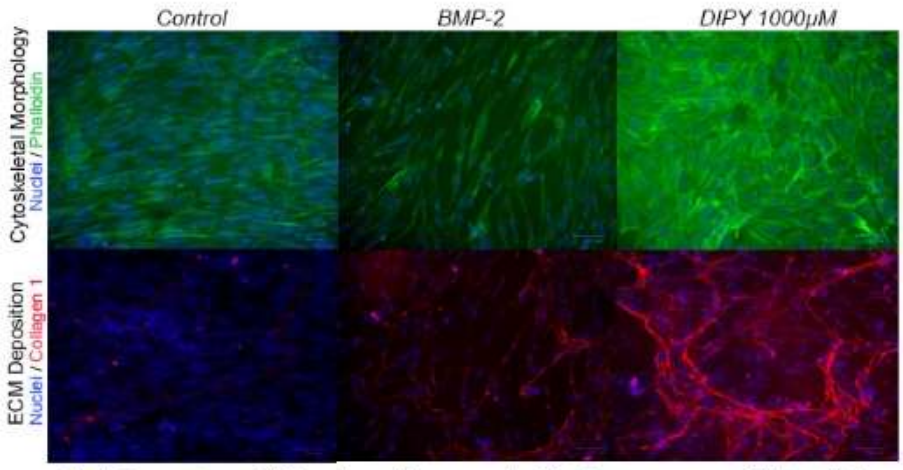

Fig 1: Comparison of different conditions on osteoblastic-appearance of differentiating cells and extracelluar collagen 1 deposition.

Disclosure of Interest: None Declared

17-9-081

ERROR ANALYSIS OF A SURGERY SIMULANTION SYSTEM FOR UNIDIRECTIONAL MANDIBULAR DISTRACTION OSTEOGENESIS USING BACKWARD INDUCTION METHOD

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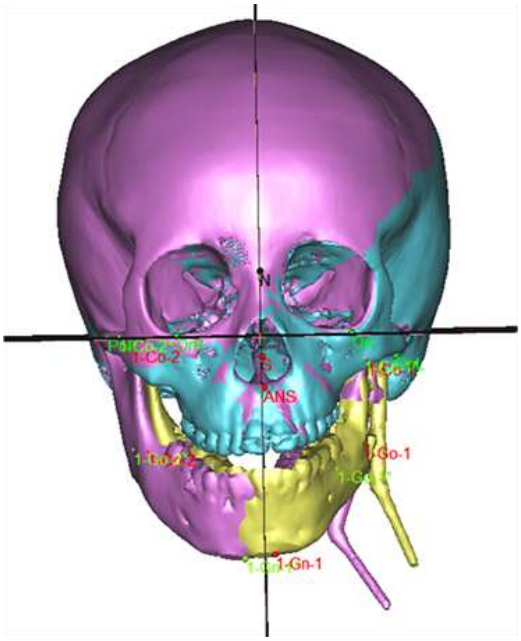
Introduction & Objectives: Distraction osteogenesis has become an important treatment in the management of patients with hemifacial microsomia since it was introduced in 1992. A surgical planning software enables surgeons to do a virtual osteotomy and distraction simulation before surgery. The preoperative virtual planning provides valuable information, such as the site of the osteotomy, distance to be distracted, and position of the distractor. However, in clinical practice, the outcome does not often replicate the simulations. Our aim was to investigate the errors of the simulation system using reverse derive method.

Material & Methods: Five patients with unilateral mandibular micrognathia were involved and studied on computed tomographic (CT) scans taken at 2 time intervals: at the end of the latent period, and at the end of consolidation. Virtual osteotomy plane and distractor were manipulated in software to match the actual position of the osteotomy plane and distractor at the end of the latent period. Actual distraction distance was measured at the end of consolidation. The mandibular distraction osteogeneisis simulation was performed according the actual distraction distance using ProPlan CMF 3.0 (Materialise, Leuven, Belgium). The superimposition of the simulation model and the actual model at the end of the latency period was performed according to cranium. Selected landmarks, such as the actual genion (Gn), simulated genion (Gn*) and upper first molar's mesial buccla tip (U6), were defined on the 3-dimensional model, and we measured the distance between genion to midsagittal plane (Gn to SP; Gn* to SP), distance between upper first molar to actual and simulated lower occlusion plane (U6 to LOP; U6 to LOP*) and angle between actual and simulated lower occlusion plane (LOP to LOP*) .

Results: The mean distance between genion to midsagittal plane is 2.19±1.36mm(Gn to SP) and 6.21±0.8mm(Gn* to SP). The mean distance between upper first molar to actual and simulated lower occlusion plane is 3.68±1.24mm(U6 to LOP) and 13.84±1.75mm(U6 to LOP*). There was a significant difference between the simulated and actual groups ($p < 0.001$). The mean angle between actual and simulated lower occlusion plane is 7.7±5.5°(LOP to LOP*) .

Conclusion: This study indicates that the unidirectional mandibular distraction simulation system dose not coincide the actual outcome. The actual movement of mandibular fragments during distraction osteogenesis is complex. The path of movement of the bone is affected by many factors, including stretching of the masticatory muscle and changes in the rotation point.

Disclosure of Interest:
None Declared



DAY17 - STATION 10 - CRANIOFACIAL TRAUMA

17-10-082

INTRA-OPERATIVE NAVIGATION ASSISTED SURGERY WITH 2-DIMENTION PLANNING FOR CORRECTION OF ORBITAL WALL FRACTURE RELATED SUNKEN EYE

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Introduction & Objectives: Correction of enophthalmos in orbital wall fractures depends on intra-operative judgement by direction observation. Intra-operative navigation assistance could provide more precise guidance to "how exophthalmos of the orbit" after reconstruction of orbital wall. Pre-operative planning is a key procedure of this technique. Theoretically, 3-dimention planning is more precise, but may not be available for every institute due to limited facility. We performed navigation assisted surgery by pre-operative 2-dimention planning and evaluated the clinical outcome and benefit.
Material & Methods: From April 2015 to January 2019, nine patients undergone navigation assisted surgery for reconstruction of orbital wall fracture, with pre-operative 2-D planning, including 5 for combined orbital floor and medial wall fractures, and 4 for orbital floor fracture alone. Five of them were secondary cases. We input unformatted DICOM images into Medtronic StealthStation® Surgical Navigation System, and made the planning by the built-in planning software. On axial view, we firstly drew the vertical midline from nose tip to center of cervical spine. Then, we made horizontal lines at top of the normal side orbit, extended to the fractured side, perpendicular to the midline. Points of the predicted position of the top of orbit at the fractured side was marked, at the same horizontal level in primary cases, and 1mm higher in secondary cases. Reduction and reconstruction of the orbital wall fracture was then performed. Titanium mesh was used for orbital wall reconstruction, and adjusted under navigation assistance. Medpor® was used for further correction of enophthalmos in secondary cases, and was adjusted with guidance of the predicted point (to reach the predicted point after inserting the Medpor®). Clinical result was evaluated by photographing of facial appearance, post-operative CT scan, and measurement of exophthalmometer.
Results: The 2-D planning of predicted reduction point was easy by drawing the vertical and horizontal lines. The predicted points of top of the orbit were compatible by intra-operative direct inspection in all cases. Post-operative exophthalmometer showed less than 1mm enophthalmos in primary cases, and satisfied correction of enophthalmos in secondary cases (four cases less than 1mm post-op enophthalmos, and one case less than 2mm). Post-operative photographing showed satisfied appearance. CT scan revealed acceptable position of orbit and the titanium mesh.
Conclusion: For limited facility, navigation assisted surgery by 2-D planning for orbital wall reconstruction might be an alternative of 3-D planning. Optimal result could be reached with less cost and easier planning. However, it may not be as precise as 3-D planning and may have limitation in patients with more complicated fractures.

Disclosure of Interest: None Declared

17-10-083

DEVELOPMENT OF AN ANATOMICAL THIN TITANIUM MESH PLATE AND PATIENT-MATCHED BENDING MODEL FOR ORBITAL FLOOR FRACTURE RECONSTRUCTION

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Introduction & Objectives: The adequate reconstruction of the orbital wall plays an important role in globe position, eyeball movement function and facial esthetics. The aim of this study was to develop a novel thin titanium mesh plate as well as the patient-specific pre-bending technique by stamping method for orbital wall fracture reconstruction.

Material & Methods: Orbital computed tomography (CT) scan images of over 100 Taiwanese adults were collected and normal orbital floor and medial wall sizes were measured for the standard plate design. 50 fractured orbital CT were classified in 6 defined regions to analyze the most common fracture pattern. Four different types of hole pattern were designed as (a) Type 1: control type without hole design; (b) Type 2: circular hole pattern; (c) Type 3: slot pattern and (d) Type 4: hole/slot hybrid pattern. Computer-aided stamping analysis was then performed. The von-Mises stress and von-Mises strain value for each design were recorded. A 3D printed stamping platform was manufactured to bend the plate for stimulating clinical conditions. The interfacial fitness accuracy was compared between stamping and manual bending through the CT scan.

Results: A 0.4mm thin fan-shape titanium plate was designed according to the average size from the orbital image database and it was able to cover the most common the fracture sites. The stamping analysis for four different types showed that the lowest maximum von-Mises stress/strain value of 603MPa/0.2447 was found in the plate of type 4 hole/slot hybrid pattern. The strength of three-point bending of type 4 plate was higher than commercial mesh plate. Due to the better biomechanical performance of the type 4 plate, it was chosen for the interfacial adaption results test. It showed that the average gap sizes in patient-matched stamping bending and manual bending was 0.821 mm ± 0.63 mm and 2.285 ± 1.82 mm respectively. The average gap size value using manual contouring was about 2.78 times that using the stamping technique.

Conclusion: Results of this study showed a newly developed anatomical orbital floor mesh plate with the pre-bending technique by stamping method led to a more precise and efficient way for orbital wall fracture reconstruction.

Disclosure of Interest: None Declared

17-10-084

TRANSNASAL ENDOSCOPIC APPROACH FOR BLOW-OUT FRACTURE: COMPLICATED CASES

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Introduction & Objectives: The blowout fracture can be surgically approached by variety of ways; the medial canthal incision, eyelid incision, transcaruncular incision; antral approach and the transnasal endoscopic approach. Several problems like postoperative scar & deformity, protrusions of surgical materials, inappropriate correction were noted. Since Yamaguchi et al. announced intranasal endoscopic correction, new materials and endoscopic approaches are showing up.

Material & Methods: All patients were operated under general anesthesia, and underwent reformed Sanno et al's method. After the incision and removal of the mucosa covering the uncinate process, the middle turbinate was put aside medially or partially removed, followed by opening the anterior ethmoidal cells in order to expose the prolapsed orbital tissue and fragments of the fractured medial orbital bone. The orbital contents were separated from the air cell mucosa and pushed back to their original position. After reduction of herniated orbital tissue with periosteal elevators, an inverted U-shaped silastic sheet and Merocel® packing were placed and soaked in broad-spectrum antibiotic solution in case of medial orbital fractured, 18 french foley catheter was inserted in case of inferior orbital fractured. In some inferiorlly or inferomedially severe fractured cases, alloplastic material were applied through subciliary approach. CT scans was checked for confirmation of the intact placement of the packing in ethmoidal sinus or ballooning in maxillary sinus on the 5th post-operative day. Four weeks after the surgery, the Merocel packing & silastic sheet or ballooned catheter were removed. Follow-up CT examination was performed 5 months after the packing or catheter removal.

Results: All patients had preoperative and postoperative ophthalmological examinations at 2, 5 weeks, 2, 4, and 6 months subsequently after surgery. The clinical records were completed focusing on enophthalmos, diplopia, postoperative complications originated from the implanted materials themselves, severe facial scarring, ectropion of the lower lid, and intranasal complication due to endoscopic approach.

Conclusion: We identified several complications with this methods such as overcorrection, undercorrection and recurrences. In this poster, we would like to discuss the appropriate treatment accordingly.

Disclosure of Interest: None Declared

17-10-085

CONCOMITANT SKULL FRACTURES AMONG PEDIATRIC PATIENTS WITH FACIAL FRACTURES

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Introduction & Objectives: Pediatric patients who are diagnosed with facial fractures often present with concomitant injuries due to the high impact of these injuries. These associated injuries may include cranial fractures. This can be attributed to the large skull to facial ratio observed in the pediatric patient population. These fractures frequently result in high injury severity scores and require complex multidisciplinary care. The objective of our study was to identify factors among pediatric patients with facial fractures that are associated with the increased risk of concomitant skull fractures.
Material & Methods: A retrospective chart review was performed for pediatric patients (≤ 18 years) with at least one facial fracture over a ten-year period (January 2006 – December 2015). Data were abstracted including demographics, mechanism of injury, fracture location, concomitant skull and cervical spine injuries, and hospital course. Univariate and multivariate analysis were performed comparing facial fracture patients with and without skull fractures. Skull fractures were defined as frontal, parietal, temporal, or occipital fractures. Significance was determined at $p < 0.05$
Results: Our study included 1274 pediatric patients with facial fractures, with 313 (24.6%) presenting with concomitant skull fractures. Patients with concomitant skull fractures were found to be significantly younger (11.4 ± 5.6 vs 12.6 ± 5.1 years) and more commonly victims of motor vehicle collisions (52% vs 40%). Patients with skull and facial fractures were more likely to suffer loss of consciousness (LOC) (68% vs 38%), traumatic brain injury (48% vs 12%), and cervical spine injury (11% vs 4%) than patients with facial fractures alone. Cranial and facial fracture patients required longer intensive care unit management (66% vs 20%), transfusion of blood products (33% vs 9%), and longer length of stay (9.7 ± 12.0 vs 4.3 ± 6.9 days) than patients with isolated facial fractures. On multivariate analysis pediatric skull fractures were associated with increased risk for LOC (OR 3.49; 95% CI 2.57 – 4.78), orbital fractures (OR 3.42; 95% CI 2.45 – 4.81), and zygomatic fractures (OR 2.39; 1.61 – 3.55). Pediatric patients with skull fractures demonstrated a decreased odds for age (OR 0.94; 95% CI 0.91 – 0.96).
Conclusion: Nearly one quarter of pediatric patients with facial fractures present with concomitant skull fractures. These patients are younger, victims of motor vehicle collisions, and require more intensive management. Careful evaluation of all pediatric patients with craniofacial trauma should be performed to stabilize the patient and recognize concomitant fracture and associated comorbidity patterns.

Disclosure of Interest: None Declared

17-10-086

IMPACT OF HOSPITAL VOLUME ON THE TREATMENT OF MIDFACE FRACTURES – INPATIENT BURDEN AND CHARGES

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Introduction & Objectives: Complex midface fracture repairs are becoming increasingly concentrated at high-volume centers that demonstrate improved outcomes. However, no studies to date have evaluated the effect of hospital volume on inpatient burden - i.e. length of stay (LOS) and hospital charges - in midface fracture patients. Therefore, the purpose of this study was to examine the volume of midface fractures across hospitals nationwide and identify patient characteristics associated with increased LOS and charges.

Material & Methods: We performed a cross-sectional analysis by analyzing the National Inpatient Sample database from 2012-2015 for patients with midface fractures as their primary diagnosis. The average number of patients admitted per year was stratified by quartiles to classify hospitals into low- and high-volume. Patient characteristics, including age, race, sex, payer status, median income, and comorbidities, as well as hospital characteristics, including region, teaching status, and bed size, were analyzed to determine factors associated with higher LOS and charges across quartiles of hospital volume.

Results: From 2012-2015, a total of 170,255 patients were identified with midface fractures. Mean age was 52.4 years and the majority of patients were male (67.1%). Hospitals in the lowest quartile of volume treated 11,315 patients (7.1%), while hospitals in the highest quartile treated 108,415 patients (67.6%). LOS was significantly higher at high-volume hospitals (4.28 days vs 3.86 days, $p=0.042$). Total hospital charges were also significantly higher at high-volume hospitals, with a mean of $68,852 compared to $39,011 at low-volume hospitals ($p<0.001$). Notably, Medicaid patients had greater mean LOS and charges than Medicare and private payer patients at high-volume hospitals, a trend that was not observed at low-volume hospitals (Figure 1). On multivariate linear regression, male sex, high number of co-morbidities, low median patient income, teaching hospital status, high hospital volume, and Medicaid payer status were all correlated with higher LOS and charges.

Conclusion: For midface fracture patients, high-volume centers are associated with significantly greater LOS and charges than low-volume hospitals. Patient factors associated with increased inpatient burden are male sex, Medicaid payer status, higher comorbidities, and low median income, suggesting that this patient population should be the focus of inpatient protocols aimed at improving outcomes and reducing hospital charges. Further investigation is required to elucidate how insurance status impacts inpatient burden differentially among low- and high-volume hospitals, which will help inform policies to mitigate these disparities.

Picture for abstract 17-10-086:

	LOW VOLUME		HIGH VOLUME	
	Mean LOS	***P***	**Mean LOS**	***P***
Age				
≤50	3.02	--	4.04	--
>50	4.15	0.001	4.58	<0.001
Race				
White	3.89	--	4.32	--
Black	3.71	0.760	4.30	0.887
Sex				
Male	3.61	--	4.33	--
Female	4.14	0.072	4.18	0.292
Primary Payer				
Medicare	4.35	--	4.38	--
Medicaid	3.65	0.167	4.77	0.028
Private	3.07	<0.001	4.23	0.377
Co-morbidities				
<3	2.74	--	3.65	--
3-5	3.88	0.002	4.57	<0.001
>5	4.76	<0.001	6.13	<0.001
	Mean Charges	***P***	**Mean Charges**	***P***
Age				
≤50	$38,710	--	$70,887	--
>50	$39,113	0.91	$66,383	0.030
Race				
White	$38,480	--	$68,513	--
Black	$36,604	0.76	$67,538	0.742
Sex				
Male	$40,631	--	$71,627	--
Female	$37,293	0.28	$61,621	<0.001
Primary Payer				
Medicare	$38,589	--	$57,806	--
Medicaid	$39,557	0.85	$77,128	<0.001
Private	$35,551	0.42	$76,937	<0.001
Co-morbidities				
<3	$36,185	--	$66,755	--
3-5	$37,137	0.80	$69,035	0.329
>5	$43,656	0.06	$76,651	0.001

Disclosure of Interest: None Declared

17-10-087

NASOFRONTOMAXILLARYETHMOID FRACTURE PATTERNS: CHALLENGES TO CURRENT CLINICAL NOMENCLATURE

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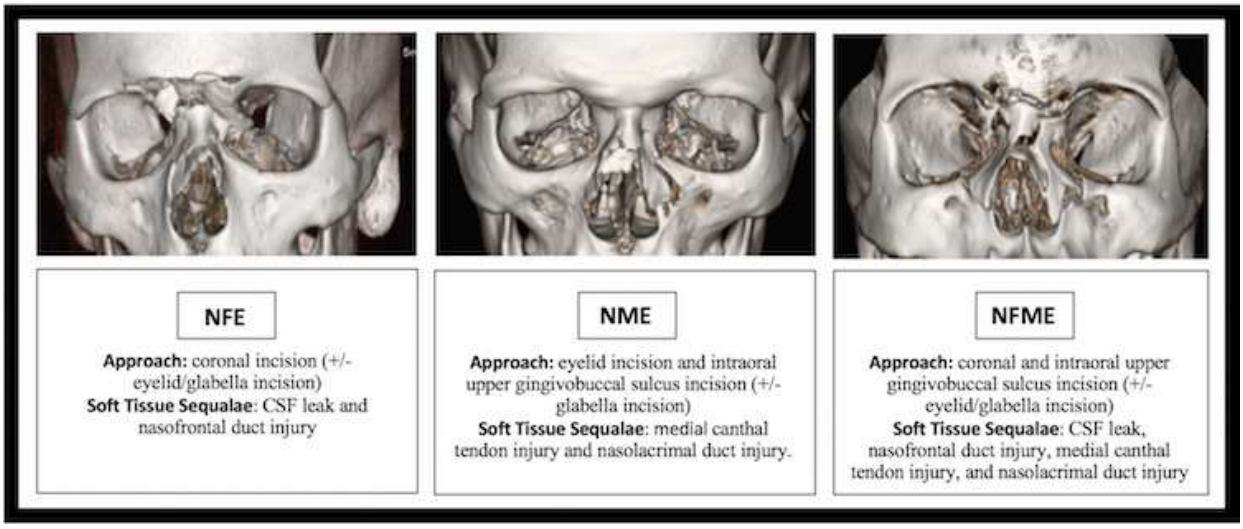
Introduction & Objectives: Naso-orbito-ethmoid (NOE) fractures present a significant clinical challenge in diagnosis and management. Currently adopted classifications stratify severity of injury but do not actively guide clinical management. Furthermore, there is no *orbital bone*, and hence the term NOE creates vague terminology. This study proposes novel nomenclature (Naso-frontal-ethmoidal (NFE), Naso-maxillary-ethmoid (NME), and Naso-frontal-maxillary-ethmoid (NFME) fracture types) that guides surgical approach and predicts risk of associated soft tissue injuries.

Material & Methods: A five year (2014-2018) single-center retrospective analysis of NOE fractures was performed, NFE/NME/NFME classification types were assigned and verified by two investigators, correlated with treatment course (surgical approach if operative) and soft tissue sequelae (incidence of CSF leak, nasofrontal duct injury, medial canthal tendon injury and nasolacrimal injury).

Results: Sixteen patients had a diagnosis of an NOE fracture and were reclassified as NFE (6.25%), NME (81.25%) and NFME (12.5%). Twelve patients were treated operatively (due to comminution or soft tissue injury). NFE fractures were characterized by increased risk of CSF leak and/or nasofrontal duct injury (100%), and optimally approached by coronal incision (+/- eyelid/glabella incision). NME fractures were characterized by increased risk of medial canthal tendon injury (7.7%) and nasolacrimal duct injury (61.5%), and optimally approached by eyelid incision and intraoral upper gingivobuccal sulcus incision (+/- glabella incision). NFME fractures were characterized by increased risk of CSF leak and/or nasofrontal duct injury (50%), and nasolacrimal duct injury (100%), and optimally approached by coronal and intraoral upper gingivobuccal sulcus incision (+/- eyelid/glabella incision).

Conclusion: This novel classification system provides an anatomic basis for guiding management of surgical approach to midface fractures with each fracture type demonstrating an optimal surgical approach and soft tissue sequalae profile.



Disclosure of Interest: None Declared

17-10-088

IMPACT ON THE ORAL HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH MANDIBLE FRACTURE RELATING TRAUMA AND SURGICAL TREATMENT

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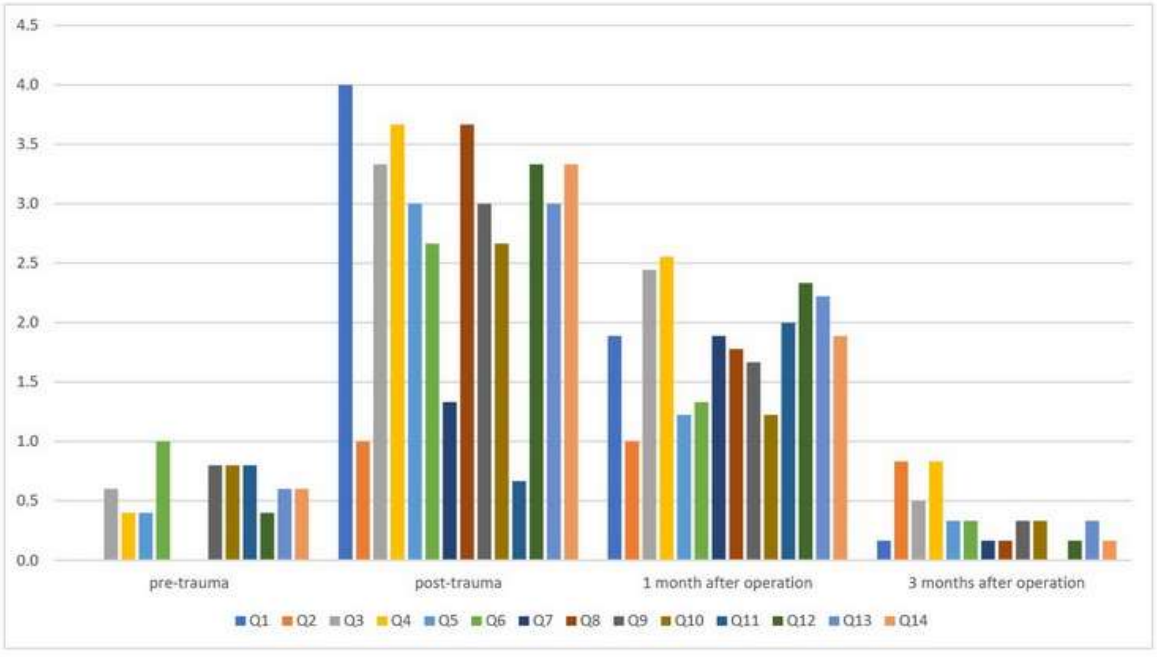
Introduction & Objectives: Facial bone trauma is considered the sudden and devastating event in a patient's life as it usually results in deformities of the face and possible psychological influences. Among facial bone trauma, mandible bone fractures are more unique trauma in that it affects feeding and speaking function. Sometimes, because of the need to maintain intermaxillary fixation for treatment, patients are more likely to suffer and feel uncomfortable, resulting in secondary mental and social suffering. In this study, we investigated the impact of mandible fracture and surgical treatment on the oral health-related quality of life.

Material & Methods: This prospective study investigated outcomes related oral health using Oral Health Impact Profile (OHIP) for patients with mandible fracture. The patients underwent operation between March, 2018 and December, 2018. The OHIP was initially designed with 49 questions and its reduced form with 14 questions (OHIP-14) has already had its reliability, validity, and accuracy confirmed to evaluate psychosocial impact. The questions were grouped into seven categories, such as functional limitation, physical pain, psychological discomfort, physical incapacity, psychological incapacity, social incapacity, and social disadvantage. Each category is formed by 2 questions whose answers are coded on a score of 0 to 4: 0, never; 1, rarely; 2, sometimes; 3, repeatedly; and 4, always. Score changes in OHIP-14 questionnaire were compared between pre-trauma, post-trauma, 1 month after operation, and 3 months after operation. Kruskal Wallis test was used for statistical analysis.

Results: In total, 10 patients were enrolled in this study. In all question items, the scores increased from 0.5 to 2.8 on average after trauma, gradually decreased with time, and recovered to 0.3 on average at 3 months postoperatively (Figure 1). These changes in the scores according to the elapsed time after operation were statistically significant in all 7 categories (p=0.006, 0.009, 0.025, 0.002, 0.015, 0.006, and 0.005).

Conclusion: Mandible fracture is an important event that causes major changes in the patient 's daily life. Appropriate and immediate surgical treatment can significantly improve the quality of life of these patients.



Disclosure of Interest: None Declared

17-10-089

CLINICAL TRIAL TO EVALUATE THE EFFICACY OF BOTULINUM TOXIN TYPE A INJECTION FOR REDUCING SCARS IN PATIENTS WITH FOREHEAD LACERATION – A PILOT STUDY

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Introduction & Objectives: Skin damage by either trauma or surgical intervention inevitably results in scar formation. Facial scars can be cosmetically disfiguring and may cause functional impairment and psychosocial withdrawal. Botulinum toxin type A(BoNTA) is known to prevent fibroblast proliferation and expression of TGF-B1. It also induces temporary muscle paralysis and decreases tension vectors. Fibroblasts induce scar contracture and hypertrophy by producing collagen fibers in wound healing processes. In theory, botulinum toxin can play a vital role in scar prevention by reducing contracture and relaxing the adjacent muscles.

Several studies have suggested the possibility of injecting botulinum toxin into nearby musculature around the traumatic or incisional wounds. However, sound clinical evidence has been missing. The aim of this study is to investigate the subjective and objective evidence of the effect that botulinum toxin has on scar formation in human.

Material & Methods: This prospective, split-scar, double-blinded, randomized controlled study. From February 2012 to December 2015, patients who presented forehead lacerations were recruited from the emergency room.

45 patients with forehead laceration were enrolled in this study and randomized into two groups with or without injection of BoNTA. When the patients presented to the clinic to remove the stitches, BoNTA was injected to the BoNTA group with 24 patients and saline was injected to the control group with 21 patients. At the time of clinical follow up, the scars were analyzed with the Patient and observer scar assessment scale (POSAS), Stony Brook Scar Evaluation Scales(SBSES) and Visual analogue scale(VAS) and analyzed with independent t-test, along with clinical photographs and biopsy

Results: There were 21 patients in the control group and 24 patients in the BoNTA group. There were no significant adverse events in all patients. In all scar scales, the scores changed into favorable direction in both groups and the changes were larger in BoNTA group compared with the control group. However, when the amount of changes of the scar scales was investigated, there were more favorable changes in BoNTA group, which was proved statistically in SBSES (*P*=0.047) and VAS(*P*=0.046). Even without statistical significance, there were more favorable changes in BoNTA group in Patient Scar Assessment Scale (PSAS) (*P*=0.110) and Observer Scar Assessment Scale (OSAS) (*P*=0.169)(Table 1)

Skin biopsy showed less collagen deposition on dermal layer in BoNTA group.

Conclusion: Based on the findings above, BoNTA can improve scar properties in various aspects, especially in decreasing collagen synthesis. This study provides useful indication of application of BoNTA in scar prevention with promising results

Table 1 Statistical results of scar scales on both group about improvement grade

	Control	BoNTA	p-value
PSAS	3.62	4.21	0.110
OSAS	4.24	4.63	0.169
SBSES	0.65	1.13	0.047*
VAS	2.38	2.92	0.045*

PSAS: Patient Scar Assessment Scale, OSAS: Observer Scar Assessment Scale, SBSES: Stony Brook Scar Evaluation Scales, VAS: Visual Analogue Scale

* p-value<0.05

Disclosure of Interest: None Declared

17-10-090-N / 19-10-296

AN EPIDEMIOLOGICAL ANALYSIS AND COMPARISON OF SINGLE FRACTURE AND COMPLEX FRACTURE REPAIR: A NSQIP ANALYSIS

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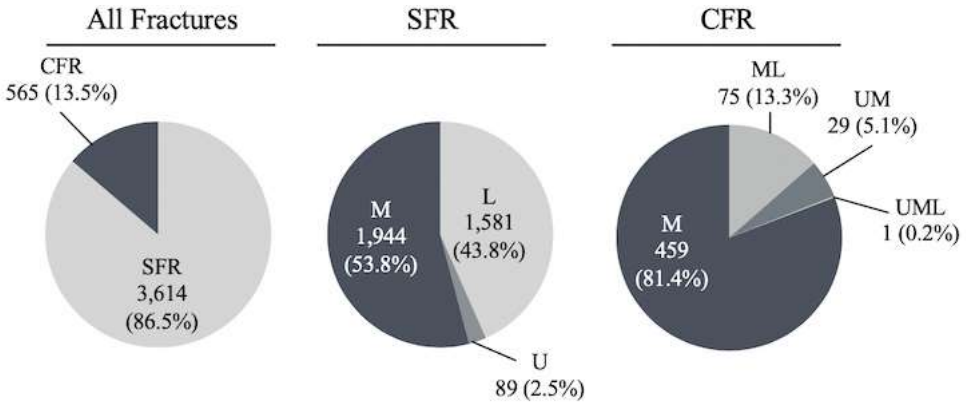
Introduction & Objectives: While some fractures do not require surgical intervention, others can be technically challenging involving multiple aspects of the face. Complex facial fractures are associated with high energy facial trauma, such as motor vehicle accidents. Complex fractures can be a significant reconstructive challenge due to a reduced number of reliable landmarks and can be further complicated by concomitant injuries. Thus, our object was to utilize a retrospective surgical database to evaluate the number and types of complex facial fracture repairs (defined as having more than 1 repair in one surgery) and compare their safety to single fracture repairs.

Material & Methods: Adult patients who underwent facial fracture repair were identified in the 2008-2016 National Surgical Quality Improvement Program (NSQIP) database. Those with multiple fractures repairs were separated from single fracture repairs and analyzed descriptively. Univariate analyses were performed to assess the difference in rates of demographics and post-operative complications between complex fractures that involved the midface (malar/zygoma, orbital, or Le Fort) and single midface fractures. A p-value <0.05 represented statistical significance.

Results: A total of 4,179 fracture repairs were identified, of which 565 (13.5%) were found to be complex repairs. 1,944 (53.8%) of the single repairs were midface fractures and 459 (81.4%) of the complex repairs involved the midface only (Figure 1). The most frequent complex fracture repair was a dual orbital and malar/zygoma repair, which represented 180 (31.9%) of complex fracture repairs. When comparing complex and single midface repairs, complex cases were more likely to be male (p=0.002), white (p=0.016), performed by plastic surgeons (p<0.001), have a contaminated wound (p<0.001), have an elective procedure (p=0.004), and be a smoker (p=0.042). No differences in age, BMI, ASA class, presence of open wound, or other comorbidities were noted. While complex fracture repairs were associated with a longer operative time (p<0.001), a longer post-operative hospital stay (p=0.003), and a greater need for intra/post-operative transfusions (p=0.001), there were no differences in death, return to OR, readmission, or overall complication rates, which were low (1.7% in single fracture repairs and 3.0% in complex repairs; p=0.077).

Conclusion: The data presented suggests that complex fractures are a common occurrence. Although plastic surgeons perform complex fracture repair more frequently, it is currently unclear whether the underlying reason is a product of management of complex fractures or referral patterns. No differences in overall complications were noted, suggesting that multiple, simultaneous repairs can be safely performed.



Key: CFR – Complex Fracture Repair; SFR – Single Fracture Repair; L – Lower Face; M – Midface; U – Upper Face; ML – Mid- and Lower Face; MU – Mid- and Upper Face

Disclosure of Interest: None Declared

DAY17 - STATION 11 - CLEFT LIP PALATE

17-11-091

CASE REPORT: THERAPY ON HAEMANGIOMA PATIENT WITH CLEFT LIP AND PALATE

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Introduction & Objectives: Cleft lip and palate accompanied with haemangioma is a rare case. Surgical therapy in haemangioma is often the best alternative therapy. Considering the function and aesthetic apearance sometimes non-surgical therapy will be the right choice without disturbing cleft lip and palate surgical timeline. The purpose of this paper is to report the role of propranolol and prednisolon in the case of hemangioma accompanied by surgical therapy in the case of cleft lip and palate.

Material & Methods: 2 month old girl came to Division of Plastic Recontruction and Aesthetic Department of Surgery RSUP Dr Sardjito with haemangioma on her nasal to right cheek region 35mm x 32 mm in size and cleft lip and palate (CLP/ - SHAL). She underwent propranolol – prednisolon therapy since she was 2 month old. Patient are consulted to pediatric cardiologist before propropanolol treatment and on the 4th day after propanolol treatment, dose of prednisolon is 2 mg/kg BW and taperring off 0,5 mg/kg BW/day until 0mg, and initial dose of propanolol is 0,5 mg/ kg BW, increase 0,5 mg/kg BW/ day until 2 mg/kg BW/day and maintain on 2 years period. On 3 month old she underwent labioplasty. Palatoplasty and nasoraphy was done when she was 1 year of age. Therapy with propranolol will continued until she is 2 years of age.

Results: Hemangiomas in the nasal area have been much reduced, leaving a little in the nose area. The cleft lip and palate operation showing a good result. The patient's family is very happy with satisfying results, especially the patient's mother. She felt her daughter's face now look beautiful and not as horrible as before.

Conclusion: Therapy of propanolol and prednisolon on hemangioma were not disturbing cleft lip and palate surgical timeline.

Disclosure of Interest: None Declared

17-11-092

USE OF A MODIFIED ENHANCED RECOVERY PROTOCOL IN PRIMARY CLEFT PALATOPLASTY

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Introduction & Objectives: Enhanced Recovery After Surgery (ERAS) protocols have been shown to improve patient outcomes in numerous adult surgical populations, but their validity in pediatric patients has not been assessed. To assess the effectiveness in a pediatric subgroup, we present a proof of concept (POC) assessment of the effect of ERAS on perioperative narcotic utilization, post-operative oral intake and length of stay (LOS) in patients underdoing primary palatoplasty. Additionally, we validate its efficacy when applied to patients of variable age, complexity, and comorbidities.

Material & Methods: A multidisciplinary ERAS program was developed and implemented. The primary components of the protocol include administration of gabapentinoids, minimal narcotic use, and postoperative pain control using nonnarcotic agents. For POC (ERAS1), 50 were collected prospectively and assigned to the modified ERAS protocol. The demographics, narcotic use, length of stay, oral intake, and complication rates were reviewed and compared to historic controls. In the expanded assessment (ERAS2), 50 further patients were collected and compared to POC data. Patient demographics, perioperative narcotic administration, LOS, and rates of return to service were analyzed.

Results: Between 4/2017 and 7/2018, 100 patients underwent palatoplasty under the ERAS protocol (ERAS2: 50, ERAS1: 50). The mean age (control: 9.1 mos; ERAS1: 10.0 mos), weight (control: 8.7 kg; ERAS1: 8.5 kg) and comorbidities did not differ between ERAS1 and controls. In comparison, ERAS2 was of advanced mean age (21.3 months) and weight (11.5 kg), included patients who were tube fed, and those found to have positive perioperative respiratory viral panels. For the POC, ERAS1 evidenced an increase in oral intake normalized per LOS (22.5 mL/hr vs. 15.7 mL/hr). Total narcotic usage (morphine equivalents) during each phase of care was significantly greater in controls when compared to either ERAS1 or ERAS2, respectively (Intraop: 3.67 mg vs. 0.11 mg vs 0.25mg; PACU: 0.52 mg vs. 0.05 mg vs 0.06 mg; Postop: 3.2 mg vs. 0.08 vs 0.24 mg). The use of the protocol led to a 36.8% (ERAS1) and 26.3% (ERAS2) decrease in LOS when compared to controls. The incidence of return to service within 30 days was higher in ERAS2 (13.0%) when compared to ERAS1 (2.1%) or controls (2.4%); the strongest independent predictor, a positive perioperative respiratory viral panel.

Conclusion: In POC, implementation of a modified ERAS protocol allowed for narcotic minimization, increased post-operative oral intake, and a shorter LOS without an increased complication rate. In palatoplasty patients of advanced age, complexity and comorbidities, consistency of improved metrics was observed. A positive perioperative respiratory viral panel was found to be an independent predictor of return to service even when ERAS was applied.

Disclosure of Interest: None Declared

17-11-093

USE OF ACELLULAR DERMAL MATRIX IN CLEFT PALATE SURGERY, KING SAUD UNIVERSITY MEDICAL CITY EXPERIENCE

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Introduction & Objectives: Cleft palate repair is a commonly performed procedure in plastic surgery that requires maximum attention to all details. Different techniques have been described to repair cleft palate to achieve efficient results and to decrease complications rate. Postoperative fistula development has been one of the most challenging complications of cleft palate repair procedures. In this clinical study, we reviewed our experience using Acellular dermal matrix (ADM) as an adjunct to facilitate difficult cleft palate and palatal fistula closure.

Material & Methods: This is a retrospective, comparative study, in which charts for cleft palate patients were reviewed from 2015 to 2018 in a single center. Patients who underwent cleft palate or palatal fistula repair with and without ADM were included.

Results: A total of 31 patients were reviewed. ADM was used in 13 patients, 61.5% of them were primary repair and 38.5% as fistula repairs. 18 patients were repaired without using ADM, 88.9% were primary cleft palate repair and 11.1% were fistula repairs. Using Fischer's exact test, the two groups (primary cleft palate repair with and without ADM) were compared, and the fistula groups were compared in relation to fistula rate postoperatively. Our statistical analysis showed no significant difference in fistula rate in the compared groups with P value 0.593, 0.286 respectively.

Conclusion: In our experience, ADM has been shown to be a simple, safe, and helpful tool to augment cleft palate repair mainly in relatively wide and high-tension cleft palate repairs. However, our statistical analysis didn't show significance in using ADM to reduce fistula rate in those cases, which could be attributed to our limited sample size. From our experience, we highly recommend routine ADM use in cleft palate surgery based on the trend noticed in clinical results.

Disclosure of Interest: None Declared

17-11-094

ASSESSING ADHERENCE TO RECOMMENDED GUIDELINES OF TIMELINESS OF PRIMARY OROFACIAL CLEFT SURGERY: IMPACT ON CLINICAL OUTCOMES

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Introduction & Objectives: Orofacial clefts (OFCs) are the most common type of craniofacial anomaly. Surgical repair of OFC' are associated with two complications: oronasal fistula and velopharyngeal insufficiency (VPD). The primary objective of the study is to assess the percentage of children with diagnosed OFCs that receive surgical intervention within the recommended ACPA guideline of 12 months, and also assess if there is a difference in outcomes and postoperative complications such as presence of oronasal fistulas (ONF) and/or velopharyngeal dysfunction (VPD).
Material & Methods: The primary source of data was the 2012 HCUP KID database includes data from 2,000-3,000 hospitals across the nation. Data collection for the primary objective included tabulating the mean age of children with OFCs who received surgical intervention who received care within the ACPA guideline of 12 months. Billable procedure codes for cleft lip and palate repair (ICD-9-CM 27.54 and 27.62), VPD (ICD-9-CM 528.9), and ONF (ICD-9-CM 478.19) were collected and recorded. A Pearson chi-squared test and logistical regression were run on STATA.
Results: There were over 3 million (3,191,876) total discharges for across 4,179 US hospitals. Of those, 5,025 presented with cleft lip or palate as the primary diagnosis, 3,905 underwent cleft lip and palate repair, 1,973 patients received a cleft repair under the age of 1 (50.52%), 5 of which (0.25%) had a VPD complication and 21 (1.06%) had an ONF complication. There were 1,932 patients who received a cleft repair over the age of 1, of those 61 (3.16%) had a VPD complication and 64 (3.31%) had an ONF complication (Fig 2). A chi-square test of independence was performed and indicated that the relationship between age of cleft repair and ONF was also significant ($X2=49$, $N = 3,905$, $p<0.0001$). A logistic regression analysis demonstrated a positive relationship between age and likelihood of developing either VPD or ONF complications. Patients who underwent cleft repair > 1 year of age were 12.8 times more likely to develop VPD and 3.18 times more likely to develop an ONF than children under the age of 1 [($P<0.0001$, $SD=5.98$, $CI=5.15, 32.01$); ($P<0.0001$, $SD=0.81$, $CI=1.94-5.23$)], respectively.
Conclusion: Only 50.52% of children presented with a primary cleft diagnosis received surgery within the ACPA guideline of 12 months. There was a significant relationship between patient age at the time of cleft surgery and the development of complications of ONF ($P<0.0001$) and VPD ($P<0.0001$). Patients receiving cleft surgery over the age of 1 were 12.8 times more likely to develop VPD and 3.18 times more likely to develop ONF.

Disclosure of Interest: None Declared

17-11-095

FILLING THE VOID: INTERPOSITIONAL BUCCAL FAT PAD TO DECREASE FISTULA FORMATION AND MAINTAIN PALATAL LENGTH

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Introduction & Objectives: Fistula after cleft palate repair is reported in up to 30% of cases. Velopharyngeal dysfunction (VPD) is reported to be as high as 30%, and may result from incompetence due to levator muscle dysfunction or insufficient length of the soft palate. At the time of revision surgery it is often noted that the levator bundle has become scarred anteriorly to the posterior aspect of the hard palate, which tethers the muscle, impeding its function, and shortens the palate. This tethering may result from secondary healing in the void that occurs between the oral and nasal mucosae after the levator muscles are mobilized from this region during primary palate repair. The buccal fat pad can easily be accessed and mobilized during palate repair to fill this void, and this may reduce secondary healing and therefore contracture/shortening of the soft palate, and may reduce fistula formation by functioning as a barrier between the coincident incisions of the oral and nasal mucosae.

Material & Methods: A chart review was completed of all patients who underwent cleft palate repair by one of three surgeons at the University of Michigan between 2007 and 2015. Charts of patients who underwent buccal fat pad flaps were further reviewed for demographics, co-morbidities, indication for fat pad utilization, palatal Length, palatal fistula formation, speech outcomes, need for secondary surgery and other post-operative complications.

Results: 53 patients underwent buccal fat pad transposition to the palate. The mean age at time of surgery was 1.4 years and 30 (57%) were female. Twenty-four (45%) had an associated syndrome. The indication for use of the buccal fat pad was excess tension or a large void in the anterior soft palate in 29 (55%) of patients and some other intraoperative finding in 24 (45%) of patients. Fistula was noted in 4 (8%) patients. Palatal length was described in 39 patients postoperatively and noted to be short in 3 (8%) patients, average in 28 (72%) and long in 8 (20%). Speech assessment was available for 33 patients. Resonance was noted as hyponasal in 1 (3%) patient, normal in 20 (61%) and borderline hypernasal in 12 (36%). No patient underwent secondary surgery for speech.

Conclusion: The buccal fat pad flap is a versatile, robust flap that can easily be mobilized during cleft palate repair and will extend beyond the midline of the palate to fill the void created in the anterior soft palate after the levator muscles are transposed from this location. Use of the buccal fat pad flap to fill this void may result in decreased fistula formation and maintenance of adequate palatal length for normal speech. A broader experience with continued follow up will shed further light on this.

Disclosure of Interest: None Declared

17-11-096

SINGLE-STAGE DIRECT REPAIR FOR UNILATERAL CLEFT LIP, ALVEOLUS AND PALATE: PRE-SURGICAL ORTHODONTICS AND SURGICAL PROCEDURE

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Introduction & Objectives: This paper is a preliminary report on the all-in-one-stage complete direct closure without raw surface for unilateral cleft lip, alveolus and palate.

Material & Methods: Our cases are composed of consecutive 60 patients with unilateral cleft lip, alveolus and palate who underwent 1-stage all-in-one (AIO) closure of the lip and alveolus and hard and soft palates following novel pre-surgical orthodontic treatment from 2006 to 2017.

Our AIO repair technique includes 1) cheiloplasty by original method of arc and step-stair incision with a small triangular flap (ASSIST), 2)gingivoperiosteoplasty (GPP), 3)palatoplasty by intravelar veloplasty with mucosal double Z-plasty using muco-periosteal flap of posterior nasal septum.

We have performed pre-surgical orthodontics in 63 cases and AIO closure in 60 cases.

Results: Average age at surgery was 192 days. Average operation time was 4 hours 21 minutes. Blood loss was very small amount (<30 ml). No airway complications, no postoperative infection were occurred. Break down of soft palate was observed in one case, that closed 2 months after surgery.Mild Velopharyngeal insufficiency was observed in only one patient with mental retardation. GOSLON Yardstick index was 3.4 in the first 10 patients who reached 5 years old.

Conclusion: No serious complications were occurred and the safety of this strategy is established.

Acceptable results have been obtained regarding appearance, speech and occlusion. We are convinced that our strategy for cleft lip and palate will be widely accepted and developed.

Disclosure of Interest: None Declared

17-11-097

A NEW PRIMARY CLEFT LIP REPAIR TECHNIQUE THAT COMBINES THREE SURGICAL CONCEPTS

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Introduction & Objectives: Various techniques have been described for unilateral cleft lip repair. These may be broadly classified into
three types of procedure/concept: the straight-line method (SL; Rose-Thompson effect); rotation eadvancement (RA; upper-lip Z-plasty); and the triangular flap method (TA; lower-lip Z-plasty).
Each procedure has advantages and disadvantages.
Based on these procedures, cleft lip repair has evolved in recent decades. The cleft lip repair method in our institution has also undergone several changes. However, we have found that further modifications are needed for Asian patients who have wider philtral dimples and columns than Caucasians, while following the principles of the original techniques mentioned above.
Material & Methods: Here, we have incorporated the advantages of each procedure and propose a refined hybrid operating technique, seeking a moreappropriate procedure for Asian patients. To evaluate our new technique, a comparison study was performed to evaluate RA, SL, and our technique.
Results: We have used our new technique to treat 137 consecutive cleft lip cases of all types and degrees of severity, with or without a cleft palate, since 2009. In the time since we adopted the hybrid technique, we have observed improved esthetics of the repaired lip.
Conclusion: Our technique demonstrated higher glance impression average scores than RA/SL.

Disclosure of Interest: None Declared

17-11-098-N / S7B-14

MANAGEMENT OF PERSISTENT BUCCOPHARYNGEAL MEMBRANE WITH DISTRACTION OSTEOGENESIS AND PHARYNGEAL FLAP RECONSTRUCTION

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Introduction & Objectives: Persistent Buccopharyngeal Membrane is a rare craniofacial condition with 27 published reports. We have treated 4 with PBM and Pierre-Robin Sequence using external mandibular distraction osteogenesis and flap reconstruction of the pharynx.

The stomodeum (primitive mouth) and the foregut are separated by the buccopharyngeal membrane, between endoderm and ectoderm. By the fourth week the membrane breaks down and establishes communication between the oral cavity and pharynx. If this fails to disintegrate, a persistent buccopharyngeal membrane obstructs the pharynx. These infants suffer from breathing and feeding difficulties, and long-term sequellae include swallowing, speech, and chronic eustachian tube dysfunction. These anomalies are frequently incompatible with life.

Management included tracheotomy and nasogastric tubes, placement of stents, to definitive surgical repair where buccal mucosal flaps are typically elevated and rotated posteriorly and interposed between a denuded area over the palatoglossus and palatopharyngeus muscles.

Material & Methods: We present case studies of 2 infants who presented with anomalies consistent with hypomandibular faciocranal dysostosis. Both underwent emergency tracheostomy at birth due to inability to instrument the upper airway. They were diagnosed with HFD syndrome, with complete buccopharyngeal membrane, absence of the mandibular component of the orbicularis oris, mentalis, and depressor anguli oris, cleft palate, low set ears, downward sloping palpebral fissures, anteverted nares, and hypoplastic nasal sinuses.

Both underwent mandibular distraction, using a navigation approach to assure accurate pin placement in the pharynx. After aggressive mandibular advancement, they returned to the OR for device removal. What had previously seemed to be aglossia proved to be microglossia, demonstrating that mandibular advancement permits lingual hypertrophy over time. Further surgery required ablation of bone across the floor of the mouth and symphyseal widening. They both underwen local flaps reconstruction of the defects left after resecting the buccopharyngeal membrane.

Results: Mandibular distraction resulted in over 40 mm of stable sagittal advancement, and resulted in hypertrophy of the hypoplastic tongue. Decannulation is not planned, as there is poor po feeding, but both retain a protective gag reflex. Suck/swallow reflexes appear to be normal, and there is no evidence of oral aversion.

Conclusion: Even in syndromes with profound oral and lingual anomalies, aggressive mandibular distraction can reposition the floor of mouth musculature and permit gradual hypertrophy of the tongue. Further refinements in reconstruction may permit some degree of oral feeding in this patient group.

Disclosure of Interest: None Declared

17-11-099

THE EFFECT OF THE CLEFT LIP SCAR AND CLEFT SIDE NOSTRIL WIDENING BY DIFFERENT SITES OF BOTULINUM TOXIN INJECTION

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Introduction & Objectives: Botulinum toxin injections into the subjacent orbicularis oris muscle had been proved produced better appearing and narrower cheiloplasty scars. We further compared different sites of injection to see the effect on the unilateral cleft lip scar and the beneficial to the cleft side nostril widening.

Material & Methods: In this double-blind, randomized, prospective trial, 60 consecutive patients with unilateral cleft lip undergoing primary cheiloplasties between August of 2016 and June of 2018 were randomized to receive botulinum toxin type A injections into the subjacent orbicularis oris muscle (4 points group) or bilateral nasolabial region (6 points group) immediately after wound closure. Scars were assessed after 6 months using the photographic scar width measurements and Vancouver Scar Scale assessments. The nostril width was compared using the ratio to the normal side by the 2D photos.

Results: 56 patients completed the trial. Measurements of scar widths above the Cupid's bow revealed significantly narrower scars in the 6 points group(nasolabial region) ($P < 0.05$). However, Vancouver Scar Scale assessments were similar between groups. The nostril width had no significant difference between these 2 groups.

Conclusion: Botulinum toxin injections to the nasolabial region produced narrower cheiloplasty scars but no beneficial to the cleft side nostril widening. The nasolabial region has more facial expression muscles involvement that may produce more traction on the scar.

Disclosure of Interest: None Declared

DAY17 - STATION 12 - CRANIOFACIAL RECONSTRUCTION

17-12-100

VERSATILITY OF THE FREE VASTUS LATERALIS MUSCLE FLAP: ORBITAL RECONSTRUCTION AFTER REMOVAL OF COMPLEX VASCULAR MALFORMATION IN A PEDIATRIC PATIENT

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Introduction & Objectives: It is a challenging problem for the reconstructive surgeon to perform adequate reconstruction of extensive pediatric orbital defect whether congenital or acquired. There is no uniform strategy. In this report, we present our experience with a free vastus lateralis muscle flap for reconstructing extended orbital defect in a pediatric patient suffering from a combined type vascular malformation with disruption of the eyeball.
The reconstruction of the orbit remains a "surgical challenge" both in adults and children. While in the adults the goals are the restoration of the volume, an adequate symmetry and facial aesthetics and a good remodeling for the integration of an ocular prosthesis, in children correcting the asymmetry to balance orbital growth is an additional goal. Many reconstructive techniques have been proposed, including the use of free flaps.The versatility of the vastus lateralis muscle flap is well known. It offers adequate amount of tissue with minimal donor site morbidity, long pedicle, possibility of working in double team, constant anatomy and safe and rapid dissection.Nevertheless there are no descriptions of its use for pediatric orbital reconstructions.
Material & Methods: The patient has been presented from a foreign country with an unclear medical history, presenting exorbitism and exophthalmos, proptosis of the eyeball, visus 4/10, limited ocular motility. We made clinical-instrumental investigations with a diagnosis of complex vascular malformation. It expanded in intra-orbital and retrorbital space with bulb anterior dislocation and optic nerve involvement. We performed an emptying of the orbital content via transconjunctival and via coronal incision with eyelid preservation. A free vastus lateralis muscle flap was used for reconstruction, filling the orbital cavity. We anastomosed the flap on the superficial temporal artery and on the temporal and retroauricular veins anteriorly to the tragus transposed with pivot on the auricular lobe. An ocular conformator was then positioned. There were no major or minor complications associated with the procedure.
Results: We report the result after twelve months, showing a good orbital rehabilitation with an adequate prosthetic cavity, a good volume recovery and consequently of facial symmetry: it is an essential objective to guarantee balanced orbital and periorbital growth. No morbidity was recorded at the donor site.
Conclusion: The vastus lateralis free flap, because of its widely described advantages in the adult, is also an interesting option in orbital reconstruction in the child, demonstrating its utility and versatility even in pediatric age.

Disclosure of Interest: None Declared

17-12-101-N / 18-12-212

THE IMPACT OF HUMANITARIAN TRANSFERS IN THE TREATMENT OF CRANIOFACIAL DISORDERS

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Introduction & Objectives: Treatment of severe craniofacial disorders is known to require a multidisciplinary approach and specialized medical facilities including access to intensive care unit. These conditions lack in most institutions of developing countries. Over more than thirty years, children and young adults with various disorders have been referred and transferred to our institution by different humanitarian organisations for such purpose.

Material & Methods: We present a retrospective series of 61 patients (28 female and 33 male; median age 9.8 years [5 weeks – 33 years]) treated between 1982 and 2018 at our hospital for different craniofacial disorders. Surgical procedures, results, complications as well as interdisciplinary collaborations and duration of transfer were assessed on behalf of medical charts and photographs.

Results: The majority had craniofacial clefts associated to 24 encephaloceles and 23 hypertelorisms. The remaining were patients with craniosynostosis (10), neurofibromatosis (6), vascular malformations (3), fibrous dysplasia (3), orbitopalpebral malformations (2) and burn or post-traumatic sequelae (5).Surgical collaboration between plastic surgery and other disciplines, such as neurosurgery (46 patients), ophthalmology (7 patients), maxillofacial surgery (13 patients), interventional radiology for preoperative embolization (5 patients), were performed, when necessary. Most patients (39) had more than one operation, mostly due to staged reconstruction. Surgical revisions were for infection (6), hematoma (3) or scar dehiscence (3). There was no postoperative death. Mean transfer duration was 143 days [30-380 days]. Aesthetic results were satisfying for most patients and the aim of social integration generally achieved. Follow up was performed by local humanitarian organisations and by our team during surgical missions.

Conclusion: Surgical treatment of severe craniofacial disorders is safe when performed in a specialized centre. Even if duration of transfer may be of several months, the impact on the social integration and quality of life for those children is obvious. Close collaboration with humanitarian organizations is the prerequisite for beneficial global outcome.

Disclosure of Interest: None Declared

17-12-102

REVIEW OF PEDIATRIC CRANIOMAXILLOFACIAL RECONSTRUCTION: EXPERIENCE FROM A SINGLE, LARGE INSTITUTION

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Introduction & Objectives: Pediatric craniomaxillofacial tumors pose unique reconstructive challenges following radical resection. This is due to the need to account for future growth, limited available donor sites and associated morbidity, and the increased technical challenges of smaller donor tissues. Successful management requires a multidisciplinary and well-coordinated approach. Much has been written about reconstruction algorithms in the adult population. While these are useful guides when considering reconstruction in the pediatric patient, they are not directly applicable for the reasons listed above. The purpose of this study is to report on the surgical experience of craniomaxillofacial reconstruction at the largest children's hospital in the United States.

Material & Methods: A review identified 18 pediatric patients undergoing oncologic resection followed by reconstruction between 2016 and 2019 at a single institution. Patient demographic information was retrieved and the surgical approach and reconstructive outcomes were analyzed. Results were reported based on anatomic location within the vertical thirds of the face: the *upper third* consists of the forehead, scalp and calvarium, the *middle third* consists of the midface including the orbit, zygoma, palate, and maxilla, and the *lower third* consists of the mandible.

Results: Defects involving the upper third of the face were reconstructed with a chimeric latissimus dorsi and serratus anterior free flap (1) and a radial forearm free flap (1). Middle third defects were reconstructed with free radial forearm flaps (1), free anterolateral thigh flaps (4), with 1 patient requiring a concurrent PEEK implant followed by a staged free fibula flap, a vastus lateralis flap (1) with concurrent PEEK implant, and varied rotational or advancement flaps for maxillary, palatal, or buccal defects (3). Combined middle and lower facial reconstructions used free fibula flaps for maxillomandibular defects (7). A 94.4% flap success rate was seen with 1 failure successfully healed by secondary intention. Complications included venous thrombosis (1), bony malunion (1), minor wound dehiscence (2), and oronasal fistula (1).

Conclusion: Reconstruction of the head and face in the pediatric population requires special consideration for future growth, and at times temporization in anticipation for skeletal maturity followed by subsequent reoperation at an appropriate age. Additional challenges include limited donor sites, smaller anastomoses, and unpredictable postoperative compliance compared to their adult counterparts. Nonetheless, successful composite bony and soft tissue, as well as isolated soft tissue defects in children can be safely reconstructed using existing local tissue and microsurgical techniques.

Disclosure of Interest: None Declared

17-12-103

EXTERNAL PORT TISSUE EXPANSION IN THE PEDIATRIC POPULATION: CONFIRMING THEIR SAFETY AND EFFICACY

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Introduction & Objectives: External filling ports in tissue expander based reconstruction have the advantages of less pain and emotional distress. However, amongst practicing surgeons utilizing tissue expansion, a theoretical concern remains regarding higher risk of infection. Our goal was to evaluate external port safety in the pediatric population by looking at their complications and overall success rate of reconstruction.

Material & Methods: A retrospective review of all patients undergoing tissue expansion using external ports at Children's Hospital Los Angeles between January 2008 and June 2016 was conducted. Patient demographic and perioperative data were collected and analyzed.

Results: 241 expanders were placed in 100 pediatric patients, resulting in 123 procedures for congenital and acquired conditions, with an average age at time of surgery of 7.1 years (1 month – 19.9 years) and average follow-up length of 2.5 years (2.8 months – 8.8 years).

Overall complication rate was 29.9% with an infection rate of 17%. The majority of these cases were treated conservatively without additional need for surgery. Of 123 cases, 25 required premature expander removals due to complications. Despite early intervention, 21 of these successfully completed their reconstruction according to the preoperative plan, resulting in an overall 96.7% success rate of tissue expander reconstruction.

Conclusion: In children, who are often less tolerant of the pain and distress associated with internal port expansion, we encourage the use of external ports. Our study found a high success rate in terms of successful reconstruction with the majority of complications being treated conservatively.

Disclosure of Interest: None Declared

17-12-104

SUPERFICIAL TEMPORAL ARTERY AND VEIN AS RECIPIENT VESSELS FOR FACIAL AND CRANIAL MICROSURGICAL RECONSTRUCTION

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Introduction & Objectives: For the successful free flap reconstruction it is important to choose appropriate recipient vessels. Superficial temporal artery (STA) and superficial temporal vein (STV) are often used as recipient vessels in reconstruction of facial and cranial region, however in some cases they are not appropriate for the recipient vessels. Here we report our case series of microsurgical craniofacial reconstruction where STA and STV are initially planned to use as recipient vessels.

Material & Methods: Fifteen patients underwent free flap reconstruction where STA and STV are initially planned to use as recipient vessels, between April of 2005 and March of 2018 in our department. Five were male and 10 were female. Their mean age was 57.8 (range 38 to 75) years old. Their clinical background, flap choice, incidence of intraoperative change in recipient vessels and postoperative course were analyzed retrospectively.

Results: Of 15 cases, 9 had cranial osteomyelitis, 4 had squamous cell carcinoma of ethmoid sinus, 1 had nasal basal cell carcinoma and 1 had a traumatic auricular defect. Omental flap was used in 9 cases (60.0%) and radial forearm flap was used in 3 cases (20.0%). Anterior lateral thigh flap, rectus abdominis musculocutaneous flap and temporoparietal fascia flap was used in 1 patient (6.67%) respectively. In 3 cases (20.0%) STV was not adequate for the drainage vein because of the scarring from previous operation and recipient vein was changed to the neck area. One patient (6.67%) who underwent cranial reconstruction with free omental flap had postoperative venous thrombosis. The thrombus was developed in STV and the flap was rescued by anastomosing flap vein to the external jugular vein via saphenous vein graft. In other 11 patients (73.3%) STA&V were utilized as recipient vessels and had uneventful perioperative course.

Conclusion: Reliability of STA and STV is still controversial and varies between literatures. In our case series, STV was not appropriate for recipient vessel in 4 out of 15 cases due to previous scarring or its small diameter. Vein is easily affected by scarring and leads to insufficient blood flow, which result in flap congestion or failure. In free flap reconstruction, it is important to estimate the blood flow of recipient vessels and not to hesitate change recipient vessels when insufficient.

Disclosure of Interest: None Declared

17-12-105-N / 19-11-301

ANTHROPOMETRIC STUDY OF HUMAN EAR: A BASELINE DATA FOR FIRST STAGE MICROTIA RECONSTRUCTION

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Introduction & Objectives: Creation of an auricular framework plays the main role on first stage of microtia reconstruction. The size of framework is determined by the size of the contralateral healthy ear. Problems appears when the microtia case is bilateral. A population based auricular framework pattern is urgently needed.
This study aimed at determining the mean values of normal anthropometric measurement of external ear in males and females and their comparison on either sides and in either sex.
Material & Methods: Measurements are taken from 524 subjects (96 men and 428 women) aged 17–35 years using a Vernier caliper. The parameters measured were total ear height (TEH), ear width (EW), lobular height (LH), lobular width (LW) each subject's right and left ears.
Results: The mean values for TEH, EW, LH, and LW in male subjects were found to be respectively 61.70 ± 3.92 mm, 26.85 ± 2.45 mm, 19.35 ± 3.63 mm, 19.10 ± 4.63 mm for the right ear, and 61.28 ± 4.21 mm, 26.33 ± 2.33 mm, 19.65 ± 4.2 mm, 18.68 ± 4.10 mm for the left ear. However, in the female subjects, these values were respectively, 58.09 ± 2.66 mm, 24 ± 3.40 mm, 16.64 ± 2.24, 15.91 ± 2.42 mm for the right ear, and 57.82 ± 2.78 mm, 24.18 ± 2.60 mm, 16.82 ± 2.96 mm, 16 ± 2.28 mm for the left ear. Comparisons between gender were performed by independent t-test and paired t-test for comparison between right and the left ear. All dimensions were significantly different between male and female ($p<0.05$) except the right LH ($p>0.05$). There was no significant difference both side among groups ($p<0.05$) except TEH on female group ($p>0.05$). Correlation Between TEH and LH, EW and LW was TEH = 3.6 LH and EW = 1.6 LW for men and women.
Conclusion: These findings suggest that the normal anthropometric study will have implication in the first stage of microtia reconstruction especially on bilateral cases as a baseline for reconstruction.

Disclosure of Interest: None Declared

17-12-106

CRANIOPLASTY WITH CUSTOM-MADE TITANIUM MESH FOR LARGE SKULL DEFECT AFTER FREE FLAP COVERAGE OF INFECTED SCALP DEFECT

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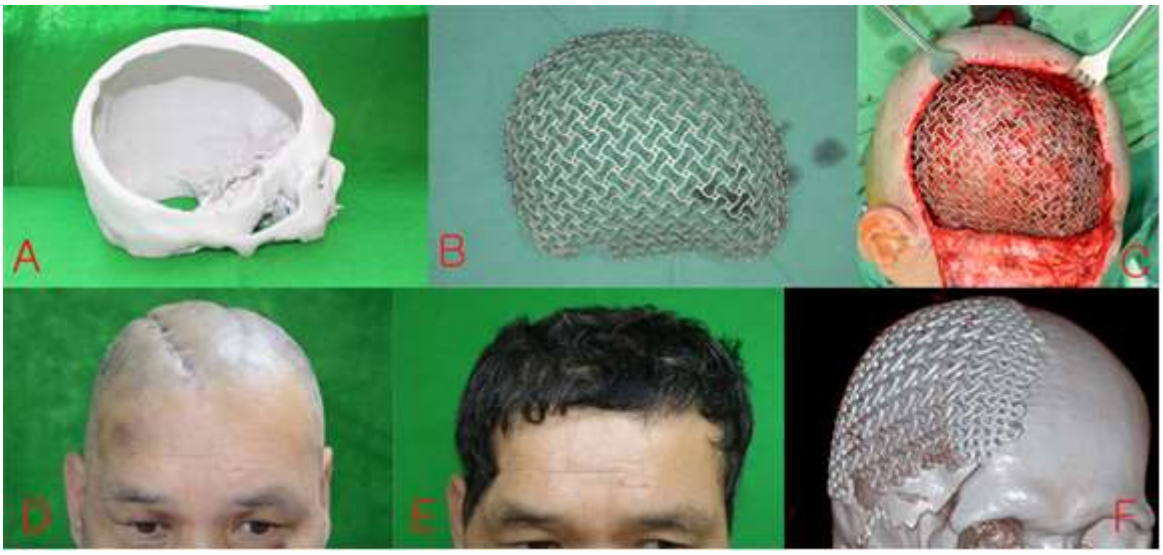
Introduction & Objectives: Covering the huge skull defect after craniectomy is challenging for both neurosurgeon and plastic surgeon. Cranioplasty using autogenous bone is first considered. When infection such as meningitis or encephalitis occurs after cranioplasty, it is hard to treat due to low vascularity and eventually implant is needed to be removed. Even after removal of autogenous bone flap, it tends to be recurrent and hard to treat. Well vascularized flap is safe to be used to prevent recurrent infection. After the infection is controlled and flap is stabilized, cranioplasty for skull defect using titanium mesh customized by 3D-reconstructed CT resulted in aesthetic and functional outcomes. Alloplastic implant can be used to cover large defect rather than autogenous bone graft from other sites. Titanium is chemically stable with low infection and inflammation rate. It is strong enough to protect the brain and to be manufactured for large size. It is easy to handle and can be customized to fit the skull defect precisely using 3D-reconstructed CT.

Material & Methods: Patients were referred to our department for recurrent infection of soft tissue around brain. They underwent craniectomy for decompression of the brain and subsequent autogenous cranioplasty with their own bone flap. However, due to the bone flap or the soft tissue infection, the bone flap was removed. The infected soft tissue around brain was hard to treat. Depression of head occurred as a result of bone defect.

Well vascularized free flap coverage were used to control infection and cover the soft tissue defect. Sometimes, despite the successful treatment of infection, atrophy of the muscle flap revealed the deformity of the head. After the healing of the soft tissue infection, reconstruction of the skull defect was planned. By using three-dimensional reconstruction of CT, plaster cast was conducted. Using the cast as template, custom-made titanium mesh was manufactured. In the operating room, the titanium mesh was insert.

Results: The large skull defect with previous autologous bone flap infection history and intractable inflammation after bone flap removal was successfully covered using vascularized free flap and custom-made titanium mesh. After surgery, the skull contour recovered without any infection. On long term follow up there was no significant complications and remarkable deformities. They were aesthetically satisfying without depression or protrusion

Conclusion: After covering with vascularized free flap of complex scalp and skull defect, chemically, biologically and mechanically stable titanium mesh which is customized to patients with 3D-CT technology is a good option for aesthetic and safe results



Disclosure of Interest: None Declared

17-12-108

THE ZYGOMATICOSPHENOIDAL ANGLE: A REFERENCE FOR SURGICAL NAVIGATION IN ZYGOMATICOMAXILLARY COMPLEX FRACTURE REPAIR

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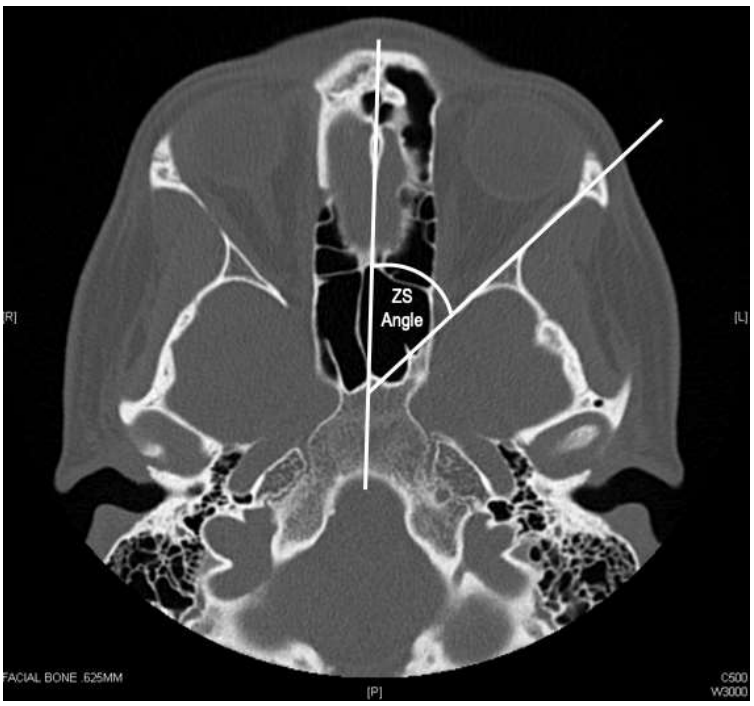
Introduction & Objectives: Alignment of the zygomaticosphenoid (ZS) suture is fundamental to reduction of zygomaticomaxillary complex (ZMC) fractures. Lateral displacement and anteroposterior impaction of the anterior segment must be corrected. Furthermore, to prevent a rotational deformity, the correct angle of the zygoma relative to the cranial base must be restored. Clinically this can be a challenge, especially when there is comminution of the ZS suture. Defining a zygomaticosphenoidal angle would provide a reference guide for use in conjunction with stereotactic navigation to achieve anatomic orientation of the anterior fracture segment. Normative data of this angle could be used in bilateral fractures and, if constant across laterality, patient-specific data could be used as a guide in unilateral injuries.

Material & Methods: A single-center retrospective analysis of 100 patients was designed to determine normative zygomaticosphenoidal angle values. Computed tomography (CT) data of patients with isolated mandibular fractures was used to select for a craniofacial trauma demographic with available computed tomography and intact midface skeletal anatomy. An angle subtended by the midline and a best fit line through the ZS on axial CT was measured bilaterally. The mean value of this measurement for three vertically adjacent cuts was calculated with the position of central cut determined by the equator of the globe and trigone of the sphenoid. Measurements and assessment of cuts were performed and verified by two investigators to ensure consensus. Demographic data including age, sex, and ethnicity was collected for comparison.

Results: The mean zygomaticosphenoid angle was 47º (range 39º -55º). 97% of angles were within two standard deviations (8º) of the mean. Subgroup analysis demonstrated no significant difference of ZS angle across age (p=0.74) or sex (p=0.89). White patients (45.60º) were found to have more acute ZS angles than Black (47.73º; p=0.02) or Hispanic (47.45º; p=0.04) patients. For each angle the variation across the three sample cuts was ≤4.5º in all cases. Patients demonstrated high fidelity of zygomaticosphenoidal angle bilaterally with a mean difference of 3º.

Conclusion: The zygomaticosphenoidal angle is a useful reference, in conjunction with stereotactic navigation, for anatomic reduction of ZMC fractures. Contralaterally obtained patient-specific data may be used to guide unilateral repair. Normative values may serve as reference in bilateral injury.

Disclosure of Interest: None Declared



DAY18 - STATION 1 - NEURO/CRANIOSYNOSTOSIS

18-1-109

PEDIATRIC SKULL FRACTURE CHARACTERISTICS ASSOCIATED WITH DEVELOPMENT OF LEPTOMENINGEAL CYSTS IN YOUNG CHILDREN AFTER SKULL TRAUMA

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Introduction & Objectives: Growing skull fractures (GSF), also known as leptomeningeal cysts, are a rare complication of pediatric skull injuries. They account for approximately 0.05% to 1.6% of cases following head injury, with almost 90% of cases occurring exclusively in children under the age of three. Currently, the pathogenesis of GSFs is still debated. The purpose of this study was to examine the specific skull fracture characteristics that are associated with the development of GSFs.
Material & Methods: A retrospective cohort study was performed that included all patients under age five presenting to a single institution with skull fractures from 2003-2017. Patient demographics, etiology of injury, skull fracture characteristics (e.g. amount of diastasis, linear v. comminuted fracture, etc.), concomitant neurological injuries, and management outcomes were recorded. Potential factors attributing to the development of a GSF as well as neurologic injuries associated with GSFs were evaluated using univariate logistic regression.
Results: A total of 905 patients met the authors' inclusion criteria. Of these, 6 (0.66%) were diagnosed with a GSF. GSFs were more likely to be comminuted (83.3% v. 40.7%, $p = 0.042$) and to present with diastasis on imaging (100% v. 26.1%, $p < 0.001$; mean amount of diastasis 7.1 mm v. 3.1 mm, $p = 0.002$). Univariate logistic regression analysis confirmed the role of a comminuted fracture pattern (OR 7.572) and the degree of diastasis (OR 2.081 per mm diastasis) as significant risk factors for the development of GSF.
Conclusion: Growing skull fractures are a rare occurrence in children with skull fracture under the age of five. Due to its low incidence and subtle clinical presentation, the identification of high-risk individuals remains challenging. Our results demonstrate that fracture comminution and diastasis length are significant risk factors in GSF development. Consideration of these characteristics in addition to an evaluation of dural and brain parenchymal integrity with a MRI or ultrasonography is necessary to risk stratify young patients who present to the emergency room with skull fractures.

Disclosure of Interest: J. Lopez: None Declared, J. Chen: None Declared, A. Reategui: None Declared, N. Khavanin: None Declared, P. Manson: None Declared, A. Dorafshar Conflict with: KLS Martin, Depuy Synthes, R. Redett: None Declared

18-1-110

MEASUREMENT OF INTRACRANIAL PRESSURE UNDER GENERAL ANESTHESIA IS NOT RELIABLE

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Introduction & Objectives: There is no reliable way to non-invasively measure intracranial pressure (ICP). A real-time wire, or fluid–fluid coupling is the only reliable method. However, intra-operative measurement is confounded by positioning and anesthetic. A similar effect has been noted on lumbar puncture (LP) results. Decisions about treatment are sometimes made based on presence or absence of raised ICP. It has been our observation that intraoperative ICP readings do not always correlate with postoperative findings once the patient is awake and breathing room air. Specifically, we have found an artificial increase in pressure, sometimes as high as 10-20 mm of mercury intraoperatively compared to postoperatively.

Material & Methods: All patients on the neurosurgical service who underwent placement of ICP monitoring wires between 2011-2017 were identified. Intraoperative and postoperative ICP, mean end-tidal CO2, and preoperative documentation of papilledema and LPs were recorded. Patients for whom intraoperative pressure was not recorded and severe traumatic brain injury were excluded.

Results: Sixty-eight patients were included. Mean intraoperative ICP (14.7) was significantly higher (P=0.01) than post-operative (8.8). 38% of patients (26/68) had a mean ICP intraoperatively that correlated within 5 mmHg to ICP postoperatively. 57% of patients (39/68) had a mean Intra-operative ICP that was 5 to 25 mmHg higher than their mean postoperative ICP, of those, 23% were > 10 mmHg higher. All of the 32 patients who had LP values available showed similar poor correlation with wire measurements.

Conclusion: Intraoperative ICP measurements for patients under general anesthesia were higher in a significant number of patients. Making surgical decisions based on “spot-checking” ICP under anesthesia is unreliable. Further investigation will include analysis of anesthetic utilized, intraoperative vital signs, and intraoperative EtCO2 measurements. We recommend 24 hours of monitoring in the awake state to determine true ICP.

Disclosure of Interest: None Declared

18-1-111

OSTEOPETROSIS LEADING TO SUBTOTAL LOSS OF THE VISCEROCRANIAL BONES

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Introduction & Objectives: Osteosclerotic metaphyseal dysplasia (OSMD) is a very rare type of autosomal recessive osteopetrosis. We report on a patient with OSMD who presents with sandwich vertebrae, platyspondyly, osteosclerosis of the tubular bones and pathologic fractures as well as with recurrent infections of the jaw, prompting genetic evaluation. Jaw necrosis was found to be similar to medication-induced osteonecrosis of the jaw (MRONJ), which is a known side effect of drugs such as bisphosphonates and anti-angiogenic cancer treatments. The here described patient has not been on such medications.

Material & Methods: Our patient is the only one described in literature with the combination of OSMD and severe recurrent osteonecrosis of the viscerocranium, having excluded feasible other causes such as MRONJ. Several surgical interventions were performed to treat various fractures but in the mandible, necrotic bone was removed without further osteosynthesis.

After exclusion of mutations in *ClCN7* we performed trio-based exome sequencing and segregation analysis in the patients' parents and two siblings.

Results: One novel homozygous splice-side mutation in a Serine/Threonine Protein-Kinase was found and the parental transmission proved by segregation analysis as the parents carry this mutation in a heterozygous state. cDNA sequencing showed that one exon is effectively spliced out. Bone biopsy revealed giant osteoclasts suggesting impaired bone resorption. Osteoclast (OC) differentiation of patient's whole blood showed a high turnover and faster differentiation compared to wildtype OCs. Confocal microscope analysis proved shallower resorption pits and unusual sealing zones compared to wildtype OCs. Our study adds one case to the three OSMD cases caused by this gene described in literature. In contrast to the other patients described in literature ranging in age from 2 y to 5 y and 14 y, this patient was observed and treated over a time span of 11 years, from age 23 to age 34.

Conclusion: In comparison to the other published cases of OSMD, our patient presented with long-lasting suffering from osteonecrosis of the jaws with sequester formation causing local infections, which still presents a major challenge in the treatment of this patient.

Disclosure of Interest: None Declared

18-1-113

RISK OF INTRACRANIAL EXTENSION OF CRANIOFACIAL DERMOID CYSTS ACCORDING TO LOCATION

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Introduction & Objectives: Congenital inclusion dermoid cysts form along lines of embryological fusion and result from ectodermal inclusion or entrapment within underlying mesoderm during early embryological development. The initial aim of our study was to investigate our own clinical experience that later presenting lateral brow dermoids were more locally destructive. We expanded the study to identify the anatomical areas within the cranium which had the highest chance of intracranial extension for dermoid cysts.

Material & Methods: We conducted a single-centre, consecutive, non-randomized comparative case series, reviewing the case notes of all patients treated surgically for craniofacial dermoid at the Royal Children's Hospital in Melbourne, Australia. The study period was the 20 years between May 1997 and May 2017, and a total of 1358 patients were identified. A total of 452 patients were excluded as the dermoid cysts were in other anatomical areas. A further 259 patients were found to have craniofacial dermoids but were excluded due to the incomplete records. The remaining 647 patients had craniofacial dermoids and adequate information to be included in the study.

Results: In this series of 647 patients, 341 (52.7%) were female and 306 (47.3%) were male. There was a total of 655 lesions. The age at surgery ranged from 2 months to 18 years, with an average age of 25.65 months. A total of 362 (55.3%) children presented with lesions of the lateral brow. The next most common locations in descending order were midline nasal with 87 (13.3%), 43 occipital (6.6%), 38 frontal/anterior fontanelle (5.8%), 38 posterior auricular (5.8%), 37 temporal (5.6%), 31 medial brow/medial canthus (4.7%), and 19 parietal (2.9%). As regards to rates of intracranial extension:

Lateral Brow Lesions: These lesions rarely extend intracranially.

Medial canthal lesions: We found no lesions within this group had any intracranial extension.

Midline nasal lesions: These lesions had a high rate of intracranial extension (11.5%).

Occipital lesions: Occipital lesions were shown to have intracranial extension in 16.3%. 71.4% of occipital lesions extending intracranially were lying in the midline. As such midline occipital lesions require preoperative imaging.

Conclusion: To our knowledge, this is the largest cases series of paediatric dermoid cysts published to date. Guided by this data, we suggest that stratifying these lesions into their precise anatomical location will facilitate more accurate identification of lesions at risk of intracranial extension. Assessing those lesions at low risk of intracranial extension avoids unnecessary imaging and will expedite their treatment. Conversely those lesions identified as being in high risk regions will alert us to the importance of imaging appropriately.

Disclosure of Interest: None Declared

18-1-114

SURGICAL CHALLENGES OF ABNORMAL LOCATION OF ANTERIOR CEREBRAL ARTERY IN THE MANAGEMENT OF FRONTOETHMOIDAL MENINGOECEPHALOCELE - ACFU EXPERIENCE

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Introduction & Objectives: Frontoethmoidal Meningo-Encephalocele (FEME) is a congenital herniation of intracranial contents through a bony defect in the skull at the junction of the frontal and ethmoidal bones. Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) provided detailed examination of associated intracranial and central nervous system malformations. Previous reports showed hydrocephalus, microcephaly, and cerebral dysplasia in 15-20% of the patients. However, the cerebral vascular changes in the frontal region in FEME and their impact on the surgical correction and clinical outcome were not reported previously.

Material & Methods: Two cases of FEME were referred to the Australian Craniofacial Unit that demonstrated cautionary relationship of the anterior cerebral arteries to FEME. The aim of this article is to describe the vascular anatomy of the anterior cerebral artery (ACA) in FEME in the first patient and complications related to its injury in the second patient.

Results: 1) A 4-year-old boy with untreated FEME underwent an MRI scan that showed a long A1 segment and an acutely angulated A2 segemtns of the ACA. 2) A 4-year-old girl with a partially resected FEME was referred with significant speech, language and behavioural problems. CT and MRI scans revealed residual FEME with anterior cerebral artery territory infarctions bilaterally secondary to amputation of glial tissue.

Conclusion: Preservation of the anterior cerebral arteries (ACAs) is important in the surgical management of frontoethmoidal meningo-encephalocele (FEME). This would avoid complications related to the loss of blood supply to the part of the brain supplied by the ACA.

Disclosure of Interest: None Declared

18-1-115

CENTRAL RETINAL ARTERY OCCLUSION FOLLOWING CALVARIAL EXPANSION FOR RAISED INTRACRANIAL PRESSURE

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Introduction & Objectives: Blindness is a known rare complication of prone positioning during surgery. Blindness following prone surgery is most commonly attributed to direct pressure on the eye but can also be caused by central retinal artery occlusion (CRAO) in the absence of pressure on the eye. The incidence and risk factors associated with CRAO in the context of prone spinal surgery are well described. While prolonged tranexamic acid use can cause spontaneous CRAO, tranexamic acid has not been associated with increased risk of CRAO during prone surgery. CRAO has not been previously described following prone surgery for craniosynostosis. Here, we present two cases of monocular CRAO following prone calvarial expansion for increased intracranial pressure secondary to craniosynostosis where tranexamic acid was used.
Material & Methods: All prone transcranial procedures performed at the Oxford Craniofacial Unit were reviewed. These cases were reviewed for the presence of raised intracranial pressure and intraoperative tranexamic acid use.
Results: A total of 662 prone procedures have been performed between 1994 and March 11, 2019. Tranexamic acid has been used routinely since 2012 and in the last 311 consecutive cases. 51 (7.7%) prone procedures have been performed for raised intracranial pressure and tranexamic acid was used in the 33 most recent cases. We identified two cases of monocular CRAO following prone surgery. Standard intraoperative precautions such as regular head-lifts were implemented in both cases, and a root cause analysis failed to reveal a clear cause in either case. Both of these cases, however, were associated with intraoperative tranexamic acid use and increased intracranial pressure. The overall incidence of CRAO in our center in 25 years has been 0.3% but is 6% in the context of raised intracranial pressure and tranexamic acid use.
Conclusion: Prone positioning during surgery for craniosynostosis is common in our centre. Since the implementation of standard intraoperative administration of tranexamic acid there have been two cases of CRAO following prone surgery. Although a root cause analysis did not identify a known risk factor or causative variable in either case, both cases occurred in the context of tranexamic acid use and raised intracranial pressure. These are the first reported cases of monocular blindness secondary to CRAO following prone surgery for craniosynostosis. Prone-positioning, raised intracranial pressure, and tranexamic acid use together may represent a potent combination of risk factors for CRAO.

Disclosure of Interest: None Declared

18-1-116

PRIMARY OSSEOUS PECOMA IN THE PAEDIATRIC CRANIOFACIAL SKELETON. A REPORT OF THE INDEX CASE

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Introduction & Objectives: Perivascular epithelioid tumours (PEComas) are a heterogenous group of tumours with immunoreactive melanocytic and smooth muscle markers. Most exhibit a benign course with a small subset having malignant potential. These tumours tend to occur in adults and can present intraabdominally, in the skeleton or as a soft tissue mass. PEComas are rare in children and to date there have been none reported in the craniofacial skeleton of a child. We present the index case of a primary osseous PEComa presenting in the craniofacial skeleton of a three-year old girl.

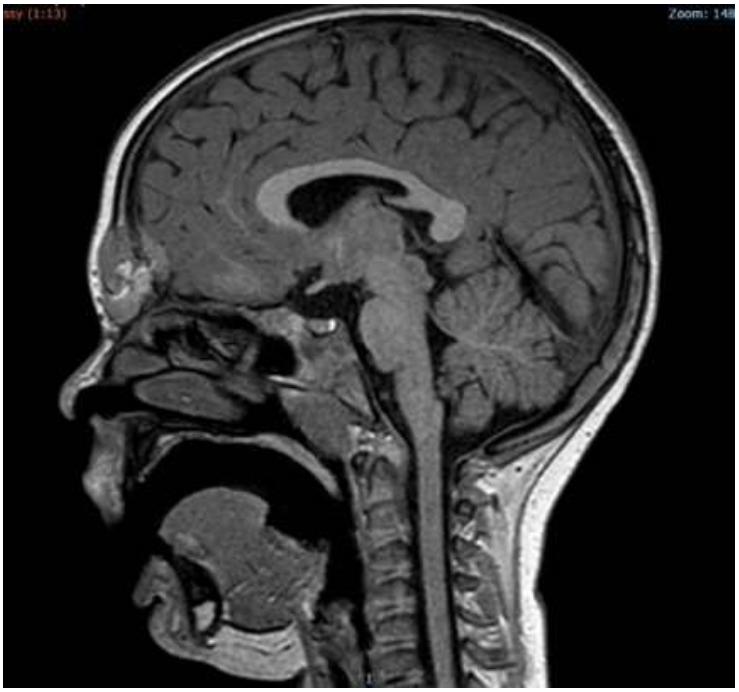
Material & Methods: A 3-year old girl presented to her GP with a slowly enlarging mass in her glabellar region. There was no other significant history or other symptoms. Biopsy showed a darkly pigmented tumour, with positive staining for HMB-45 and a TFE3 gene rearrangement. A diagnosis of PEComa was made and surgical resection was carried out. Excision of the tumour was complete histologically following a second resection.

Six months later, imaging showed evidence of recurrence in the roof of the right orbit, extending into the sphenoid sinus. This was resected via an endoscopic transnasal approach. Following discussion with the paediatric oncology team, the patient was commenced on Sirolimus(rapamycin).

A further six months following the surgery, further recurrences were detected in the roof of both orbits. There was no distant spread on imaging. She underwent further surgical resection of the macroscopic disease and Sirolimus was continued. To date there has been no further growth or distant spread of disease.

Results: The patient currently remains under close regular observation through the craniofacial, neurosurgical and oncology team. At this stage there has been no further growth of the tumours with Sirolimus treatment. The patient is otherwise well and has no significant side effects to date.

Conclusion: This is the index case of a rare tumour affecting the craniofacial skeleton in a child. There remains no consensus on the management of PEComas in general, with surgical resection being the mainstay and neoadjuvant therapy considered for recurrent and unresectable disease.



Disclosure of Interest: None Declared

18-1-117

CRANIOMETER-APP - A NOVEL MOBILE SOFTWARE TO ASESS CRANIAL DEFORMITY

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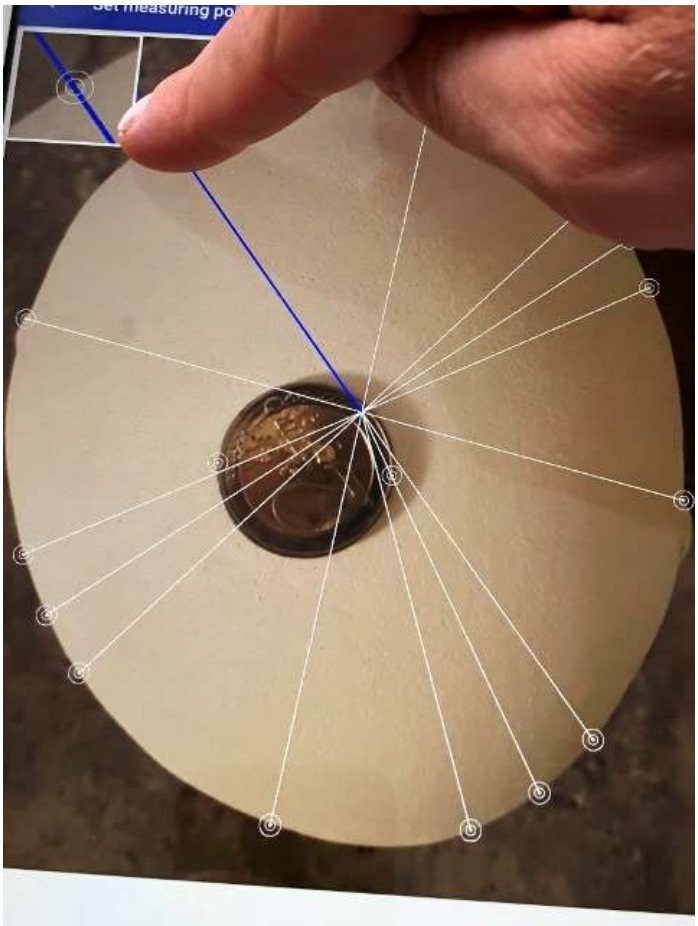
Introduction & Objectives: The reliable assessment of craniofacial deformity in early childhood is bound on the presentation in specialized craniofacial centers. Primary detection of these deformities, however, is mainly identified in the outpatient-setting by pediatricians, midwifes, physiotherapists or others.

Material & Methods: A newly generated mHealth-Application was programmed in order to spread the option to verify cranial deformities in early childhood to rural or underdeveloped areas. A standardized photograph along with a test specimen allows reliable measurements of the head and analysis of cranial circumference, Cranial Index, and Cranial asymmetry. Included algorithms of shape identification shall allow notification of craniosynostoses in near future. The collection of data will be used to further specify existing normative data on cranial shape in infancy.

Results: This new mobile software was developed and validated in a university setting. Central and automated data processing along with flexible integration of different algorithms for the detection of cranial deformations based on statistical methods forms the basis for the optimization of the cognitive algorithms. The application allows a cross-sectoral professional analysis of head shape regardless of the scientific or medical education of the investigator. In daily practice, these include the clarification of rare syndromes with specific types of cranial deformities, the assessment of abnormalities in the shape of the skull as well as the targeted assignment of findings worthy of treatment or surgery

Conclusion: The Craniometer-App holds potential to identify cranial deformities in childhood early, induce preventive actions, connect patients with specialized centers and enhance patient empowerment in rural or less developed areas.



Disclosure of Interest: None Declared

18-1-117BIS / 19-9-285

SQUAMOSAL SUTURE SYNOSTOSIS: ITS ASSOCIATIONS AND CLINICAL SIGNIFICANCE

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Introduction & Objectives: Squamosal suture synostosis (SQS) is a phenomenon of unclear clinical significance though it is thought to occur more commonly in syndromic patients and in the context of multisuture synostosis. This retrospective single-center study sought to identify pathology and syndromes asscociated with SQS

Material & Methods: The central radiology database was reviewed at a single tertiary center. The filter terms "squamosal suture" and "synostosis" were applied to yield an initial list of patient CTs. Each was reviewed with accompanying radiologist's report to identify cases.

Additionally, the senior author maintains a list of orthognathic patients with accompanying CT data. These were systematically reviewed to identify further cases.

Results: The central radiology database yielded 19 cases and 28 were identified using the senior author's database-a total of 47. 30/47 (63.8%) had additional suture fusions; sagittal (19), coronal (16), lambdoid (9), metopic (6). 2 cases had incomplete CT images.

10/47 (21.3%) were syndromic; Cruzons (4) Kallmans (1), Dilantin (1), Pfeiffer (1), Apert (1) Mobius (1) Van der Woude (1).

9/47 (19.1%) underwent surgery. These cases also had coronal/sagittal CS. Raised ICP was the primary reason.

In isolated SQS (n=14): 2 had dysmorphology (2 occipital plagiocephaly, 1 ipsilateral flattening of the parietal bone) one had hearing loss (cause unclear). 1 patient had multiple cranial nerve palsies, developmental delay and behavioral difficulties in the setting of Mobius syndrome.

Conclusion: This is the largest cohort of SQS patients to date. As in previous studies, most cases of SQS were part of multisuture synostosis and there was a slight male preponderance. Contrary to previous studies, most were non-syndromic and most were asymptomatic. Where symptoms did manifest their relation to SQS was unclear or it was in the context of multisuture synostosis.

Disclosure of Interest: None Declared

DAY18 - STATION 2 - SYNDROMIC CRANIOSYNOSTOSIS

18-2-118

UNDIAGNOSED NORMOCEPHALIC PANCRANIOSYNOSTOSIS PRESENTING AS BILATERAL ABDUCENS NERVE PALSY

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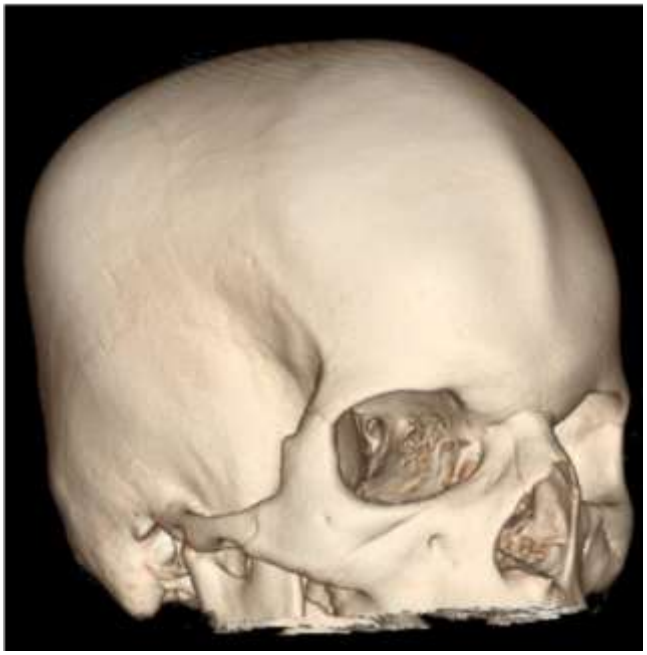
Introduction & Objectives: Normocephalic pancraniosynostosis is a rare variant defined as the premature fusion of more than three major cranial sutures with a grossly normal head shape and size. It typically presents with symptoms of increased intracranial pressure and is usually diagnosed significantly later than cases with abnormal head shape. Prompt treatment is necessary to prevent serious morbidity resulting from chronically elevated intracranial pressure. Here we present diagnosis and management of a patient presenting with this disorder and unique neurologic sequelae.
Material & Methods: A 9-year-old boy presented to the ophthalmologist with a 1-month history of double vision, drifting of his right eye toward the nasal bridge, and intracranial hypertension evident with papilledma. Physical exam was notable for mild turricephaly, trigonocephally, and schaphocephaly with occipital bulleting. A computed tomography study demonstrated radiologic thumbprinting, diffuse osseous sclerosis, and fusion of the bilateral coronal, sagittal, metopic, and lambdoid sutures (Figure 1). A cranial vault expansion with fronto-orbital advancement were performed.
Results: Within 4 months of surgery, the papilledema resolved, and at 1-year follow up, the abducens nerve palsies showed improvement and the optic disks remained without evidence of papilledema. The patient had improvement in head shape.
Conclusion: Bilateral abducens nerve palsy is a rare presentation of increased intracranial pressure and a previously unreported presentation of pancraniosynostosis with hyptertension. Early diagnosis and treatment are imperative in cases of pancraniosynostosis with intracranial hypertension for the prevention of long-term sequelae.



Disclosure of Interest: None Declared

18-2-119

MULTIDISCIPLINARY MANAGEMENT OF CHILDREN WITH GENETICALLY CONFIRMED CROUZON SYNDROME: A RETROSPECTIVE REVIEW IN THE OXFORD CRANIOFACIAL UNIT

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Introduction & Objectives: Crouzon syndrome is a rare autosomal dominant genetic disorder which is caused by a mutation in the fibroblast growth factor receptor-2 (*FGFR2*) and the fibroblast growth factor receptor-3 (*FGFR3*) genes. This syndrome is characterised with a triad of craniosynostosis, maxillary hypoplasia and exophthalmous. Due to the nature of this syndrome, this patient cohort is at risk of developing raised intracranial hypertension; this has the potential to impair both vision and neurocognitive development. Potential cognitive difficulties, multiple medical interventions and visible appearance differences are implicated in this syndrome and may therefore have an impact on the psycho-social status of this patient cohort. Speech and language development may also be compromised due to the craniofacial, otological, intraoral and visual abnormalities.

Material & Methods: A retrospective case note review of all patients with a genetic diagnosis of Crouzon Syndrome attending the Oxford Craniofacial Unit during a 20-year period (1997 to 2017) was undertaken. Patients' medical records were reviewed. Inclusion criteria were: positive genetic screening for Crouzon syndrome; and available speech, language, neurocognitive and hearing data.

Results: Thirty-four patients satisfied the inclusion criteria: 29 with the FGFR2 mutation; 5 with the FGFR3 mutation. Midface hypoplasia (n=20) and class 3 malocclusion (n=13) were the most commonly reported orofacial and intraoral abnormalities. 79% (n=27) of our patients had documented exorbitsm, and the leading cause of visual impairment was astigmatism (n=9, 26%). 38% (n=13/34) of patients presented with conductive hearing loss and 53% (n=18) reported a history of otitis media with effusion. Enlarged adenoids and tonsils were reported in 15 patients, of which nine required an adenotonsillectomy. Fifteen patients (44%) were diagnosed with obstructive sleep apnoea, of which 6 children required a tracheostomy. Two of our patient cohort required feeding via either a gastrojejunal tube or gastrostomy. 64% (n=22/34) required an intracranial pressure monitoring: 56% (n=19) experienced at least one episode of raised intracranial pressure. Speech and language data were available for 20 patients: 3 presented with delayed receptive and expressive language difficulties; 6 with speech difficulties.

Conclusion: Early management and continuous monitoring by a multidisciplinary team of specialists will help ensure that all aspects of this syndrome are addressed, permitting appropriate intervention as required.

Disclosure of Interest: M. Abukhder Conflict with: The Scar Free Foundation, H. Care: None Declared, S. Wall: None Declared, S. magdum: None Declared, S. kilcoyne: None Declared, J. JayaMohan: None Declared, D. Johnson: None Declared, A. Wilkie: None Declared

18-2-120

A PROSPECTIVE STUDY OF FORCES IN CRANIOFACIAL DISTRACTION

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Introduction & Objectives: While much has been written about the variables “distance” and “rhythm” in craniofacial distraction osteogenesis (CMF DO), little is known about the forces involved. The purpose of this study is to study force magnitudes and force trends in CMF DO and associate these forces to operative outcomes.
Material & Methods: Seventeen patients undergoing distraction of the mandible or cranial vault with a semi-buried KLS-Martin (KLS-Martin, Tuttlingen, Germany) distractor, were included in this prospective study. Subjects’ distractors were activated each day by study personnel, using a digital torque-measuring screwdriver. Torque measurements were then converted into generalizable force values and associated with patient outcomes.
Results: Cranial vault distraction (CVDO) was performed on 7 subjects (41.2%), and mandibular distraction (MDO) on 10 subjects (58.8%). Across the entire cohort, the maximum force per activation was 27.023.5 N, and the elastic force (the rise in force over a single activation) was 10.714.1 N. Maximum force (CVDO:52.920.2 N vs. MDO: 12.98.5 N; $p<0.0001$), and elastic force (CVDO: 22.015.6 N vs. MDO: 4.58.2 N; $p<0.0001$) were significantly higher in the CVDO sub-group than in the MDO cohort. On multivariate regression analysis, statistically significant associations were seen between maximum activation force and the following independent variables: active DO day number (beta-coefficient: 1.1; $P<0.001$), DO rate (mm/day) (beta-coefficient: 8.9; $P=0.016$), CVDO (relative to MDO) (beta-coefficient: 41.4; $P<0.001$), and device failure (beta-coefficient: 10.3; $P=0.004$).
Conclusion: In CMF DO, both the magnitude of, and the trend in forces are relatively predictable, and correlate significantly with easily discernable factors such as DO-modality (MDO vs. CVDO), DO rate, and other factors. Deviations from these predictable force magnitudes and trends are correlated with systems failures. A more thorough understanding of the normal and abnormal states, as they relate to force measurements, may allow for novel diagnostic and prognostic tools, and a better heuristic with which clinicians can optimize DO protocols for the patients.

Disclosure of Interest: A. Wes Conflict with: Ostiio (CMF Distractor) Shareholder, L. Lin: None Declared, D. Mazzaferro: None Declared, M. Hast: None Declared, R. Zhang: None Declared, S. Naran: None Declared, S. Bartlett: None Declared, J. Taylor Conflict with: Ostiio (CMF Distractor) Shareholder

18-2-121-N / 19-2-225

ANALYSIS OF AIRWAY AND MIDFACE IN CROUZON SYNDROME

A. J. Forte [1], X. Lu [2,*], P. Hashim [2], D. Steinbacher [2], M. Alperovich [2], J. Persing [2], N. Alonso [3]

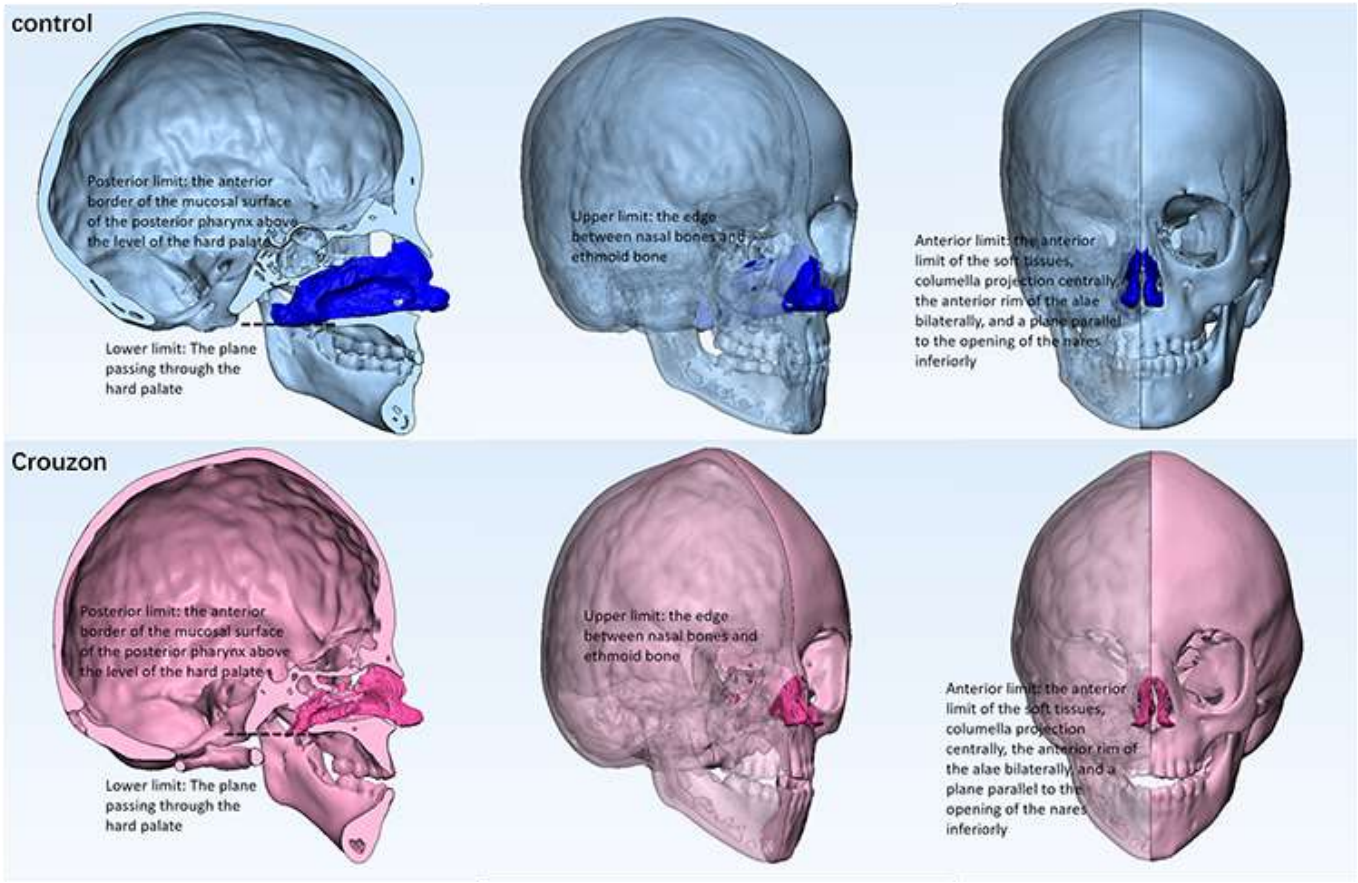
[1]Division of Plastic and Reconstructive Surgery, Mayo Clinic Florida, Jacksonville, Florida, [2]Section of Plastic and Reconstructive Surgery, Yale University School of Medicine, New Haven, Connecticut, United States, [3]Department of Plastic Surgery, University of São Paulo, São Paulo, Brazil

Introduction & Objectives: Crouzon syndrome is associated with severe respiratory impairment of the upper airway due in part to mid-facial dysmorphology. We calculated the distinctive nasal diameter and pharyngeal airway volume in patients with Crouzon syndrome and compared them to age-matched controls.

Material & Methods: Children with computed tomography (CT) scans in the absence of surgical intervention were included. CT scans were digitized and manipulated using Surgicase CMF (Materialise). Craniometric data relating to the midface and airway were collected. For all linear measurements, mean percent increases or decreases were calculated relative to the size of controls, and volumetric assessment of the airway was tabulated. Statistical analysis was performed using t test.

Results: Twenty-six CT scans were included (control n=17, Crouzon n=9). All children were in early mixed dentition. The distances between sella-PNS and basion-PNS were reduced 17% (p=0.006) and 26% (p<0.001), respectively, which is consistent with the reduced pharyngeal and hypopharynx airway volume. The pharyngeal airway volume was decreased in patients with Crouzon syndrome relative to controls by 46% (p=0.003). The distance from the posterior tongue to the posterior pharyngeal wall decreased 31% when comparing the Crouzon group versus the control (p=0.04).

Conclusion: Three-dimensional analysis revealed notably decreased pharyngeal and hypopharynx airway volumes in patients with Crouzon syndrome, but nasal bone tissue and soft tissue measurements showed very little change between patients and controls.



Disclosure of Interest: A. J. Forte : None Declared, X. Lu: None Declared, P. Hashim: None Declared, D. Steinbacher Conflict with: KLS and Synthes grants, M. Alperovich: None Declared, J. Persing: None Declared, N. Alonso : None Declared

18-2-122

AN INTERNAL DISTRACTION DEVICE FOR MIDFACE DISTRACTION OSTEOGENESIS: THE NAVID SYSTEM TYPE Z'GOK

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Introduction & Objectives: Midface advancement with distraction osteogenesis is more routinely used for for faciocraniosynostosis. Distraction devices are generally classified into external and internal types. Compared with external distractors, internal distractors are smaller and better tolerated, but their removal is complicated. Here, we introduce a refined internal distraction device and describe its applicability.

Material & Methods: Instead the previous anterior fixation plate by using screw, the refined internal distraction, type Z'gok has three claws. This anterior point of the distractor is positioned behind the malar, or the lateral orbital wall. By using this device, 8 patients with syndromic craniosynostosis underwent midface distraction osteogenesis between 2016 and 2017.

Results: Their operative age ranged from 6 to 21 years. Among them, 4 patients were performed Le Fort III distraction osteogenesis, and the others were performed Le Fort IV distraction osteogenesis. Compared with 12 patients using conventional internal distractors (control group), operative time to remove distractors was 65 ± 18 minutes, and was shorter than 89 ± 12 minutes in control group. The blood loss per weight in Z'gok and control group were 3.6 ± 3.3 ml/kg and 4.7 ± 1.7ml/kg, respectively.

Conclusion: The NAVID system type Z'gok is a reliable and effective internal distractor for midface distraction osteogenesis.

Disclosure of Interest: None Declared

18-2-123

OUTCOMES IN INTERNAL VERSUS EXTERNAL MIDFACE DISTRACTION IN SYNDROMIC CRANIOSYNOSTOSIS: A SYSTEMATIC REVIEW

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[1]Plastic and Reconstructive Surgery, UCLA David Geffen School of Medicine, Los Angeles, [2]Plastic and Reconstructive Surgery, Northwell Health Hofstra School of Medicine, New York, [3]Sociology, Stanford University, Palo Alto, United States

Introduction & Objectives: There are two main methods of distraction osteogenesis for midface advancement in patients with syndromic craniosynostosis: internal and external. The choice is primarily based on the surgeon's discretion and expertise, but research comparing the outcomes of the two techniques is lacking. In this work, we performed a systematic review to compare outcomes of internal versus external midface distraction.

Material & Methods: A systematic review of works published between 1998 and 2018 produced a collection of 61 studies that met inclusion criteria (n=689 patients). Data on operative characteristics, early reoperations, complications, and relapse rates were extracted. Bias evaluation was performed using the Newcastle-Ottawa instrument. Independent samples t-tests and linear regression analyses were performed with $p<0.05$ considered statistically significant.

Results: External distraction was associated with more Le Fort III osteotomies and hardware adjustments ($p=0.023$), whereas internal distraction was associated with more Monobloc osteotomies and longer consolidation times ($p=0.008$). There were no significant differences in the distance of midface advancement, reoperations, complications, or relapse rates between internal and external distraction. However, although insignificant, external distraction trended towards higher relapse rates. Consolidation time was found to be a strong negative predictor for relapse (Beta= -0.792, $p=0.02$) regardless of distraction method.

Conclusion: Method of distraction for midface advancement does not have a significant effect on advancement distance, reoperative rates, complication rates, or relapse rates. There was a strong negative association between consolidation time and relapse rates regardless of the distraction method used. This association could explain the trend towards significantly higher relapse rates seen with external distraction and lower consolidation times. Further work is necessary to evaluate specific aspects of consolidation to elucidate the relationship between consolidation times and relapse rates.

Disclosure of Interest: None Declared

18-2-124

THREE DIMENSIONAL AIRWAY ANALYSIS IN APERT SYNDROME

A. J. Forte [1], X. Lu [2,*], P. Hashim [2], D. Steinbacher [2], M. Alperovich [2], J. Persing [2], N. Alonso [3]

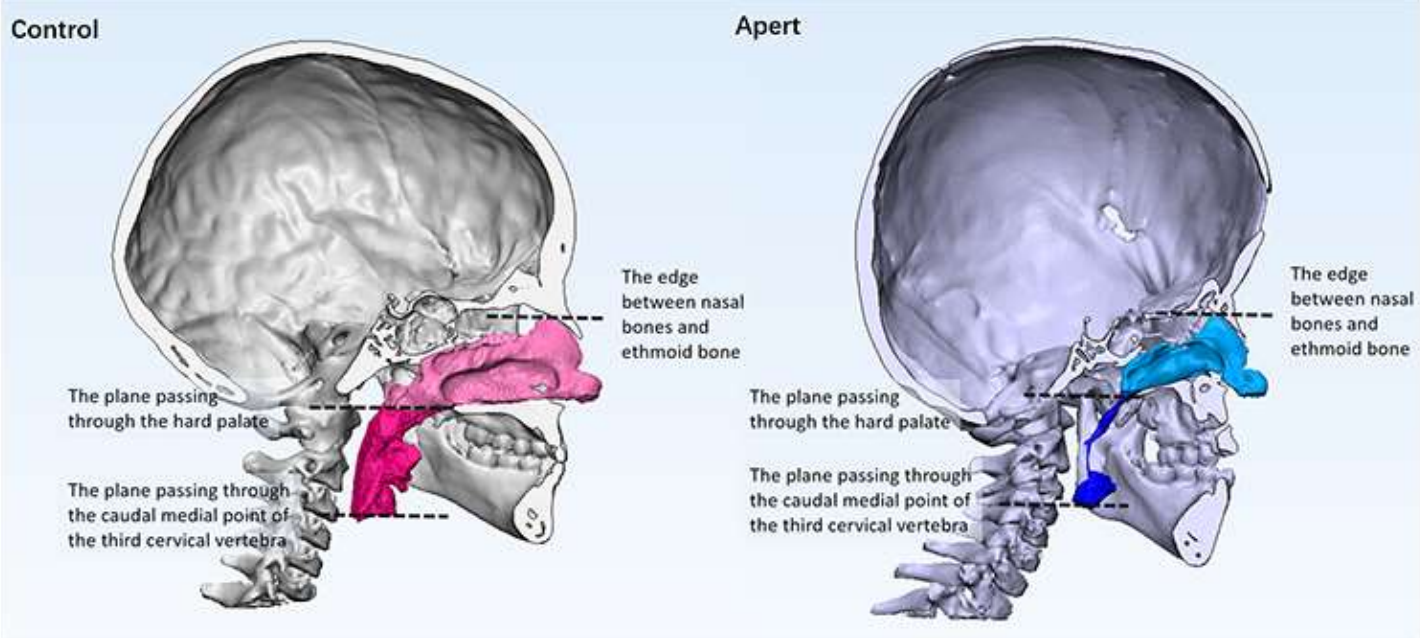
[1] Division of Plastic and Reconstructive Surgery, Mayo Clinic Florida, Jacksonville, Florida, [2]Section of Plastic and Reconstructive Surgery, Yale University School of Medicine, New Haven, Connecticut, United States, [3]Department of Plastic Surgery, University of São Paulo, São Paulo, Brazil

Introduction & Objectives: Apert syndrome is frequently combined with respiratory insufficiency, due to the mid-facial deformity, which, in turn, is influenced by the malformation of the skull base. Respiratory impairment resulting from Apert syndrome is caused by multilevel limitations in airway space. Therefore, this study evaluated the segmented nasopharyngeal and laryngopharyngeal anatomy to clarify subcranial anatomy in children with Apert syndrome and its relevance to clinical management.

Material & Methods: Twenty-seven patients (Apert, n=10; control, n=17) were included. All of the CT scans were obtained from the patients preoperatively, and no patient had confounding disease comorbidity. CT scans were analyzed using Surgicase CMF. Craniometric data relating to the midface, airway, and sub-cranial structures were collected. Statistical significance was determined using t-test analysis.

Results: Although all the nasal measurements were consistent with those of the controls, the distances between nasion-PNS, sphenethmoid-PNS, sella-PNS, and basion-PNS were decreased 20% ($p<0.001$), 23% ($p=0.001$), 29% ($p<0.001$), and 22% ($p<0.001$), respectively. The distances between bilateral gonions and condylions were decreased 17% ($p=0.017$) and 18% ($p=0.004$) respectively. The pharyngeal airway volume was reduced by 40% ($p=0.01$).

Conclusion: The airway compromise seen in patients with Apert syndrome is more attributable to the pharyngeal region than the nasal cavity, with a gradually worsening trend from the anterior to the posterior airway, resulting in a significantly reduced volume in the hypopharynx.



Disclosure of Interest: A. J. Forte : None Declared, X. Lu: None Declared, P. Hashim: None Declared, D. Steinbacher Conflict with: KLS and Synthes grants, M. Alperovich: None Declared, J. Persing: None Declared, N. Alonso : None Declared

18-2-125

POST-EXPANSION CRANIAL SHAPE AND DEFECT HEALING IN SAETHRE CHOTZEN BILATERAL CORONAL SYNOSTOSIS COMPARED TO NON-SYNDROMIC CONTROLS

W. Adidharma [1], C. Purnell [2], M. Calis [2,*], E. Mercan [2], R. A. Hopper [2]

[1]School of Medicine, University of Washington, [2]The Craniofacial Center, Seattle Children's Hospital, Seattle, United States

Introduction & Objectives: Bilateral coronal synostosis (BCS) in Saethre Chotzen syndrome (SCS) is treated with fronto-orbital advancement (FOA). Twist mutations associated with SCS can affect osteogenesis in vitro, but the effect on surgical outcome is unknown. Our theory was that impaired osteogenesis from the Twist mutation would result in less stability and bone defect healing. Our purpose was to compare cranial healing and FOA stability in a series of SCS patients compared to nonsyndromic BCS controls.

Material & Methods: We compared pre-op, immediate post-op, and 2 yr CT scans of patients with SCS (n=9) to age-matched non-syndromic BCS (n=10) undergoing FOA. We quantitated frontal cranial shape (vertical and horizontal bossing ratio, bossing angle, interfrontal divergence angle) using digital landmark morphometics. % cranial defect size change was measured using customized software that warped the immediate post-op and 2 yr scans to a canonical template.

Results: There was no significant difference in anterior and middle cranial vault morphology before and up to two years after surgery between groups. Cranial defect size decreased from 8.6% post-op to 4.2% at 2 yr in the SCS group, and 9.7% to 4.2% in the controls. One SCS patient with an abnormal stop codon Twist sequence was an outlier, healing only 9% of their defect.

Conclusion: Patients with SCS can be counselled to expect similar morphology outcomes and defect healing compared to non-syndromic BCS, but specific Twist mutations may be associated with impaired defect healing and therefore pre-operative genetic testing is still indicated.

Disclosure of Interest: None Declared

18-2-126

SIMULTANEOUS LEFORT II DISTRACTION AND FRONTO-MALAR ADVANCEMENT: CORRECTING SEVERE MIDFACE RETRUSION IN A PATIENT WITH CROUZON'S SYNDROME

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[1]Plastic Surgery, Mater Dei private medical center, Buenos Aires, Argentina

Introduction & Objectives: Craniofacial syndromes present with airway obstruction as a result of mid facial hypoplasia. Classical Lefort III or Monobloc distraction using an external halo is used to treat midface retrusion (1), advancing an abnormal face, to a more normal position. In patients with a severe midface retrusion, in order to achieve differential facial changes, Hopper has proposed in combination with a Lefort III distraction, the use of nasal passenger grafts, cerclage hinges and segmental movements (2).

The aim of this presentation is to show a three year follow up of a patient with Crouzon's Syndrome with severe midface retrusion, who underwent a Lefort II distraction combined with a fronto-malar advancement in order to achieve midface expansion combined with facial ratio normalization.

Material & Methods: We performed photographs and craniofacial TC scans to evaluate the patient's appearance and shape of the cranial base.

Results: We found an important expansion of the middle third of the face with improved facial rations due to differential movement of the bony segments.

Conclusion: Lefort II distraction in combination with fronto-malar advancement is an excellent option for the treatment of patients with severe mid face retrusion. It provides mid facial expansion with a better aesthetic outcome and it remains stable after 3 years.

Disclosure of Interest: None Declared

DAY18 - STATION 3 - CRANIOSYNOSTOSIS/SAGITTAL

18-3-127

SURGICAL PROCEDURES OF NON-SYNDROMIC SAGITTAL CRANIOSYNOSTOSIS BY THE TYPE OF CRANIAL SHAPE

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Introduction & Objectives: Several surgical methods are known for treating sagittal suture synostosis. To choose the proper procedure, careful judgment is necessary for the selection of the modality by considering the patients characteristics, cranial shape, age and so on. We have retrospectively analyzed our cases and divided into four groups by the type of the cranial shape.
Material & Methods: Sixteen patients who underwent operation for sagittal craniosynostosis in our institute between 2010 and 2018 were reviewed for cranial shape, pre- /post- cephalic index (CI) and surgical procedure. We defined the shape of the skull by calculating the ratio of the width of the skull at the level of the coronal suture and the level at the lambdoid suture using a CT scan image. It was defined in four groups. Anterior type≧1.2, central type: 1.1~1.2, posterior type≦1.1 and other cases which CI was over 76 was defined as non-scaphocephalic type.
Results: Pre-CI was 60.8 to 94.4 (mean 72.8) while post-CI was 74.3 to 95.3 (mean 79.5).
Types of cranial shape was divided in 6 cases of anterior type, 3 cases of central type, 3 cases of posterior type, and 4 cases of non-scaphocephalic type.
2 cases of anterior type, 1 case of central type and 3 cases of posterior type underwent modified πprocedure, 4 patients of non-scaphocephalic type underwent fronto-orbital remodeling. 2 cases of anterior type underwent total cranial remodeling and 2 cases of anterior type and 2 of central type underwent distraction and contraction osteogenesis
Conclusion: Sagittal craniosynostosis was divided into two types, scaphocephaly or non-scaphocephaly.
In cases of non-scaphocephaly, it is important that the transverse retro-coronal band is removed rather than aesthetic improvement of the cranial shape. Therefore, we thought that fronto-orbital remodeling the suitable surgical procedure to remove the transverse retro-coronal band.
On the other hands, in cases of scaphocephaly, it is important to improve the cranial shape aesthetically. The surgical procedures of scaphocephaly were largely separated into 2 kinds for the age of patients older than one and a half years old or less than that age.
If the child's age is older, the bone will become harder and it will be difficult to process the bone. So that, we thought that distraction and contraction osteogenesis was adequate for the patients of scaphocephaly more than 1years 6months old. On the contrary, the surgical procedure was chosen according to types of cranial shape for the patients of scaphocephaly less than 1years 6months old.
For anterior type, it was necessary to expand posterior site. In some cases of anterior type, we chose total cranial remodeling because we thought that it was insufficient to expand posterior site by modified πprocedure.

Disclosure of Interest: None Declared

18-3-128

MULTIPLE TONGUE-IN-GROOVE TENONS REMOLDING CRANIOPLASTY IN LATE CORRECTION, MULTISUTURAL AND REVISION CRANIOSYNOSTOSIS SURGERIES

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Introduction & Objectives: There is currently no consensus on the surgical attitude to be adopted for late management of sagittal synostosis, for revision surgeries or for multiple suture synostosis without chiari malformation. Data from the literature shows very variable rate of surgical revision after restenosis or secondary craniosynostosis between surgical teams.

We present here a monocentric retrospective study of patients operated consecutively by a fixed expansion method of the cranial vault which may be associated with a fronto-orbital advancement.

Material & Methods: From 2015 to 2018, we treated 15 children aged 51.4 months (4.3 years) on average.

Patients were treated for late scapholephaly late in 3 cases (20%), for multisutural craniosynostosis or for pansynostosis in 8 cases (53.3%) and finally for craniosynostosis revision (after uni or multisutural synostosis) in 4 cases (26.6%).

The procedure consists in the realization of multiple parietal tongue-in-groove osteotomies fixed by resorbable plates. The macroscopic expansion was custom made depending on the degree of intracranial hypertension, age and sutures that were involved, but did not exceed 1.5 cm of staining which often corresponded to the limit of closure under tension of the scalp. In the case of frontal involvement, fronto-orbital advancement was also performed and fixed.

Results: No intraoperative complication was noted. The average operating time was 118 min. Ten patients (66.7%) had a transfusion during the perioperative period. The average hospital stay was 4.8 days.

With a mean follow-up of 24.6 months, no surgical revision was noted.

In all patients with clinical or ophthalmologic signs of intracranial hypertension, we highlighted a disappearance of signs within 3 months. In all patients with MRI signs of hypertension, the signs were all regressive at the 6-month MRI. No protective helmet has been used.

The craniofacial remodeling was judged very good by the family and the surgical team.

Conclusion: Multiple tongue-in-groove tenons remolding cranioplasty associated or not with a fronto-orbital advancement is a safe technique. It seems to us to be a good alternative to floating or fixed bi-parietal or bi-parieto-frontal cranial flaps because of the very large increase in endocranial volume and the possibility of physiologically and aesthetically remodeling the parietal expansion.

Disclosure of Interest: None Declared

18-3-129

EVALUATION OF SURGICAL OUTCOMES IN SAGITTAL CRANIOSYNOSTOSIS WITH 3D CURVATURE ANALYSIS - OPEN VERSUS ENDOSCOPIC TECHNIQUE

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Introduction & Objectives: The differential efficacy of current array of surgical techniques for sagittal craniosynostosis (CRS) is difficult to assess because of paucity of reliable 3D outcomes measures. A robust computational framework possesses features of automatic image-to-image registration and quantification of entire cranial shape in 3D with a 3D-based shape metric. This computational framework is applied to the evaluation of cranial form outcomes in patients with sagittal CRS undergoing open cranial vault remodeling versus a minimally invasive endoscopic strip craniectomy.

Material & Methods: Surface triangular meshes are derived from 3dMD images acquired from representative sets of patients with diagnosis of sagittal CRS treated with an open cranial vault remodeling operaiton (n = 36) and an endoscopic strip craniectomy (n = 10), with a range of severity. Pre- and post-operative (at least 12-month follow-up) images were analyzed for each patient. Automatic, source-to-target mesh registration is performed. The target and source mesh is then compared utilizing a set of 3D metrics: minimum, maximum, Gaussian, and principal 3D curvatures are computed at each vertex. The curvature at each vertex is then compared between the source and target meshes, with calculation of 3D curvature differnce. Finally, regional and global changes in cranial morphology are represented quantitatively with a **total surface area difference (TSAD)** metric which relates the pre- to post-operative mesh.

Results: The 3D computational framework is a reliable method to evaluate the differences in total cranial morphology across a spectrum of cranial dysmorphology in sagittal CRS patients treated with open versus endoscopic technique. The *global* and *regional* differences in cranial shape between pre-operative and post-operative image sets will be presented. On average, both the minimally invasive, endoscopic technique and open cranial vault technique resulted in a predictable pattern of change in the distribution of 3D curvatures across the cranium. An increase in uniform low-curvature regions which correspond to more evenly round shapes and reduction in high-curvature regions was observed across the surface of the mesh in both groups. On average, a larger shift in 3D curvature between pre-operative and post-operative data sets is observed for the endoscopic group.

Conclusion: This computational framework is able to reliably quantitate 3D shape changes in cranial morphology for patients with sagittal CRS. No substantial 3D shape differences are noted for patients with sagittal CRS treated with endoscopic versus open cranial vault techniques, based on 3D curvature analysis.

Disclosure of Interest: None Declared

18-3-130-N / 19-2-226

DOES VECTOR CORRELATE WITH IMPROVEMENT IN SLEEP APNEA FOLLOWING SYNDROMIC MIDFACE DISTRACTION?

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Introduction & Objectives: Obstructive sleep apnea (OSA) associated with severe syndromic midface hypoplasia can be treated with subcranial distraction. The goal of this study was to compare pre- and postoperative polysomnography with corresponding cephalometric measurements to determine if a specific vector correlated with an improvement in sleep apnea.

Material & Methods: We reviewed 62 subcranial distraction procedures performed by the senior author over a 15-year period. Patients with documented OSA were included. Pre- and postoperative Apnea-Hypopnea Index (AHI), nadir oxygen saturation ($nSaO_2$) and maximum end tidal carbon dioxide ($mEtCO_2$) were compared using Wilcoxon signed rank tests. Pre- and postoperative lateral cephalograms measured midface advancement vectors. Change in AHI was compared to vector magnitude and direction of the subspinale (A-point) using linear regression.

Results: Twenty patients were included (mean age 8 $\pm$ 4 years). Total advancement was 14 $\pm$ 6mm, (13 $\pm$ 6mm horizontal, -0.1 $\pm$ 5mm vertical). After surgery, mean AHI decreased from 33 $\pm$ 31 to 13 $\pm$ 23 ($p < 0.001$), mean $nSaO_2$ increased from 84 $\pm$ 9% to 90 $\pm$ 6% ($p = 0.005$), and mean $mEtCO_2$ did not change (51 $\pm$ 5mmHg to 52 $\pm$ 4mmHg, $p = 0.41$). Ninety-five percent of patients experienced a decrease in AHI after subcranial distraction and 50% had resolution of sleep apnea (AHI < 5). Change in AHI had the strongest linear correlation with the sagittal vector ($r = -0.62$), followed by the total vector ($r = -0.59$), but no correlation with the vertical vector ($r = -0.11$).

Conclusion: Sleep apnea in patients with severe midface hypoplasia improves significantly after subcranial distraction. The amount of midface sagittal advancement strongly correlates with improvement in sleep apnea, while the vertical vector does not.

Disclosure of Interest: None Declared

18-3-131

RADIATION-FREE 3D HEAD SHAPE AND VOLUME EVALUATION AFTER ENDOSCOPICALLY ASSISTED STRIP CRANIECTOMY FOLLOWED BY HELMET THERAPY FOR SCAPHOCEPHALY

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Introduction & Objectives: Post-operative follow-up in craniosynostosis is still mainly relying on radiation techniques or subjective panel evaluation of 2D photos. Radiation-free 3D post-operative sequential follow-up in craniosynostosis is hindered by the lack of consistent markers restricting evaluation to subjective comparison. However, using the computed cranial focal point (CCFP), it is possible to perform correct sequential image superposition and objective evaluation. We used this technique to evaluate the result of endoscopically assisted scaphocephaly surgery, followed by helmet therapy, looking at the mean volume and 3D shape change of the head utilizing 3D photos.
Material & Methods: We performed a mean head 3D shape and volume evaluation on age grouped 3D Photos (n=127) of 36 children that underwent endoscopically assisted scaphocephaly surgery with helmet therapy. We used 3D photos of age grouped children as reference for comparison. We performed a mean 3D shape evolution analysis and calculated both the volume and cephalic index (CI) over time.
Results: The mean volume followed the reference group with deviations at the time of pre-surgery. The mean CI was initially 69.5% and increased to 77.0% at around 9 months from where it declined to between 72-73% from hereon. The 3D head shape showed the highest amount of growth in the parietal area especially in the first few months after surgery.
Conclusion: Using a novel technique we were able to objectively evaluate 3D head shape, volume and CI using stereophotogrammetry after endoscopically assisted scaphocephaly correction followed by helmet therapy. The most prominent 3D shape change was around the surgical site and the CI showed initial increase post-surgery with some decrease over time.

Disclosure of Interest: None Declared

18-3-132

COMPARISON OF PARENTAL SATISFACTION AND OUTCOMES OF STRIP CRANIECTOMY WITH HELMET VERSUS SPRING-MEDIATED REMODELING IN SAGITTAL CRANIOSYNOSTOSIS

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Introduction & Objectives: There is much debate in the literature about the best surgical procedure for correction of sagittal craniosynostosis. We sought to compare two minimal invasive approaches: strip craniectomy with spring-mediated skull remodeling (SMSR) and strip craniectomy with post-operative helmet (SCH). The aim of the study is to improve decision making when choosing a surgical procedure and knowledge of their expected outcomes.

Material & Methods: All SMSR or SCH patients from 07/2010– 08/2018 were retrospectively reviewed for demographics, operative details, and conversion to open cranial vault reconstruction.

A phone survey was administered to parents of children who underwent SMRS or SCH to measure their satisfaction using a Likert scale (four questions).

Results: A total of 61 children were treated for sagittal craniosynostosis by either SMSR (n = 44) or SCH (n = 17). The SCH group had a lower estimated blood loss (EBL) (29.08 mL vs 52.03 mL, p = 0.009) and age at surgery (11.60 weeks vs 18.07 weeks) than the SMSR group. Total anesthesia time was not significantly different between the groups. Three patients underwent early springs removal due to trauma or dislodgement, all of whom converted to helmeting. Mean follow-up time was 30.50 months (n = 12, range 13.03-80.23) in the SCH group and 22.36 months in the SMSR group (n = 36, range 6.23 – 54.86, p = 0.054). Two patients in the SCH group converted to open cranial vault reconstruction. There was no difference in head circumference percentile between the groups at follow-up. Thirty parents were contacted for the satisfaction survey (8 SCH, 22 SMSR). Average satisfaction was 3.86/4.0 in the SCH group and 3.45/4.0 in the SMSR group. No parents in the SCH group would change to SMSR while 13.7% would have changed to SCH in the SMSR group.

Conclusion: In general, complication rates were similar in both groups except for EBL. Also, 3 patients required early springs removal. These results will help better educate parents on the perioperative complications of both procedures and satisfaction outcomes. Further information is needed to determine ideal age at time of surgery for either procedure.

Disclosure of Interest: None Declared

18-3-133

CALVARIAL VAULT RECONSTRUCTION FOR SAGITTAL CRANIOSYNOSTOSIS AFTER 1 YEAR OF AGE

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Introduction & Objectives: The reconstructive goals in sagittal craniosynostosis are to relieve growth restriction, improve both biparietal narrowing and frontooccipital bossing. Techniques have evolved from strip craniectomy to cranial vault reconstruction (CVR). Repair is more challenging in older patients due to thicker bone requiring more extensive remodeling. The aim of our study is to assess the safety and efficacy of open repair in patients over 1 year of age. We then propose an algorithm for treatment based on age at surgery.
Material & Methods: Retrospective chart review was performed of open repairs for nonsyndromic sagittal craniosynostosis between 2004-2016 (N = 170). Inclusion criteria required primary CVR surgery performed after 1 year of age (N = 20). Length of stay (LOS), estimated blood loss (EBL), transfusion rates, operating room (OR) times, cephalic indices (CI), point of maximum width (PMW) and complications were reviewed. Measurements were taken from preoperative and 1-year postoperative 3D reconstructed CT scans.
Results: Patients' mean age (± SD) at surgery was 31 ± 17 months. Of the 20 patients, 7 were treated by barrel staves, 3 by parietal craniotomy, 7 by clamshell and 3 by posterior vault only. As a cohort, OR time was 265 ± 50 minutes; EBL was 328 ± 206 ml; and LOS was 3.8 ± 0.8 days. 85% of patients required intraoperative transfusions while 40% required postoperative transfusions. Pre- and postoperative CI values were 67.8 ± 3.7 and 73.7 ± 4.5, respectively. Within the first 30 postoperative days there were no readmissions, complications, additional surgery, or mortality. Mean pre and postoperative CIs for barrel stave (68.6±4.2, 74.9±5.0), parietal craniotomy (72.5±1.6, 78.1±5.9), clamshell (67.2±2.0, 72.0±2.6) and posterior vault (64.7±2.0, 70.4±3.4) were not different ($p > 0.08$). Postoperative CI for 13 of the 20 patients (65%) remained below normal range ($75 \leq CI \leq 85$). Age at surgery did not have an effect on improvement in CI ($p = 0.55$). Change in PMW for barrel stave (2.4), parietal craniotomy (10.4), clamshell (3.5) and posterior vault (-0.7) were significantly different ($p < 0.001$).
Conclusion: CVR is a safe method to correct sagittal craniosynostosis in older children. However, our series suggest that intervention results in suboptimal correction of CI in majority of these patients regardless of technique. Increasing age of patients did not appear to result in worse outcomes. Endoscopic treatment has been promising for patients between 3-6 months, while open CVR utilizing primarily barrel staving techniques has been successful for 6-12 month olds. Here we show that the PMW is best controlled with more extensive parietal craniotomy in children greater than 12 months old.

Disclosure of Interest: None Declared

18-3-134

MANAGEMENT OF SAGITTAL SYNOSTOSIS IN THE SYNOSTOSIS RESEARCH GROUP (SYNRG)

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Introduction & Objectives: Sagittal synostosis is the most common form of craniosynostosis. The role of imaging and approaches to management are variable. The Synostosis Research Group (SynRG) has prospectively collected data on new cases of sagittal synostosis in order to identify areas for improvement in care.

Material & Methods: All cases of newly diagnosed synostosis from 5 craniofacial centers were prospectively entered in the SynRG database from March 2017 to December 2018. For patients with sagittal synostosis and up to date data, we analyzed presentation, use of imaging, operative techniques and in hospital complications.

Results: 139 children had a clinical diagnosis of sagittal synostosis. Among the 80 treated with strip craniectomy for sagittal (mean age 100 days), 70% had pre-op imaging. Additional fused sutures on imaging included 5 coronal, 4 metopic, 2 lambdoid. Enlarged subarachnoid spaces were seen in 25%. Periop adjuncts were steroids in 49%, arterial lines in 30%, TXA in 15%. Post op 10% went to PICU and 80% wore a postop helmet. Surgical technique varied by center (4.8cm wide craniectomy with parietal wedges;2.5 cm wide craniectomy; 1.0 cm craniectomy with springs; 3.7 cm wide craniectomy with barrel stave cuts). Intraoperative transfusions in 7.5%, 2% patients had dural openings. Narcotics prescribed at discharge in 73% of strips.

Sagittal synostosis was treated by treated by cranial vault surgery in 59 cases at a mean age of 591 days. 95% had pre-op imaging; additional fused sutures were 10 coronal, 12 metopic, 10 lambdoid, 14% had enlarged subarachnoid spaces, 2 had copper beaten skull and 1 had Chiari 1 malformation. Periop adjuncts included TXA in 85%, art line 85%, foley 83%, steroids 80%, doppler 34%, cell saver in 12%, central line 7%; all patients went to PICU. Intraop 73% were transfused and a durotomy occurred in 10%. Postop subdural blood on imaging in 4%. Narcotics prescribed at discharge in 83% of vaults.

Conclusion: Sagittal synostosis was more commonly treated at a younger age by strip craniectomy than cranial vault surgery. Preop imaging revealed additional fused sutures and impacted the clinical diagnosis. Craniectomy methods vary by site. Transfusions were less common with strip craniectomy. Narcotic prescription at discharge is common in both groups. Detailed prospective data collection allows identification of practice patterns and opportunities for improvement in care.

Disclosure of Interest: None Declared

18-3-135

FRONTAL WIDENING AND REMODELING FOR SCAPHOCEPHALIC CHILDREN OLDER THAN ONE

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Introduction & Objectives: Surgical correction for scaphocephaly is recommended before 6 months of age to provide more complete skull remodeling with a better mental outcome. However, in late presenting patients, alternative techniques may be used to adress transverse frontal narrowing and anterior bulge.

Material & Methods: Among a larger group of operated patients, eighteen children aged between 15 months and 6 years were retrospectively evaluated because of sufficent imaging. Mean age at surgery was 28 months and follow up was 23 months (Minimum 1 year and maximum 4 years). The forehead was splitted in two halves and a 1 cm wide strip of bone was fixed in the middle. A bilateral advancement was provided by sagittal split in both lateral aspects of upper orbits. The morphology of the forehead was assessed by two measurements on the imaging before surgery and immediately after in most patients, and 1 year after in 5 patients only because of the limitation of irradiation.

1) The anterior bulging was assessed by the fronto-nasal angle (FNA), corresponding to the angle between the lines tangential to the nasal bone and to the most prominent part of the forehead taking the nasion as the summit.

2) Transverse diameters of the forehead were assessed by ratios of the most transverse width over transverse distance between fronto-zygomatic junctions

Statistical analysis was carried out using Student paired and unpaired t-tests.

Results: In all patients but one a transverse widening and a posterior tilting of the forehead were obtained ($p<0.05$). In one patient, the midline sagittal strip of the forehead consolidated with a midline ridge. The transverse dimension of forehead increased and remained stable at time of follow-up.

Conclusion: It is recommended to adress sagittal synostosis correction before 6 months of age both for functional and aesthetic results. However in patients operated later, after 12 months of age, some forehead remodeling needs to performed in order achieve better esthetic results. The sagittal split of forehead with lateral advancement of both extremities of the bandeau provide a satisfactory reshaping as well as a brain decompression.

Disclosure of Interest: None Declared

DAY18 - STATION 4 - CRANIOSYNOSTOSIS/MISCELLEANOUS

18-4-136

SERIOUS COMPLICATIONS AFTER LE FORT III DISTRACTION OSTEOGENESIS IN SYNDROMIC CRANIOSYNOSTOSIS: EVOLUTION OF PREVENTIVE AND THERAPEUTIC STRATEGIES

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Introduction & Objectives: There is a paucity of studies that report complication rates following a subcranial Le Fort III advancement using distraction osteogenesis. The purpose of this study was to identify and describe serious postoperative complications following Le Fort III advancement with distraction osteogenesis, and provide strategies to assist in the resolution of these complications.

Material & Methods: An observational retrospective study was performed on consecutive patients with Apert, Crouzon, or Pfeiffer syndromes (n=16) who underwent Le Fort III advancement using distraction osteogenesis between 2008 and 2017. Serious complications were defined as frontal bone loss, cerebrospinal fluid leak, meningitis, seizures, or major blood loss (i.e., massive transfusion within the first postoperative day).

Results: Three (18.7%) patients presented serious complications, namely cerebrospinal fluid leak (n=1; 6.2%), seizures (n=1; 6.2%) due to a halo-type device trans-pin intracranial migration, and major blood loss (n=1; 6.2%). Adopting well delineated interventions, all of these complications were resolved without fatality.

Conclusion: A Le Fort III advancement has a significant morbidity rate, with 3 of our patients (18.7%) in this study presenting serious complications. Appropriate management reduced this morbidity, and all complications were resolved without fatality.

Characteristics	Diagnosis			
	Crouzon Syndrome	Apert Syndrome	Pfeiffer Syndrome	All patients
Number of patients	9	5	2	16
Age at surgery (years) M±SD	16.7 ± 7.8	14.4 ± 8.2	18.5 ± 13.4	16.2 ± 8.1
Male/Female (%)	66.7/33.3	60/40	100/0	50/50
Duration of hospital stay (days) M±SD	4.6 ± 1.2	4.8 ± 2.5	4 ± 1.4	4.6 ± 1.6
Device internal/external	7/2	3/2	1/1	11/5
Distraction advancement (mm)	12.1 ± 4.2	11.8 ± 4.5	18	11.9 ± 3.9
Previous operation (yes/no)	1/8	4/1	2/0	7/9
Serious complications				
Frontal bone loss (n*)	0	0	0	0
Cerebrospinal fluid leak (n*)	0	0	1	1
Seisures (n*/n°)	1/1	0/0	0/0	1/1
Blood volume transfused (ml)	516.8 ± 234.1	430.9 ± 294.0	585.6 ± 430.6	477 ± 276.5
Blood transfused (ml/kg)	13.8 ± 9.9	9.8 ± 6.1	18.4 ± 20.7	12.2 ± 8.1
Other complications				
Wound healing complications	0	0	0	0
Local wound infection	0	0	0	0

n.*; number of patients , n°;number of crisis; M, mean; SD, standard deviation; –, not applied. Transfusion was performed to maintain patients with a hemoglobin level equal to or higher than 10 g/dl during the operation.

Disclosure of Interest: None Declared

18-4-137

BENIGN FEVER IS VERY COMMON FOLLOWING TRANSCRANIAL SURGERY FOR CRANIOSYNOSTOSIS: PERSISTENT FEVER IS ASSOCIATED WITH COMPLICATIONS

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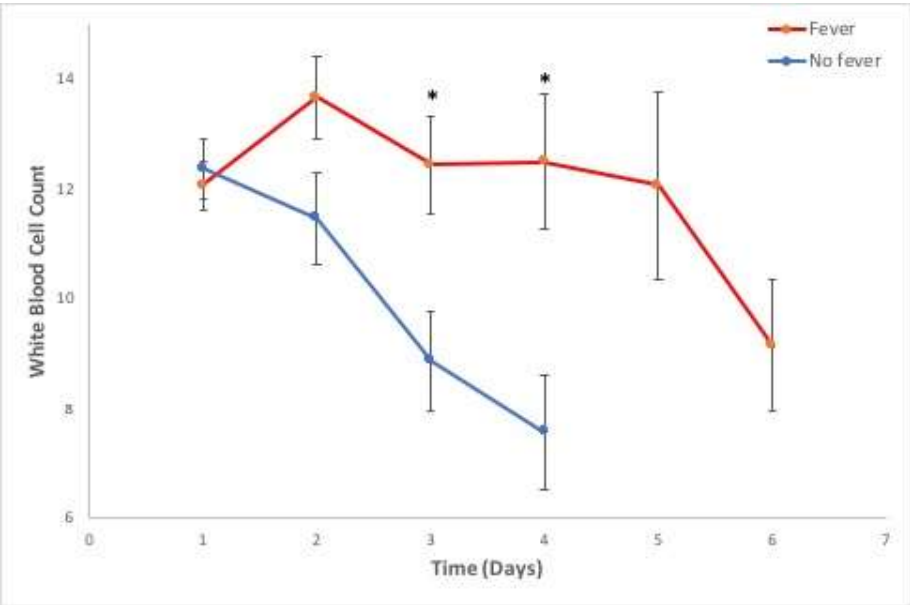
Introduction & Objectives: Fever following transcranial surgery for craniosynostosis is *very common* (90% for patients <24 months of age; 70% for patients >24 months). Postoperative complications, however, are infrequent. Nonetheless, benign postoperative fever often prompts costly diagnostic work-up, increased intensive care unit (ICU) duration, and total hospital duration – all of which drive health care costs.
The objective of this study is to analyze the development of fever relative to patient factors and to determine which factors are associated with surgical complications.
Material & Methods: We present a retrospective analysis of patients who underwent transcranial surgery for craniosynostosis repair (January 2012-December 2016). Procedures included: fronto-orbital advancement, reverse pi vault reconstruction, anterior/middle/posterior vault expansion, and strip craniectomy.
Results: 149 patients were included in the study (mean age= 2.65; range: 0.17 – 20.0 years) with 127 (85.2%) non-syndromic and 22 (14.8%) syndromic patients. A total of 89/149 (59.7%) patients developed a fever (>38°C) in the immediate post-operative period (Day 0- Day 7). The incidence of fever was greatest on post-operative Day 1 (60.7%) and Day 0 (19.1%). Procedure length, procedure type, syndromic diagnosis, quantity of red blood cells transfused, intraoperative dural disruption, use of fibrin sealant, or allograft were not predictive of fever. Those who developed a fever were younger (1.67 vs 3.07 years; p=0.03) and had a longer hospital stay (103.4 vs 84.3 hours; p=0.01). White Blood Cell count elevation correlated with fever on postoperative day 3 and 4 (both p's= 0.01, see Figure) but not with presence of a complication. Complications (mostly respiratory related) occurred in 11 patients and had higher rates of fever compared to those without complication (91% vs 61%; p<0.05) and also more days with fever (mean: 2.55 vs 1.15 days; p=0.01).
Conclusion: Our study corroborates previous studies demonstrating that fever is very common after transcranial surgery for craniosynostosis, especially in younger patients. All but one patient who had a complication had a fever. It is important to identify factors that are associated with postoperative complication. The major finding of this study was that multiple days of fever was the only factor associated with a complication. Thus, surgeons should expect that postoperative fever is very common and should minimize diagnostic tests in the absence of other clinical signs of infection or multiple days of fever. These findings may lead to improved decision making and lower health care costs related to decreasing hospital length of stay and minimizing unnecessary diagnostic tests.



Disclosure of Interest: None Declared

18-4-139

FRONTO-ORBITAL ADVANCEMENT REMODELLING (FOAR) - THE DEVELOPMENT OF AN IMPROVED TECHNIQUE IN MINIMISING BLOOD LOSS OVER 10 YEARS

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Introduction & Objectives: Craniosynostosis is the premature fusion of one or more of the sutures of the skull and occurs in approximately 1:2500 live births. Fronto-orbital advancement remodelling (FOAR), used most commonly to treat metopic and uni/bicoronal craniosynostosis, is extensive surgery with significant risks. The most common of these is blood loss. We describe the development of techniques to minimise blood loss in FOAR surgery over the past decade.
Material & Methods: A retrospective review was undertaken of blood loss in patients undergoing FOAR at Birmingham Children's Hospital 2009-2019. Demographics of patients, indication for surgery, surgical technique, mean blood loss and methods used to minimise blood loss are described. We also draw comparisons to the paper previously published by White *et al*J Craniofac Surg. 2009 Mar;20(2):378-81 in describing the success in development of techniques used to minimise blood loss.
Results: Of the 337 procedures undertaken, indicators for FOAR surgery were metopic and unicoronal craniosynostosis. Over a 10-year period mean blood loss has reduced from 120-130% to around 70% and Units of Packed Red Blood Cells (PRBC) transfused has reduced from 2 (range 1-6) to 1 (range 0-2). The introduction of tranexamic acid (TXA) use, regular auditing, increased attention to blood loss and the use of cell salvage have all resulted in an improvement in blood loss figures.
Conclusion: Over a 10-year period the FOAR surgical pathway at Birmingham Children's Hospital Craniofacial Unit has developed considerably in minimising the perioperative blood loss in paediatric patients. This approach has applications for all paediatric surgery.

Disclosure of Interest: None Declared

18-4-140

THE PATH TO TRANSFUSION FREE CRANIAL VAULT SURGERY THROUGH CONTINUED QUALITY AND SAFETY EVALUATION

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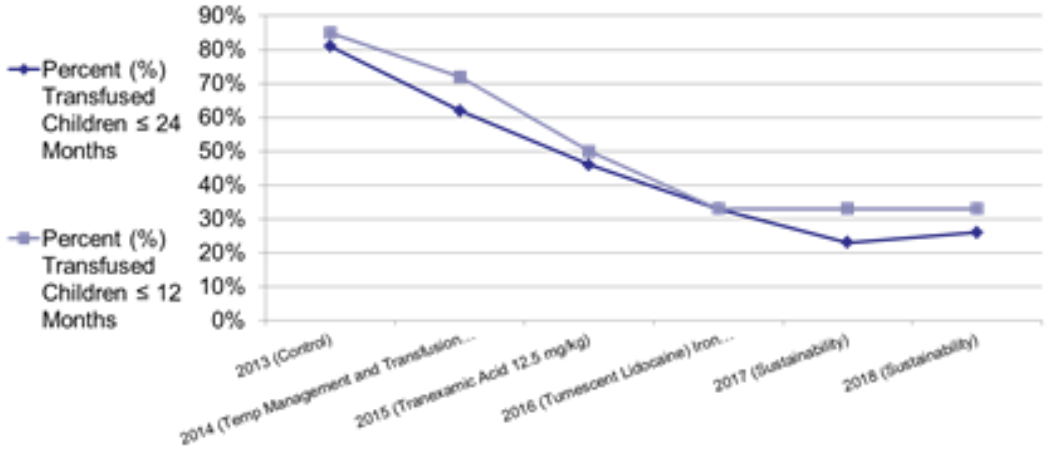
Introduction & Objectives: Craniofacial reconstruction surgery is a high risk surgery associated an average blood loss of 20-150ml/kg resulting in transfusion rates as high as 95 percent. The craniofacial team at Children's Hospital and Medical Center (CHMC) desired to improve the safety profile for children undergoing cranial vault reconstruction by examining diversity of anesthesia practices, use of tranexamic acid (TXA), rates of transfusion of PRBC's, and temperature management.

Material & Methods: Data collection began in 2013. A total of 120 patients had cranial vault reconstruction at CHMC from March 1, 2013 to December 31, 2018. The authors analyzed transfusion rates before and after initiation of a process changes. The effect of TXA was analyzed by exact Fischer test by examining a small, matched cohort of 41 patients.

Results: Patient data from 2013 served as our control group. All patients received small bowl cell saver, which allowed us to salvage small volume losses. With regards to temperature, patients were arriving to the operating room hypothermic, the operating room was cold, and the method of temperature monitoring was inconsistent. The following changes were made: a pre-operative warming protocol, operating room thermometer set at 72-75 C, and a foley catheter with a bladder temperature monitor was placed for consistent management. Also in 2014 a post-operative transfusion protocol was initiated in the ICU setting. If the hemoglobin dropped below 7.0gm/dL and the patient was hemodynamically stable, the intensivist would check with the surgical team prior to transfusing. This protocol, in addition to the changes to decrease hypothermia, decreased the transfusion rates in patients <24 month. In 2015, we began giving patients TXA 12.5 mg/kg IV over 15 minutes before incision. TXA decreased the percentage of patients receiving autologous blood transfusion. In 2016, preoperative iron supplementation was prescribed and intraoperative injection of the tumescent lidocaine was injected 20-30 minutes before incision to facilitate less blood loss with incision. This change resulted in a decrease in transfusion rates.

Conclusion: Low transfusion rates in craniofacial surgery are multifactorial. Our institution is able to offer a reasonable chance at transfusion free cranial vault reconstruction through coordinated efforts and constant evaluation of quality.



Disclosure of Interest: None Declared

18-4-141-N / 19-7-271

TEMPORAL FAT GRAFTING IN CHILDREN WITH CRANIOFACIAL ANOMALIES

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Introduction & Objectives: Children with craniosynostosis frequently require extensive surgical procedures which can result in bitemporal hollowing. At our institution, we utilize simple fat grafting to treat this condition. The goal of this study is to assess the surgical and aesthetic outcomes of fat grafting to the temporal region in children with craniofacial anomalies.

Material & Methods: This was an IRB approved retrospective review of patients who underwent temporal fat grafting at a single tertiary pediatric craniofacial center from 2008 to 2017. Pre- and post-op photographs were evaluated by 3 independent investigators. Pre-op temporal hollowing severity was assessed using a 3-point grading scale (1-mild, 2-moderate and 3-severe). Post-operative outcomes were graded using a 5-point scale (0-no, 1-mild, 2-moderate, 3-significant and 4-complete improvement). Intraclass correlation coefficient (ICC) determined the inter-rater reliability for graded photos. The average improvement score was the dependent variable in a linear regression model to determine factors affecting aesthetic outcomes.

Results: 43 patients met inclusion criteria, 27 (63%) of which were male. 39 (91%) had a history of craniosynostosis. Right temporal fibroscarcoma, temporoparietal cranial defect due to trauma, congenital nasofrontal encephalocele, and craniofacial frontal dysplasia affected 1 (2.3%) patient each. 18 (42%) had associated syndromes.

The mean age at fat grafting was 9.9 years (2.7–20.4, SD-5.5) with a follow-up time of 1.6 years (0–5.8, SD-1.8). Bitemporal fat grafting was performed in 36 (84%) patients and unilateral grafting in 7 (16%) with 7 (16 %) patients undergoing at least one repeat procedure. The average volume of fat grafted was 8.6 ml (0–30, SD-5.9) to the right temporal region, and 8.6 ml (0-30, SD-5.8) to the left with a total of 17 ml (2–32, SD-8.8) per patient.There were no peri-operative complications.

The ICC for the severity and improvement scores of temporal hollowing were 0.842 (95% CI=0.734-0.910, $p<0.001$) and 0.733 (95% CI=0.551–0.849,$p<0.001$), respectively indicating strong correlations. The mean temporal hollowing severity score was 1.8 (range = 1-3, SD = 0.6). The mean improvement score was 2.9 (range=1–4, SD=0.7) demonstrating that most patients experienced moderate to complete improvement. Multiple linear regression analysis demonstrated that syndromic status had a negative impact on the aesthetic outcome ($p < 0.007$).

Conclusion: Findings demonstrate fat grafting is an effective method to treat temporal hollowing in children with craniofacial anomalies with no perioperative complications.

Disclosure of Interest: None Declared

18-4-142

EFFECT OF PARENTAL ENGLISH PROFICIENCY ON PSYCHOSOCIAL FUNCTIONING IN CHILDREN WITH CRANIOFACIAL ANOMALIES

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Introduction & Objectives: Children with craniofacial anomalies (CFA) face a variety of different psychosocial stressors and certain populations within the CFA community are at a higher risk for psychosocial distress. Limited English proficiency is known to cause psychosocial distress in childhood, but has yet to be evaluated within a CFA population. In this study we investigated the potential influence of parental English proficiency on the psychosocial outcomes of children with CFA.

Material & Methods: 246 children with CFA and 50 children without CFA (a comparison group) were prospectively administered the pediatric Patient Reported Outcomes Measurement Information System at two craniofacial institutions to assess anger, anxiety, depression, and peer relationships. The CFA and comparison group were further stratified by parental English proficiency versus limited English proficiency. For the purposes of our study, limited English proficiency was defined as parents who necessitated interpreting services during clinic appointments. Independent t-tests, analyses of variance, and linear regressions were performed to compare groups and identify predictors of psychosocial functioning.

Results: There were no differences in psychosocial functioning between the comparison and CFA groups overall. There were also no differences in the comparison group between parental limited English proficiency and English proficiency. However, CFA children with parental limited English proficiency demonstrated higher anxiety, anger, depression, and lower peer relationships compared to CFA children with English proficient parents. Linear regression analyses demonstrated that parental limited English proficiency status was a significant predictor for anger ($p=0.005$), anxiety ($p=0.002$), depression ($p<0.001$), and poor peer relationships ($p<0.001$).

Conclusion: Children with CFA with parental limited English proficiency demonstrated increased psychosocial distress. Results from this study suggest a need to implement translated and validated measures to identify and assist those who are at an increased risk for poor psychosocial functioning to help improve their overall care.

Disclosure of Interest: None Declared

18-4-143

QUANTITATIVE EVALUATION OF TREATMENT FOR CRANIOSYNOSTOSIS FROM 3D PHOTOGRAPHY

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Introduction & Objectives: Computed tomography (CT) is the standard modality to diagnose and plan the surgical treatment of craniosynostosis, but it is not normally acquired after surgery to avoid unnecessary radiation in children. 3D photography offers non-invasive post-surgical head imaging, but current quantitative methods are affected by subjectivity and inter-observer variability. We present an automatic method to evaluate quantitatively the treatment of patients with craniosynostosis by comparing their post-operative 3D photograph with a pre-operative CT image.

Material & Methods: We collected the pre-operative CT images and post-operative 3D photographs of 14 patients with craniosynostosis. Six patients underwent endoscopic strip craniectomy (age 0.28 ± 1.84 years), two fronto-orbital advancement (age 2.54 ± 1.43 years), and six calvarial reconstruction (age 4.80 ± 3.03 years). The pre-surgical CT image was acquired 13.50 ± 7.77 days before surgery, and the post-surgical 3D photograph 27.17 ± 17.92 days after. We used our automatic image processing algorithms to segment the head shape from both image modalities. We calculated head changes between the times of acquisition of the CT image and 3D photograph. and we estimated the average head expansion and the local volume increase at the area of each cranial bone, which was labeled automatically from the pre-operative CT image. We compared the average head volume increase between the pre-surgical and post-surgical images for the three groups of patients. We also compared the volume increase at the areas of the cranial bones whose growth was restricted before surgery by suture fusion with the rest of the head.

Results: We calculated a volume increase of 17 ± 6%, 12 ± 6 %, and 14 ± 4 % for the patients who underwent endoscopic treatment, fronto-orbital advancement, and total calvarial reconstruction, respectively. Differences between the three groups of patients were not statistically significant, obtaining p-values over 0.36 for pairwise comparisons using a Student's t-test. The volume increase at the areas of the cranial bones whose growth was restricted before surgery by suture fusion was 2.25 times higher than in the rest of the head ($p<0.001$).

Conclusion: Automatic quantitative analysis of 3D photography can quantify the increase of head volume both globally and locally after surgical treatment of craniosynostosis. Our methods provide the tools to evaluate quantitatively and longitudinally the evolution of patients after surgical treatment without any risks, which is essential for a prompt detection of abnormalities or relapses.

Disclosure of Interest: None Declared

18-4-144

TOMOGRAPHIC EXOPHTHALMOMETRY IN PATIENTS UNTIL 3 YEARS OF AGE

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Introduction & Objectives: The relationship between the globe and the orbital rim is determinig for diagnostic, surgical planing and postoperative controls. Otherwise, clinically measurements present multiple and subjective variables, in some cases not allowing consensus for decisions. The objective of this study is evaluating Mulliken´s anthropometric landmarks and employing it in tomographic scans for adults, Posnick landmarks and index were used in pediatric patients.
Material & Methods: Mulliken landmarks were taken and described: superior, inferior and lateral orbital rim, nasion, and corneal apex. The following Posnick landmarks were taken: ocular protrusión grade, axial ocular lenght, oculoorbitary index, transverse diameter of ocular globe, medial rectus diameter, medial interorbitary distance, lateral orbital distance, teleorbitism index, lateral Wall lenght, lateral-medial wall angle, angle between lateral orbital walls, and medial Wall anatomy.
Results: Preliminary results were obtained, 45 tomographic scans were evaluated in patients presenting trauma and soft tissue injuries. Patients were distribuited in age groups: 5 patients newly born, 9 patients from 2 – 12 months, 12 patients from 13 – 24 months, 7 patients from 25 – 36 months, and 12 patients from 37-48 months. Measurements were analysed and standard deviations were obtained for each age group and also were divided by gender.
Conclusion: Exophthalmometric landmarks are difficult to obtain in pediatric patients. For craniofacial anomalies this measurements have great importance for decision making, the findings regarded in this study allow us to have objective landmarks for treatment

Disclosure of Interest: None Declared

18-4-138

GASTRO-OESOPHAGEAL REFLUX, GLUE EAR AND INTRACRANIAL HYPERTENSION: AN INVESTIGATION OF 182 CONSECUTIVE INFANTS IN THE OXFORD CRANIOFACIAL UNIT

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Introduction & Objectives: Gastro-oesophageal reflux (GOR) occurs throughout the day in healthy infants, usually manifesting as regurgitation or vomiting. In craniofacial populations, children are closely monitored for the clinical signs of intracranial hypertension, which may include headache, papilloedema and vomiting. Children's hearing is also closely monitored, as children with craniofacial conditions may be at an increased risk of otitis media with effusion secondary to midface hypoplasia, cleft palate or associated difference in eustachian tube function. Previous research has identified the presence of gastric juice secondary to GOR in the middle ear effusions of children with glue ear (Tasker et al., 2002; Karkos et al., 2004; Luo et al., 2014).

This research investigated the relationship between the presence of GOR, otitis media with effusion and intracranial hypertension in children receiving craniofacial care.

Material & Methods: A one-year retrospective chart review was performed on 182 consecutive cases of infants under one year of age receiving craniofacial care via the Oxford Craniofacial Unit. Feeding history, intracranial hypertension and hearing results were examined in detail.

Results: 182 infants who attended for an initial multi-disciplinary craniofacial assessment were identified. 8% (n=28) children had documented reflux. 38% (n=69) of children had a risk factors for reflux: 35% (n=64) had a history of prematurity, 2% (n=3) had a parental history of heartburn/acid reflux and two children had a diagnosed neurodisability. No child had a history of congenital diaphragmatic hernia, congenital oesophageal atresia, obesity or a hiatus hernia.

Results indicated that 13% (n=23) of infants had hearing loss; 11% (n=20) had evidence of otitis media with effusion. 4% (n=7) of these children had concurrent reflux and otitis media with effusion. Three children presented with abnormal readings on intracranial pressure monitoring, none of whom had documented reflux or hearing loss.

Conclusion: We report the first known investigation into hearing history, reflux and intracranial hypertension in infants receiving craniofacial care. Results do not support the hypothesis of an association between reflux and otitis media with effusion in children with craniofacial conditions. The rates of hearing loss and reflux reinforce the importance of close monitoring of children's hearing and ensuring children's reflux is appropriately managed prior to proceeding to intracranial pressure monitoring.

Disclosure of Interest: None Declared

DAY18 - STATION 5 - IMAGING/PLANNING

18-5-145

THE USE OF 3D PRINTING IN CRANIOSYNOSTOSIS SURGERY

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Introduction & Objectives: The objective of the work was to present modern 3D printing technologies and their use in craniofacial surgery and neurosurgery based on the experience of the Almazov National Medical Research Center (children's neurosurgical department). We used prototypes of craniosynostosis skulls as demonstration models, training models and operational patterns in our study.
Material & Methods: We have produced 28 models of children's skulls with craniosynostosis over the period 2017-2019 years. All 3D models were produced according to computed tomography data and were printed on a professional personal 3D printer using FDM printing technology. All models are divided into 3 groups: operational templates, educational models and demonstration models for parents.
Results: The first group included 15 models of skulls with craniosynostosis of two or more sutures. There were children with verified syndromic forms of craniosynostosis among them: Crouzon, Apert, Tricher-Collin, Kippel-Feil. After printing was completed on the models, osteotomy lines were planned and fixation elements (titanium and biodegradable plates) were fitted. Then the fragments of the drilled model were used intraoperatively as templates for the performed craniotomy. The use of preoperative planning helped to reduce the operating time by 18%. The second group consisted of teaching models for clinical residents and graduate students. 4 models demonstrated the development of deformity with simple craniosynostosis with the involvement of a single cranial suture. 4 models displayed deformations of bicoronal, coronal and sagittal, lambdoid and sagittal, bilambdoid craniosynostosis. 2 models of skulls were also made after the fronto-orbital reconstruction and total cranial vault reconstruction. The third group consisted of 3 models of skulls, that were produced in order to demonstrate to the parents the features of the disease and the intended treatment. These group included patient models with Kippel-Feil syndrome, with sagittal and squamosal craniosynostosis, with bilambdoid and sagittal craniosynostosis.
Conclusion: Prototyping simplifies the work of surgeons in the operating room greatly, allowing them to fully plan in advance all stages of the intervention. Better perception of cranial deformity can significantly affect the functional and aesthetic results of treatment of patients with craniosynostosis. It is also worth noting that the scope of this technology is not limited to the manufacture of templates and mock-ups of surgical intervention. This method opens up new educational opportunities, allowing to effectively convey information to listeners, whether they are clinical residents, medical students or patient's relatives.

Disclosure of Interest: None Declared

18-5-146

PREOPERATIVE SIMULATION AND OPERATIVE FACILITATION OF FRONTO-ORBITAL REMODELING IN CRANIOSYNOSTOSIS USING A NOVEL TEMPLATE

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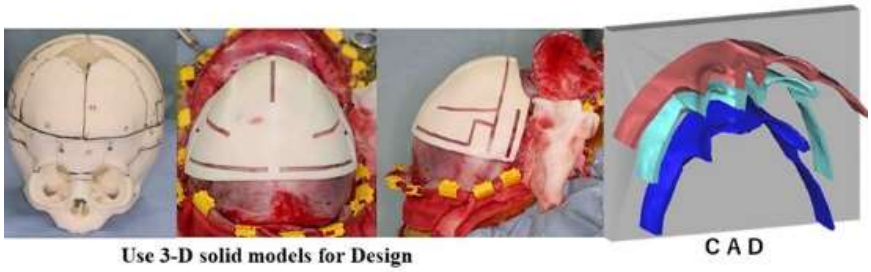
Introduction & Objectives: Preoperative simulation is very important to perform less invasive and more rapid surgery. Recently, many preoperative simulations reports have been published due to improvement of the image inspection unit or the simulation software, and of the three dimensional (3-D) printers which make them real. We also perform preoperative solid model surgery using 3-D printers. We believe that making our simulations more precise will improve the outcomes of our surgeries. Therefore, we have tried preoperative simulations using 3-D planning software to design the templates, and finally a 3-D printer to make the final template. Herein, we examine whether this simulation is as useful and feasible for clinical practice and application as compared to the more costly 3-D printing of many templates for practice.

Material & Methods: The study subjects were patients with trigonocephaly(n=5) and frontal plagiocephaly(n=4), who met the following criteria: firstly, supra-orbital reshaping had been completed; secondly, preoperative and postoperative computed tomography (CT) data were available, and a comparison between both 3-D models had been done. We constructed the template using normative data of the crania, as we usually do (Eur. J. Plast. Surg.14: 80, 1991). Using 3-D CAD, we converted the paper template to a 3-D template using in our planning software, and then we applied the simulation to the actual surgery. Finally, we created solid templates of the successful software versions using in practice as well as in actual surgery.(see Picture) Subsequently, we printed 3-D solid models based on the preoperative simulation data and compared them to postoperative CT data of the actual supra-orbital bars constructed during surgery. We indicate herein the simulation results compared to the actual surgery.

Results: In all cases we studied, the shapes of the supra-orbital reshaping created operatively correlated well with the predictive solid models. The 3-D material models created based on the data from the software closely corresponded to those based on the actual postoperative CT data. Clinical results indicate this simulation technique is quite satisfactory, and a clear improvement over repeated printing of actual 3-D models.

Conclusion: This study demonstrates the validity of template models constructed from appropriate software after extensive testing in a CAD environment. We have concluded that the combination of extensive use of 3-D planning software and printed 3-D material templates is a potentially useful clinical application. We believe creating a few solid templates after appropriate software design and testing for reshaping the supra-orbital bar is useful in clinical applications, offering extensive savings of time and resources.



Use 3-D solid models for Design

Use 3-D solid model template for Reshaping of Fronto-orbital portion

Disclosure of Interest: None Declared

18-5-147

CRANIAL SHAPE COMPARISON FOR AUTOMATED OBJECTIVE 3D CRANIOSYNOSTOSIS SURGERY PLANNING

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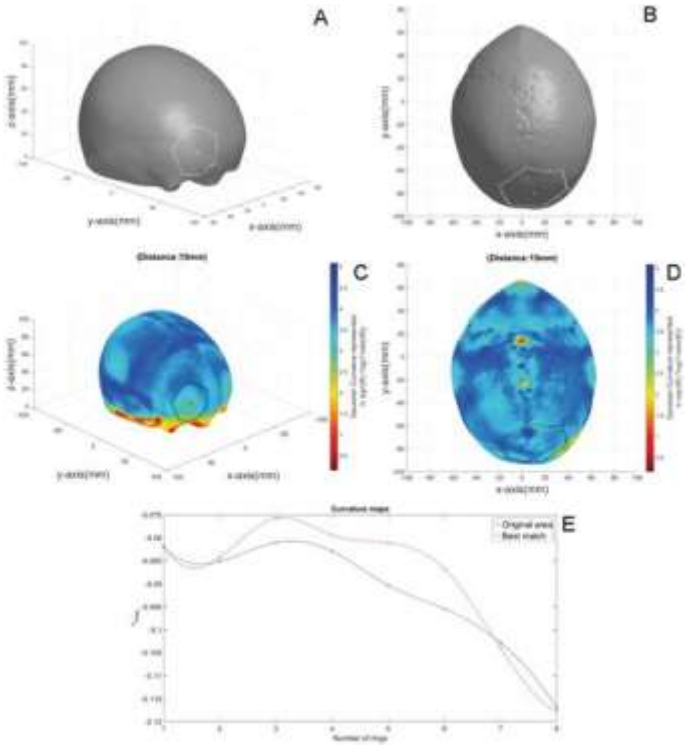
Introduction & Objectives: 3D virtual planning of open cranial vault reconstruction is used to simulate and define an operative plan for craniosynostosis surgery. However, virtual planning techniques are subjective and dependent on the experience and preferences of the surgical team. In order to enable further development of a truly objective automated 3D pre-operative planning technique for open cranial vault reconstructions, we used curvature maps for the shape comparison of the patient's skull with an age-specific normative skull model.

Material & Methods: A normalised skull was created for the age group of 11-14 months. Also, a test object was created and a cranial CT-scan of a 11 months old trigonocephaly patient was selected. Mesh data of skulls were created using marching cubes. All skulls were oriented similarly within the coordinate system and ray casting was used to obtain sampled 3D metrical data of the inner and outer layer of the skulls. Curvature was estimated with quadric surface fitting and curvature maps were computed. The shape comparison was tested for the test object and within the normalised skull. Finally, shape comparison was performed for the trigonocephaly skull with the normalised skull.

Results: Similar shapes were correctly identified and the identification of the area on the patient's skull that maximally corresponded in shape with the reference shape was feasible. See fig 1.: Shape comparison of a trigonocephalic skull with an age-appropriate normative skull: (A) Normative skull. The border of the selected reference area and corresponding centre vertex are marked by the whtite dots. (B) The trigonocepalic skull. The area and corresponding centre vertex that were matched with the reference area is surrounded by white dots. (C) Curvature colour map of the normative skull. The border of the selected reference area and the centre vertex are marked by black dots. (D) Curvature colour map of the trigonocephalic skull. The border of the best matched area and the centre vertex are marked by black dots. (E) Curvature maps of the reference area in blue and the best matched area in red.

Conclusion: It is shown that curvature maps allow the comparison of craniosynostosis skulls with age-appropriate normative skulls. This study showed the first step towards an objective user-independent pre-operative planning technique for open cranial vault reconstructions.



Disclosure of Interest: None Declared

18-5-148

VIRTUAL PLANNING IN LE FORT III DISTRACTION OSTEOGENESIS

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Introduction & Objectives: Mobilisation of the midface by a Le Fort III osteotomy is a keystone intervention in the treatment plan of syndromic hypoplasia of the midface. The introduction of distraction osteogenesis in midface advancement surgery reduced peri- and post-operative morbidity. Only little data is available on technical aids that could improve the surgeon's comfort in the peri-operative period and increase surgical accuracy. The objective of this study is to determine the value of using 3D planning tools and 3D printed cutting guides in Le Fort III osteotomies with external frame distraction osteogenesis.

Material & Methods: The virtual planning is transferred to the operating room using a 3D-printed supra-orbital reference bar. Cutting guides connect to this reference bar with puzzle connections and indicate the planned orbital, nasal, septal and pterygoid osteotomy cuts. Different systems are presented to transfer the vector of distraction and the position of the RED distractor (3D-printed facebow, extended occlusal splint). The accuracy of the planning of the osteotomy cuts, the position of the RED-frame and the distraction vector is validated using a standardized protocol of comparing planned and post-operative DICOM-images.

Results: The process of planning and the transfer of the virtual planning to the operating room is illustrated with 4 cases (2 Crouzon patients, 2 Pfeiffer patients). No adverse effects were encountered. The planned osteotomies and vector of the distraction were accurately transferred to the patient.

Conclusion: Le Fort III distraction osteogenesis with an external RED frame has proven to obtain stable results in young children. 3D planning tools and 3D printed cutting guides help to design the Le Fort III osteotomy and the distraction vector, anticipate possible difficulties and help to avoid adverse events. The transfer of the planned surgery to the operating room has proven to be accurate, using the 3D printed supra-orbital reference bar.

Disclosure of Interest: None Declared

18-5-149-N / S9B-02

USING AUGMENTED REALITY TO REMOTELY TEACH CLEFT SURGERY: BUILDING LONG- TERM INTERNATIONAL CAPACITY AND SUSTAINABILITY

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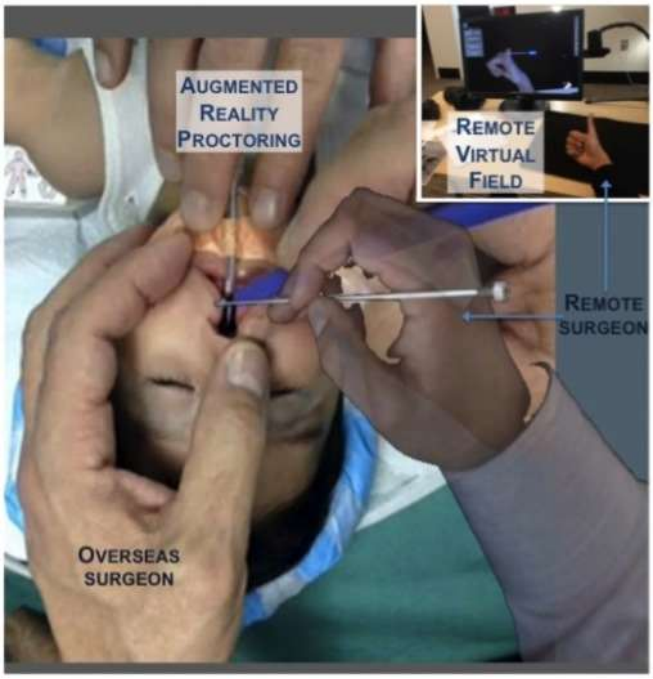
Introduction & Objectives: Building capacity and long-term sustainability for global cleft care requires continued presence. Augmented Reality (AR) is a novel technology that permits a remote yet "hands-on" virtual interactive presence. A 2014 multi-center proof-of-concept investigation demonstrated AR is safe, reliable, and accurate/precise. Here, we investigate AR's efficacy in building capacity/sustainability of comprehensive cleft care at one international center.

Material & Methods: A 12-month AR-based curriculum was designed and approved by the Ministry of Health in Trujillo, Peru. Global Smile Foundation and PROXIMIE, L.L.C. provided logistical/technical partnerships; grant support was provided by CPF and PSF. Three semi-annual site visits engaged Peruvian colleagues in evidence-based didactics, on-site cleft surgery, and familiarization with the AR platform. Each month, AR was used to remotely guide cleft repairs in Trujillo, Peru. Quarterly assessments by Peruvian and U.S. surgeons utilized Lickert Surveys and *VAS* Questionnaires.

Results: Two surgeons were recruited, serving a population of over 3,000,000. Neither had specialized cleft training. Mulliken's technique for unilateral/bilateral nasolabial repair was taught during site visits and remote sessions. Sustained gains in seven areas of cleft care were demonstrated by self-reporting and by assessment of the remote surgeon. Site visits preferentially augmented capacity for anatomic diagnosis, principles of repair, and intra-operative decision-making. Remote sessions preferentially developed capacity for cleft anthropometry, operative anatomy, and operative efficiency. 18 months after completion of AR-based curriculum, no child with cleft lip required transfer to tertiary care center (Lima, Peru) because of diagnosis or severity of cleft lip; 6 patients were transferred for treatment of additional congenital anomalies.

Conclusion: A curriculum combining on-site training and AR-based "hands-on" remote teaching can build sustained capacity of comprehensive cleft care in under-resourced international areas. Specific needs assessments and established partnerships/trust are pre-requisites. We plan to next test the efficacy of an AR-based curriculum in developing sustained international capacity for NasoAlveolar Molding (NAM).



Disclosure of Interest: None Declared

18-5-150-N / 19-7-267

DISCOVERING THE TRUE RESOLUTION OF POSTOPERATIVE SWELLING AFTER RHINOPLASTY USING 3-DIMENSIONAL PHOTOGRAPHIC ASSESSMENT

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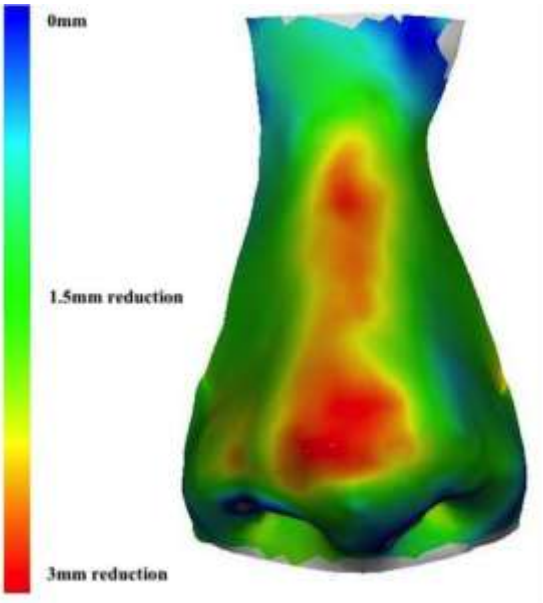
Introduction & Objectives: While prolonged nasal edema is a well-known sequela after rhinoplasty, the anticipated time-to-resolution and anatomical distribution of edema remain largely anecdotal. Nasal swelling obscures the delicate contours and definition of the nose, and it is particularly noticeable in the nasal tip. Edema and lack of definition in the nasal tip may affect patient satisfaction and prolongs the assessment of the final aesthetic result. These changes are of great clinical importance, and thus the following study set out to quantify the dynamics and anatomic distribution of postoperative edema after rhinoplasty.

Material & Methods: Consecutive patients undergoing primary open rhinoplasty in 2018 were included in this study. Retrospective analysis of post operative three-dimensional photographs was performed using Canfield Vectra VAM software. Three dimensional changes to the nose were analyzed for patients who had 3D pictures at either 7 or 14 days post operatively and at 45, 90, 180, and >250 days post operatively (N=18). Three dimensional metrics including volume, anterior-posterior projection, horizontal width. The distribution of edema was calculated as the percent of total nasal volume in the upper two thirds versus the lower third (nasal tip). Topographic color maps and mesh overlays were created for each interval to visualize changes to the nasal contour at post operative intervals.

Results: Maximum nasal volume occurs at 7-14 days post-operatively. The mean volume loss from 7 days post operatively to >250 days post operatively was (2.8+/- .7cc). The distribution of edema changed over time; however, and was consistently greater in the nasal tip than the upper two thirds. The proportion of overall nasal edema was greatest in the nasal tip, and this proportion increased progressively over time. The anterior projection of the nasal tip was greatest at 1 week, while the width was minimum at one week. The projection decreased and width increased progressively from 7 to 90 days, with near resolution at >250 days. The width of the nasal dorsum increased in a similar fashion.

Conclusion: Three-dimensional analysis reveals that nasal tip edema is more prominent, and has prolonged time to resolution, compared to the upper two thirds of the nose after rhinoplasty. Interestingly, the relative distribution of edema in the nasal tip increases over time. In addition, the width of the nasal dorsum and nasal tip increased over time while projection decreased. The behavior of overall nasal edema was comparable to prior published data. This study objectively quantifies the amount and duration of edema in the nasal tip after rhinoplasty that can guide patient and surgeon expectations.



Disclosure of Interest: None Declared

18-5-151

DIAGNOSIS OF CRANIOSYNOSTOSIS: ARE CT SCANS NECESSARY?

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Introduction & Objectives: The risks of cancer and cognitive impairment are important considerations when ordering radiographic studies in children. In many centers, the workup for single-suture craniosynostosis involves a computed tomography (CT) scan, despite data suggesting that routine CT scans may not be necessary.The aim of this study is to investigate the utility of preoperative CT scans in the diagnosis of non-syndromic, single-suture craniosynostosis.

Material & Methods: An IRB-approved retrospective review was performed for children who underwent surgery for craniosynostosis at the Regional craniofacial center for Southern California Kaiser Permanente from 2007 to 2017. At our center, the preoperative assessment protocol of single suture non-syndromic craniosynostosis is based on clinical examination, with imaging studies reserved only for cases where a diagnosis cannot be made clinically. However, some patients already have imaging studies performed prior to presentation, therefore they were removed from the study. The objective data we collected included: the preoperative clinical diagnosis, whether preoperative imaging was obtained, and the correlation of the intraoperative diagnosis.

Results: 130 patients underwent surgery with a median age of 7.1 months. Of those, 99 met the study criteria with a median age of 4.5 months at the first craniofacial visit. Based on initial clinical assessment, single-suture craniosynostosis was diagnosed in 90 (90.9%) patients, whereas in 9 (9.1%) the diagnosis was not clear. Of those with unclear diagnosis, one was diagnosed with sagittal craniosynostosis during a follow-up visit based on clinical assessment and the remaining eight patients were diagnosed using imaging studies. CT scans were obtained in three patients with diagnoses of two unicoronal and one sagittal, and plain X-rays in five patients with two unicoronal, two sagittal and one lambdoid craniosynostosis. The frequency of craniosynostosis type was: sagittal 58 (58.6%), metopic 20 (20.2%), unicoronal 20 (20.2%) and lambdoid 1 (1.0%). In all patients, who received surgical repair based on clinical diagnosis alone, the preoperative diagnosis was confirmed during intraoperative assessment.

Conclusion: Our preoperative assessment protocol demonstrates a 100% success rate as measured by positive correlation with intraoperative assessment, with only 9.1% of patients requiring an imaging study for diagnosis. The results of this study suggest that CT scanning is not necessary for the preoperative evaluation of over 90% of single-suture, non-syndromic craniosynostosis. Given its associated risks, CT scans should be ordered with caution in the management of patients with craniosynostosis.

Disclosure of Interest: None Declared

18-5-152-N / 19-7-269

INTEGRATING 3D-PRINTED MODELS FOR SOFT TISSUE APPLICATIONS IN CRANIOFACIAL SURGERY

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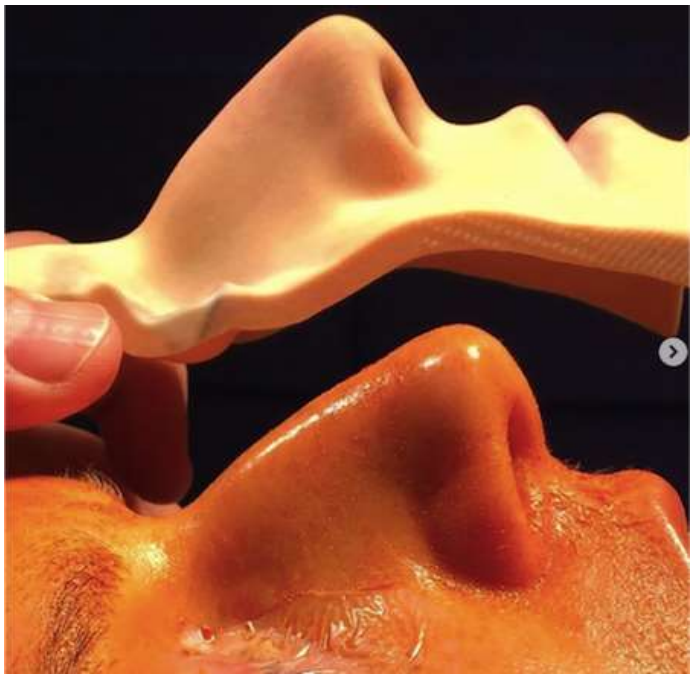
Introduction & Objectives: Three-dimensional (3D) technology, such as patient-specific 3D-printed models and virtual surgical planning, is becoming routine for many craniomaxillofacial procedures. To date, applications of three-dimensional technology focused on planning and executing osseus reconstruction, while soft tissue applications are less established. The following abstracts reports our experience with 3D-printing for soft-tissue applications in craniofacial surgery.

Material & Methods: 3D surgical planning and patient-specific 3D-printed models were applied in craniofacial procedures that alter the overlying soft tissue over a 1-year period (2018-2019). All patients had 3D-printed surface models of their baseline image as well as simulated ideal result that served as an adjunct to standard 2D photographs for reference during surgery. 3D printed contour guides were sterilized and available intra-operatively to fit on the patient and establish the ideal soft tissue contour.

Results: 3D models and guides were applied in 43 cases involving soft tissue changes: rhinoplasty (n=28), facial feminization (n=8), fat grafting (n=7). Baseline 3D printed facial models served as an intraoperative reference and replaced standard 2D photographs in all cases. Virtual surgical planning of the ideal soft tissue contour was performed pre-oepratively in all cases. Intraoperative guides based on theses simulations were printed and sterilized to guide surgical decision-making and assessment of adherence to the surgical plan. In rhinoplasty, nasal dorsum contour guides were used intra-operatively to guide dorsal reduction and tip projection, as well as dorsal width after osteotomy. Patient specific 3D printed nasal splints were placed and used in the postoperative period. Simulation for facial fat grafting calculated the amount and location of fat needed to obtain facial symmetry and pleasing contour. For fat grafting cases, a 3D printed shell of the ideal result was used as a reference in reconstructive cases to correct facial asymmetries.

Conclusion: 3D printing technology is a useful adjunct for soft tissue planning and execution in craniofacial surgery. Applications of this technology extend beyond the current application limited to skeletal elements. 3D printed models based on pre-operative virtual simulation replaced traditional 2D photographic reference, and assisted in creating a surgical plan and establishing aesthetic and reconstructive goals. Patient-specific 3D printed guides were useful intra-operatively to assess the adherence to the surgical plan and establish the target contour. With recent advances that allow for low-cost and seamless 3D surface photographs, we believe 3D printing applications for soft tissue will gain popularity in the coming years.



Disclosure of Interest: None Declared

18-5-153

MORPHOMETRIC ANALYSIS IN CRANIOSYNOSTOSIS RECONSTRUCTION SURGERY BASED ON STRUCTURED LIGHT SCANNING

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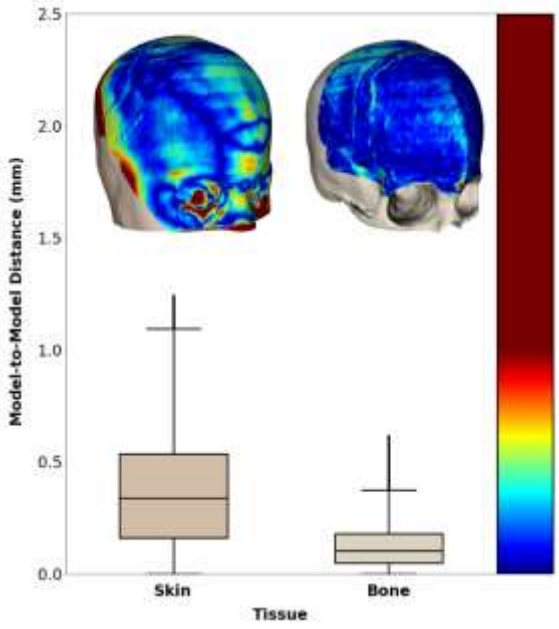
Introduction & Objectives: Surgical correction of craniosynostosis is performed to reshape affected bone and avoid functional impairment. However, there is still no standard and validated methodology for objective quantification of surgical outcomes. Postoperative computed tomography (CT) scans are performed in some centers, but require the exposure to ionizing radiation. In this work we evaluate the accuracy of structured light scanning for intraoperative three-dimensional (3D) modelling of the cranial vault.

Material & Methods: The method was evaluated on two patients suffering from isolated, non-syndromic metopic and coronal cranisynostosis. Surgical correction was performed through fronto-orbital advancement using patient-specific surgical guides and templates. During surgery, cranial vault was scanned using Artec EVA structured light scanner before and after the exposure of the cranium, therefore modelling skin and bone tissue. Preoperative CT scans acquired prior to the surgery were used as a reference for 3D photogrammetry performance evaluation. For the analysis, iterative closest point (ICP) algorithm was used to align the acquired 3D scans with the segmented models obtained from the preoperative CT scans. Once aligned, scanning accuracy was measured as the average absolute model-to-model distance. In addition, total scanning time was also measured.

Results: The average error was 0.37 ± 0.25 mm for skin tissue and 0.13 ± 0.10 mm for bone tissue scans. Scanned bone surface included orbital and frontal areas, which are the regions of the cranium exposed during fronto-orbital advancement. The average scanning duration was 60.17 s and 67.54 s for skin and bone tissue, respectively. Increased duration of bone tissue scanning was caused by the presence of blood on the bone surface which hinders image acquisition.

Conclusion: 3D photogrammetry with a structured light scanner provides an accurate and fast 3D modelling of skin and bone tissue during craniosynostosis surgical correction. This technique does not require the exposure to ionizing radiation or anesthesia, presenting a valuable alternative to CT scans. Therefore, our results show that multiple scans could be performed during surgical reconstruction to accurately compare the actual surgical outcome with preoperative virtual plan.



Disclosure of Interest: None Declared

DAY18 - STATION 6 - HYPERTELORISM

18-6-154

PROTECTION OF MEDIAL CANTHAL LIGAMENT ATTACHMENT DURING CORRECTION OF HYPERTELORISMS

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Introduction & Objectives: Traditionally, the medial canthal ligament attachments (MCLA) are marked and detached to provide a better view for osteotomy during the first stage osteo-correction of hypertelorisms. Then the ligament attachments are reconstructed by wires after bone fixation in the same surgery. While the relapse of the ligament detachment is always observed in follow-up and the attachment would be re-wired again and again because the scar of the ligament might not heal with orbital bone. Since about 3 years ago, the authors' group began to change the classic procedure. The medial canthal ligament attachments were carefully protected during the operation with no separation from bone. In this manuscript we will observe whether there's benefit with this small change.

Material & Methods: A group of 16 cases of hypertelorisms accepted MCLA-protection during the osteo-correction. 6-12 months after the first surgery, a secondary no-tension medial canthoplasty was performed. The follow-up was 12-18 months after the second surgery. The photos and CT data before the first surgery, 6 months after first surgery and 12 months after second surgery were documented.

As a control group, the medical data of 28 cases of hypertelorisms with MCLA-detached were retrospectively analyzed. IOD, HPT, relapse of medial canthus abnormalities and the cosmetic results were compared between these two groups.

Results: No operation related differences are observed between the two groups, including blood loss, operation time, CSF leaking, infection radio and so on.

No significant relapse of IOD are observed in both two groups.

The relapse of HPT can be found in both two groups with no significant discrepancy after the first surgery.

Only 1 relapse of HPT in experimental group is observed after second surgery while in control group there were 15 cases. In control group, 13 cases accepted a third-time medial canthoplasty, in which 5 cases needed more.

Conclusion: MCLA-protection during osteo-correction of hypertelorisms provides a better anatomic foundation for secondary medial canthoplasty. In the new workflow, the secondary medial canthoplasty becomes a soft-tissue-only, no-tension, convenient Z-plasty. No wires is needed. MCLA-protection do not make the operation more difficult, reduces the requirement of followed surgeries and provides better cosmetic results. The authors recommend this tip as a routine procedure in correction of hypertelorisms.

Disclosure of Interest: None Declared

18-6-155

TESSIER NUMBER 3 FACIAL CLEFT: A CASE REPORT OF A NEW METHOD OF REPAIR AND A REVIEW OF LITERATURE OF AVAILABLE TECHNIQUE

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Introduction & Objectives: Tessier 3 is among the rare craniofacial clefts. There are few reported cases in literature with their management. Lack of standardized guidelines and variability of the clinical findings have led the management to a real challenge. In this work, we are describing a new modified technique and reviewing the surgical techniques published in the literature.

Material & Methods: A case report of one-year-old boy presented with right sided Tessier number 3 cleft. Detailed steps of the surgical technique used are presented. Also we reviewed the literature for the previously published techniques for correction of Tessier 3 cleft.

Results: Many techniques have been described in literature as the Z-plasty, rotation and advancement flap of the cheek, other local flaps and less frequently with tissue expansion. Different modifications applied according to the clinical findings in each case. Interestingly, similar techniques with different names were applied by the authors. We tried to unify the nomenclature of the techniques. None of the techniques reviewed included reconstruction of the nasal lining.

Our technique included the use of the inferior turbinate flap for internal nasal lining reconstruction together with dorsal nasal flap in the nasal sidewall for skin reconstruction with upward transposition of the medial canthus and canthopexy. Step by step illustrations of the details of the technique with 8 months follow up. Esthetic outcome was very satisfactory for the parents and surgeons with symmetry and natural results.

Conclusion: Many techniques were described in the literature for the reconstruction of the Tessier number 3 deformity. Knowing the available techniques are important to select the best match of the deformity presented. The nomenclature of the techniques is important to be unified in the literature. Nasal layer reconstruction is important detail for better outcome and should not be ignored.

Disclosure of Interest: None Declared

18-6-156

PAI SYNDROME IN A 4-MONTH-OLD INFANT: RARE LIPOMAS ALONG WITH MIDLINE FACIAL ALVEOLUS CLEFT

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Introduction & Objectives: Pai syndrome is a rare congenital disorder of face and central nerve, with few cases reported worldwide. We present a female infant case of Pai syndrome which had nostril and intraoral lipomas accompanying midline alveolus cleft with review of literature.

Material & Methods: A 2-month old female infant was referred to our department for evaluation and treatment of soft masses in the right nostril and oral cavity. The intraoral mass based in the midline upper alveolar process. Respiration and breast milk feeding were possible. Cerebral MRI showed a subtle high signal intensity lesion near pituitary gland, suggestive of lipoma. After assessment of the growth and the general condition of the infant, we scheduled surgery to excise the mass prior to the infant being weaned from breast milk.

Results: Surgical removal of the lesions was performed at the age of 4 months. Upon excision of nostril and intraoral masses, thin fibrous structure was found connecting the two,as well as a narrow cleft of median hard palate extending to the frontal maxilla. After closure of the surgical wound by direct suturing,healing occured with no complications. Histopathology revealed lipoma for both excised masses. At 8 months postoperatively, no tumor recurrence or malformation of the operated sites was observed.

Conclusion: Although our 4-month-old case did not fulfill the triad Pai symdrome criteria of midline cleft lip,midline facial polyp, and lipoma of the central nervous system, early surgecal management facilitated the transition from breast milk to weaning food. Comprehensive evaluation by pediatricians, neurosurgeons, and orthodontists, with careful surgical planning and follow up for the central nerve lesion and corrective orthodontics are considered necessary cases of Pai syndrome.

Disclosure of Interest: None Declared

18-6-157

A NOVEL PROPOSAL: ALGORITHM FOR THE STRATIFICATION AND TREATMENT OF THE HYPERTELORISM

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Introduction & Objectives: Hypertelorism is a manifestation of several conditions characterized for an increase in the interorbital distance; altough several papers have described those anomalies as well as their treatment options, there is no reference in the literature for a stratification algorithm that involve as many variables as possible such as clinical manifestations, severity, anatomic alterations that if not considered could lead to operative complications or at least impair the final functional an aesthetic result. The objective of this paper is to propose a complete algoritm for the stratification of patiens with hypertelorism and a treatment protocol tailor made for the treatment according to specific characteristics.

Material & Methods: According to the experience of more than 20 years of the craniofacial surgery clinic of our medical service and the protocol designed in the clinic for the treatment of the hypertelorism and comparing the information submitted with adequate level of evidence, we designed an algoritm for the stratification of patiens with hypertelorism considering in the preoperative fase clinical, radiographic and anatomic variables such as: Age, skeletal maturity, dentitition stage, severity, orbital asymmetry, inclination of the horizontal orbitary axis (considering 22.5° as normal), dental occlusion and alterations in the palatine shape, radiologically the position of the crista galli and the etmoidal height, the midface height were determined

Results: Complete treatment algorithm will be presented at lectura, however in general terms for mild cases wiith symmetrical orbits and normal occlusion after 5 years old or adults we recomend the treatment with extracranial procedures as interorbitary osteotomies or partial orbitary osteotomies, in more severe cases with normal orbital axis we recomend intracranial orbital medialization or U inverted osteotomy; in cases with same anatomic features but asymmetric orbits an orbital asymmetric rotation osteotomy is recommended.

In cases with midface shortening, edged occlusion, ogival palate or big, duplicated or abscent crista galli, in mixed dentition or symmetric abnormal orbital axis a facial rotation-bipartition would be suited. Regarding oclussal features, if midface retrusión is present we recomend a facial bipartition with distraction advancementthat, could be combined if necessary with a LeFort I osteotomy if an advance of more than 10 mm is required. Detailed sequence will be given at oral presentation.

Conclusion: This is a usefull algoritm to stratify patients with hypertelorism in order to improve clinical and aesthetic outcomes according to precise clinical, anatiomic and radiological features. We think this approach could assist in the therapeutic decisions of medical teams involved in the treatment of these cases.

Disclosure of Interest: None Declared

18-6-158

TESSIER 9 LATERAL ORBITOCRANIAL CLEFT: A CLINICAL AND RADIOLOGICAL OVERVIEW OF AN UNDERDIAGNOSED ENTITY

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Introduction & Objectives: Tessier 9 Clefts are described as extremely rare in the litterature. We present a series of 9 patients with lateral orbitocranial clefts compatible with the classification proposed by Paul Tessier.

Material & Methods: Clinical photographs and 3D CT images.

Results: 9 patients were identified with a confluence of clinical and radiologic signs compatible with a lateral orbitocranial cleft. In a tertiary referral center, these patients were only slightly less common than the prevaliling Tessier 7 cleft (n=14). Reasons for referral to the craniofacial clinic included meningocele (n=2), abnormal head shape (n=4) and Cutis Aplasia (n=4). Cutaneous features were present in all 9 patients, while osseous changes were seen in 8. Unique cutaneous features such as "butterfly pattern" Cutis Aplasia, "cove" or "atoll" alopecia of the temporal hairline associated with lateral eyebrow notch may suggest the diagnosis. Osseous changes identified by CT scan include absence of the zygomatic process of the frontal bone, supernumerary intraparietal suture, meningocele, as well as partial or total synostosis of the coronal and squamosal sutures.

Conclusion: Patients referred with "Cutis Aplasia" or "Asymmetric head shape" may harbor an underlying osseous anomaly. Such patients present a constellation of singular clinical and radiologic findings. Knowledge of this lateral orbitocranial cleft entity may provide patients and their families more accurate diagnostic and prognostic information.

Disclosure of Interest: None Declared

18-6-160

INNOVATIVE 3-D PRINTED TITANIUM PLATES WITH INTEGRATED POSITIONING CONFIRMATION PROCESS FOR CORRECTION OF VERTICAL ORBITAL DYSTOPIA

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Introduction & Objectives: Our objective is to present a further refinement and application to orbital repositioning. An innovative custom 3D printed titanium plate designed with osteotomy registration provides positioning confirmation as well as fixation. This innovation obviates separate positioning guides and confirms placement.

Material & Methods: A 15 year old boy with vertical orbital dystopia presented for correction. Pre-op CT scan was used to allow for virtual planning And the design of 3D printed titanium plates that not only follow contour but register into the osteotomies. The plan was transferred to the craniofacial skeleton directly in the OR using the BrainLab system. Box osteotomies were completed and mobilized. The custom plates confirmed the corrected positions and provided fixation simultaneously. The frontal sinus was cranialized, transnasal canthopexy was done and pericranial flap was placed. The craniotomy was closed in routine fashion.

Results: Surgery was without complications. No blood transfusions were necessary. A CT scan was obtained on post-op day #1 and he was discharged home on post-op day #2. The post-op scan was compared to the plan. Movements were within 0.44 mm of the plan. Follow-up is over 3 months at the time of this writing.

Conclusion: A simple innovative design takes advantage of our ability to custom design and print our fixation plates. Such a design may allow us to provide improved precision for complex craniofacial reconstructions.

Disclosure of Interest: None Declared

18-6-161

VIRTUAL PLANNING AND DESIGN OF CUTTING AND POSITIONING TEMPLATES FOR FACIAL BIPARTITION: FIRST GLOBAL REPORT

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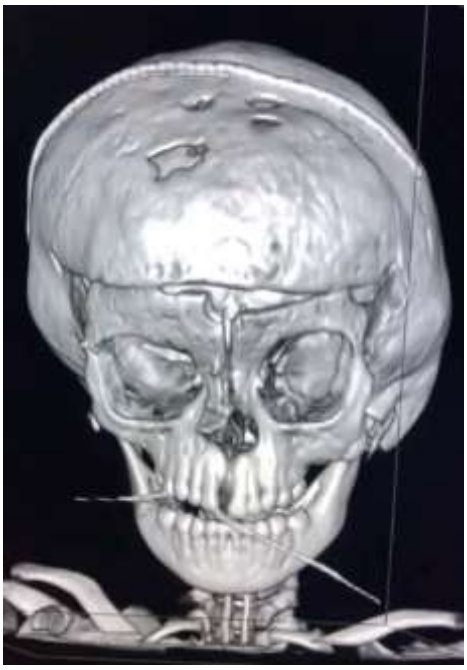
Introduction & Objectives: The purpouse of this paper is to describe the planning sequence, as well as the surgical technique using CAD/CAM designed templantes to complete a facial bipartition with asymmetric rotation of the segments, as our results. It is described the use of cutting templates for the correction of multiple synostosis, scaphocephaly and orbitary osteotomies, nevertheless, for a facial bipartition, wich is our objective.
Material & Methods: The case is of a 3 year old female, with the diagnosis of fronto-nasal dysplasia, with secondary hypertelorism grade 2 of Tessier (34mm), clinically presenting left plagiocephaly, with an intercantal distance of 36mm, alteration of the horizontal orbital axis in the left orbit, primary dentition with anterior open bite and ogival palate. The preoperative protocol is completed with plain cephalometric studies, computed tomography and steriolitography to make renders of the surgery in paper and 3D models; also we made the virtual surgical planning using CAD/CAM, using the program Materialisse of Mimics, and the design of the cutting templates applied to the frontal bar, and the positionating splint for the frontal segment and a occlusal dento-sopported splint. The surgery was performed in the traditional fashion using the cut and position templates with no operative complications.
Results: Our goals: a final interobitary distance of 14mm, with a vertical increase of 8 mm of the midface height, an expected discrepancy of 4mm of the right hemimaxilla to correct the orbital assymetry; to assess the result, a computed tomography was made in the first 24 hours of the posoperative period, with no evidence of cerebral edema or microinfarts, corroborating the surgical objectives reached, we compare the posoperative tomography with the virtual surgery, and the result is exact.
Conclusion: We present a case of success, using CAD/CAM techonolgy, in a facial bipartition with no antecedent in the literature of this tipe of cutting and positionating templates. We propose, the use of the CAD/CAM technology as a new standard for osseous reconstruction of any segment of the facial squeleton, with the refinements for each case and the improvement of the cutting and positioning templates, contour models or implants three-dimensionally designed that this technology can achieve, it is secure and effective for complex osteotomies and it can be reproducible with a correct learning curve achieved. Further, long term studies are necessary to compare the results, improvements and standardization is needed to implement this technology to all the craniofacial procedures.



Disclosure of Interest: None Declared

18-6-162

VARIANT OF FRONTO-ORBITAL ADVANCEMENT BEFORE HYPERTELORISM CORRECTION

G. Paternoster [1 2], H. Khonsari [1 2], S. Haber [1 2,*], J. Britto [1 2], D. Benderbous [1 2], S. James [1 2], E. Vergnaud [1 2], C. Legros [1 2], E. Arnaud [1 2]

[1]French National Reference Center for craniofacial malformations (CRMR CRANIOST- Necker Craniofacial Unit) – Hôpital Necker Enfants Malades, Paris, [2]Clinique Marcel Sembat – Ramsay Générale de Santé, Boulogne-Billancourt, France

Introduction & Objectives: Boxshift osteotomy is commonly used around 4 years of age to correct an hypertelorism when the occlusion is normal. In case of an associated craniosynostosis, Marchac has recommended the initial correction of craniosynostosis before one year of age, and secondarily the boxshift.

Material & Methods: Five children with frontocranionasal dysplasia (a rare condition linked to chromosome X which combines a bicoronal dysostosis and an increase distance between the bony orbits.) were treated in a two stage strategy. All children underwent a fronto orbital advancement before one year of age

In order to prepare the boxshift, a modified cut of the osteotomy is designed at the time of the FOA. In both lateral upper part of the bandeau, a slight triangular shape was integrated, corresponding to the mirror design in the inferior lateral part of the forehead. This modification was carried out with resorbable fixation.

Results: In all patients there was no defect in reossification in the triangular part, allowing for a simpler procedure at the time of boxshift medialization. When the boxshift has been carried out, the Marchac technique of conservation of lateral spurs allow the avoidance of the supraorbital bar, making the procedure simpler.

Conclusion: This variation emphasizes the two stage strategy of treatment in cranio-fronto-nasal dysplasia, :

1) modified FOA before age 1

2) Boxshift osteotomy around 4 years of age (when occlusion is normal)

Disclosure of Interest: None Declared

DAY18 - STATION 7 - ORTHOGNATHIC

18-7-163

ANTERIOR TONGUE MICROGLOSSIA: IMPACT ON FACIAL DEVELOPMENT AND PRESENTATION OF TWO CASES

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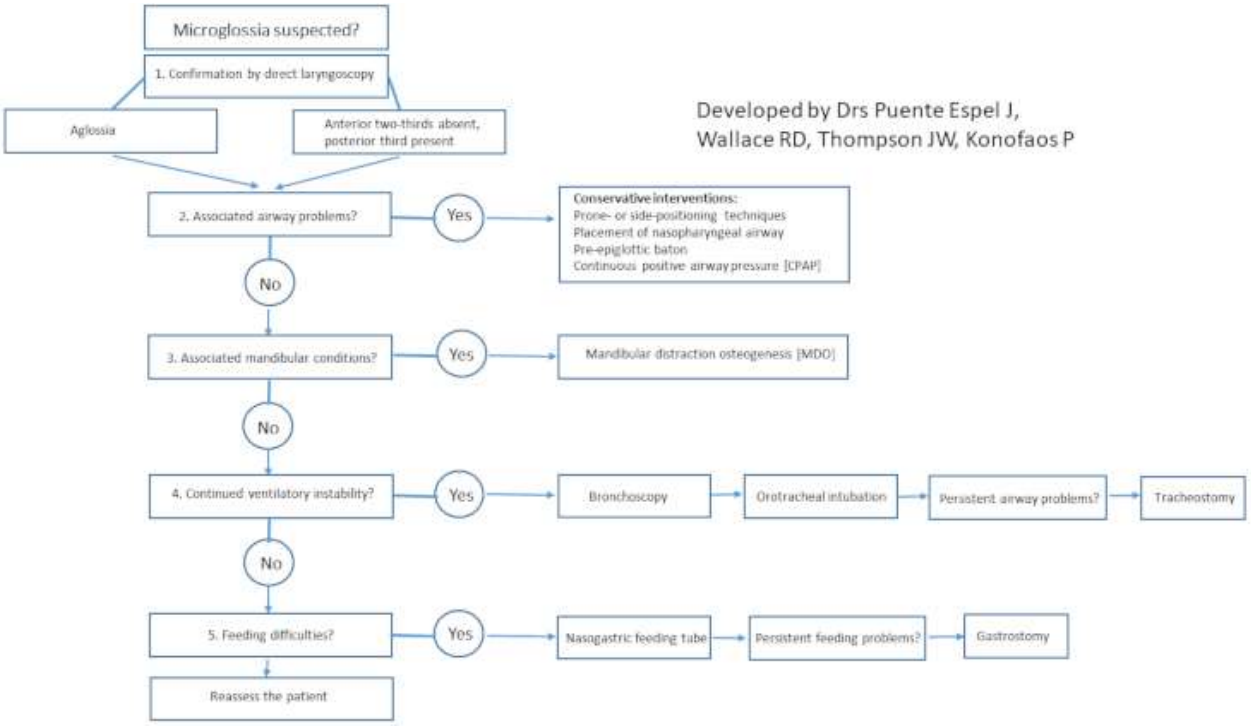
Introduction & Objectives: Microglossia is an extremely rare developmental condition that might impact the patient's respiratory, feeding and speech functions, in addition to other intraoral structures. Embryologically, the tongue has two origins, which when affected, will determine whether the patient has microglossia or aglossia. Currently, there is no consensus regarding a conclusive etiology and an evidence-based management of this condition. The aim is to present two cases, review the available literature and propose a management algorithm.
Material & Methods: A chart review of two patients with microglossia treated at our institution was conducted. The demographic information, clinical and perioperative data were analyzed. In addition, a systematic literature review, of the PubMed and Ovid databases, using the keywords "microglossia," "aglossia" and "tongue abnormalities". Case reports and case series were included.
Results: Two patients with documented microglossia involving the anterior two thirds of the tongue are presented. The first patient underwent mandibular distraction osteogenesis without tracheostomy. The second case (treated many years earlier) was treated with a mandibular graft and tracheostomy. In spite of the failed graft, the patient was successfully decannulated in puberty.
3 case reports and 1 case series of patients with microglossia/aglossia (8 cases in total), and 2 two series of patients with oral (73 cases) and tongue anomalies (2 cases), were included. A management protocol for patients with microglossia based on five steps was developed.
Conclusion: Microglossia, as a condition, needs to be addressed rapidly but in an orderly fashion taking into account the airway (and its potential anomalies), the mandible (searching for deformities), continued ventilatory instability and feeding difficulties. The involvement of multiple factors, the presence of several anatomical anomalies and the growth exerted by patients, confer microglossia a rather dynamic clinical entity.



Disclosure of Interest: None Declared

18-7-164

A 28 YEAR REVIEW OF AIRWAY MANAGEMENT IN TREACHER COLLINS SYNDROME

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Introduction & Objectives: Treacher Collins Syndrome (TCS) is a rare inherited disorder of craniofacial development, characterised by mandibular, zygomatic and maxillary dysplasia. These features predispose patients to difficult intubation and difficult bag mask ventilation (BMV) and may be complicated by palatal and temporomandibular joint abnormalities.

The evidence around airway management in TCS is limited. The literature suggests that it becomes more difficult and airway related complications increase with age. This is important because children with TCS commonly undergo multiple general anaesthetics for staged procedures including mandibular distraction osteogenesis (MDO), to improve their function and cosmetics.

We present the largest documented case series of airway management in TCS and evaluate factors influencing the technical difficulty of airway management, including age, weight and MDO.

Material & Methods: Retrospective review of airway management in patients with TCS undergoing general anaesthesia at Great Ormond Street Hospital between 1990 and 2018. Patients were identified and reviewed utilising the maxillofacial surgical database and electronic patient records. Data was evaluated with Excel® and GraphPad®.

Results: 78 patients underwent 444 general anaesthetics between 1990 and 2018. The median age was 7.1yrs(IQR=3.4–12.4) and weight 21.9kg(IQR=13.9–40).

We identified weakly negative correlations between the technical difficulty of intubation, patient age (-0.19) and weight (-0.31). There was no relationship between ease of BMV and age (p=0.07) or weight (p=0.99). There was no relationship between MDO and altered technical difficulty of BMV (p=1.0) and intubation (p=0.13).

Airways were managed with tracheostomy 41.2%(183/444), endotracheal tube 35.3%(157/444) and laryngeal mask airway (LMA) 20.4%(91/444). 74.9%(158/211) of patients were difficult to intubate (MCML grades ≥3). The most commonly used techniques for intubation were videolaryngoscopy (61.1%), fibreoptic (32.5%) or combined techniques using fibre optic and video laryngoscopy (6.3%). There were 7(1.6%) cases of failed airway management due to difficult ventilation and intubation. These cases were rescued with LMA.

Conclusion: We present the largest documented case series of airway management in Treacher Collins Syndrome(TCS). Our data suggests that the technical difficulty of airway management in TCS may not increase with advanced age (correlation= -0.19) or weight (correlation= -0.31) or change folloing mandibular distraction osteogenesis (p=1.0 and p=0.13), as previously theorised within the literature. We also demonstrate a high incidence of difficult intubation in TCS (74.8% MCML Grading ≥3) uneventfully managed with a variety of techniques with LMA as a rescue in can't intubate or can't ventilate scenarios.

Disclosure of Interest: None Declared

18-7-165

EXPERIENCE WITH A NEW INTERNAL LE FORT I DISTRACTOR – THE TRANS-NASAL DEVICE

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Introduction & Objectives: Le Fort I distraction is indicated in a small subset of patients who have severe maxillary deficiency, often in the skeletally immature patient, when the anticipated magnitude of the bony movement is deemed likely to be unstable using conventional orthognathic surgery. Le Fort 1 advancement by distraction has been performed successfully using both external and internal devices, and is largely dependent on operator preference. The external halo device, while popular among many surgeons for ease of vector control, is objectionable to most patients. The alternative, internal devices, while being inconspicuous, suffer from problems such as vector control, trismus, burying of activation arms in the soft tissues, and bony anatomic limitations. In an effort to alleviate many of the shortcomings with current internal devices, a new internal trans-nasal Le Fort I distractor was designed. It is the aim of this presentation to describe the experience with a new internal trans-nasal Le Fort I distractor.

Material & Methods: After IRB approval, patients with severe maxillary deficiency (at least 8 mm of negative overjet) who were treated with the trans-nasal Le Fort 1 distractor were retrospectively reviewed. Preoperative virtual simulation of the Le Fort I osteotomy and distraction vector was performed. Distractors were bent on a 3D model preoperatively. A 5 day latency period preceded a distraction rate of 1 mm per day. Cephalometric images were evaluated and compared by the same orthodontist at time point zero (preoperative) and 6 months postoperatively, and when available, after one year. Speech outcomes were measured before and at least 6 months after surgery.

Results: Four male patients with bilateral cleft lip and palate (average age 13) underwent the maximum advancement allowed by the device (25 mm). Follow-up averaged 1.5 years. Consolidation averaged 5 months. All patients achieved positive overjet (-9 mm to 2 mm), that was maintained at one year. Average SNA changed from 75.3 degrees preoperatively to 82.4 degrees postoperatively. Average ANB angle changed from -6.9 to 3.7 degrees, or a tendency to Class 2 overcorrection. There was an overall increase in upper anterior facial height by 6 mm. Families reported ease of turning with minimal discomfort reported by patients. Two of the patients developed localized pin site infections after the distraction phase that were treated successfully with oral antibiotics. Two patients with borderline velopharyngeal function preoperatively developed velopharyngeal insufficiency postoperatively that did not resolve after 6 months, necessitating further speech surgery.

Conclusion: The trans-nasal Le Fort I distractor can be an effective device to advance the deficient maxilla, and is well tolerated by patients.

Disclosure of Interest: None Declared

18-7-166

ACCURACY OF CUSTOM PRINTED PLATES FOR 2 JAW ORTHOGNATHIC SURGERY:

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Introduction & Objectives: Computer aided design and VSP have become the gold standard of care for pre-operative planning of orthognathic surgery. Taking the next step advancements in orthognathic surgery, has been the utilization of pre planned, patient specific cutting guides as well as fixation plates. This method has the potential benefit of bypassing intra-operative occlusal splints and facial measurements which could result in inaccuracy. The primary purpose of this study is to compare the post-operative bi-maxillary position accuracy in patients utilizing patient-specific fixation plates. This is the first part of an ongoing investigation to determine the margin of error that is acceptable for post-operative orthodontic correction.

Material & Methods: All patients who underwent bi-maxillary orthognathic surgery in 2017-2018 with at least 6 months follow up were included in the study. Group 1 utilized maxillary pre-printed fixation plates. Group 2 utilized both maxillary and mandibular pre-printed fixation plates. Demographics, pre and post-op 3-D cephalometric measurements were reviewed.

Results: A total of 23 patients met the inclusion criteria. Group 1: 9 patients (4 cleft). Group 2: 14 Patients (6 cleft, 2CFM, 3 previous mandibular distraction). 8 cephalometric landmarks to evaluate the three-dimensional movements of the osteotomy segments including rotational movements of mandible were chosen. The landmarks in mandible included B-point, left mandibular first molar, right mandibular first molar, mandibular midline-incisor and the maxillary landmarks included A-point, left maxillary first molar, right maxillary first molar, and maxillary midline incisor. The ranges of SNA, SNB and ANB angle were analyzed in order to assess the angular change among the study subjects. Mean squared displacement which is a measure of the deviation of the position of a particle with respect to a reference position was calculated. The central tendency of the calculated distances was measured using average equation and the standard deviation of the distances. The results showed the greatest variation among the mandibular landmarks in terms of three-dimensional movements of the fragments. T-Test study compared the average distances group 1 and 2 with right mandibular first molar land mark showing p= 0.03 (significance p val <0.05). Box & Whiskers plots used to show the error distribution in the group 1 and group 2 and to identify the outliers among the study subjects (Fig 1).

Conclusion: Patient specific implants for orthognathic surgery show good accuracy for maxillary movements in all dimensions. Mandibular accuracy varies much more from the predicted positions. Further studies will determine the margin of error that cannot be corrected with post operative orthodontics.

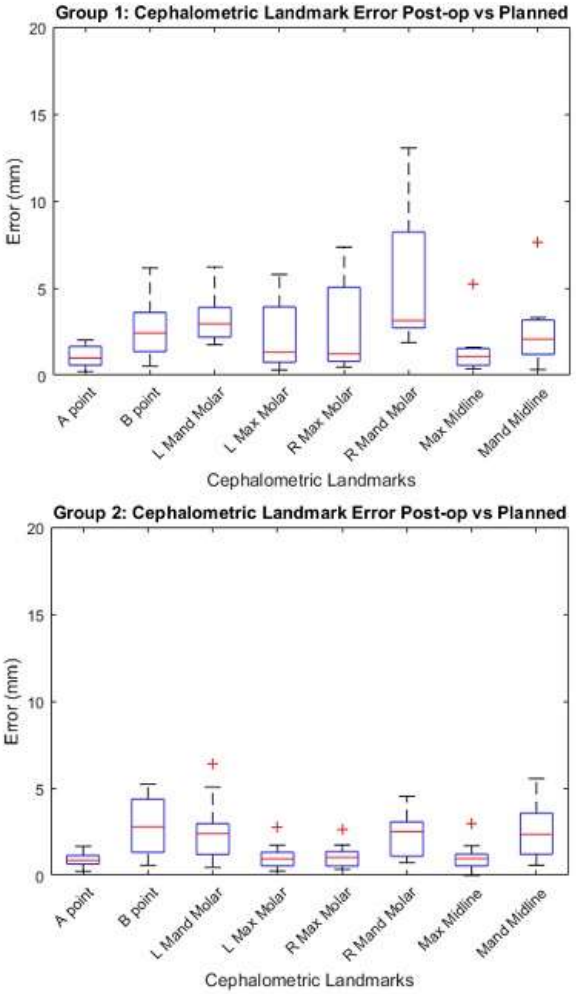

Figure 1: Box & Whiskers Plots of the Group 1 and Group 2 Cephalometric Landmark Error Distribution with Outliers Shown Using Red Plus Sign

Disclosure of Interest: None Declared

18-7-167

THE DENTAL PATHWAY, AND A REVIEW OF THE ORAL HEALTH OF CHILDREN ATTENDING THE NATIONAL PAEDIATRIC CRANIOFACIAL CENTRE IN IRELAND

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Introduction & Objectives: Children with craniofacial conditions are at a high risk of and from dental caries. Despite this high risk, there is limited data in the literature on the oral health of these children.

The objective of this paper is to present the dental pathway of children attending the National Paediatric Craniofacial Centre (NPCC) in Ireland and to review the oral health of a cohort of children over an 18-month timeframe.

Material & Methods: The World Health Organisation examination criteria were used with the inclusion of visual caries. Dental caries was recorded using the dmft index (decayed, missing and filled primary teeth), and a score for oral hygiene. For the purposes of our study, a single, calibrated examiner carried out clinical examination and recorded the dmft score in the dental record of each child.

Results: Children attending the NPCC typically attend the consultant Paediatric Dentist by their first birthday for consultation and planning. Thereafter they are reviewed at the Craniofacial Multidisciplinary Clinic annually. They are also referred to the community services for ongoing review and prevention of dental disease. If dental treatment is required it can be provided in the dental outpatient setting or under general anaesthesia. As part of the pathway children also attend for orthodontic consultation and planning from 6 years of age.

The dmft of 33 children aged between 1 and 8 years was determined. Within this group, the average dmft was 1.2. 75.8% were caries free (dmft = 0), 97% were dentally fit (dt = 0) and the treatment index was 94.7%.

To compare to national values, the same parameters for 5-year olds were evaluated (n = 12). Of this group, the mean dmft for this group was 1.3. 66.7% were caries free, 91.67% were dentally fit and the treatment index was 87.5%. According to the last National Survey in 2002, the dmft of 5-year-olds in the general population was 1.3.

The oral hygiene (OH) of the same group aged between 1 and 8 years was also evaluated. Overall, 27.3% required supplementary OH instruction.

Conclusion: The dental pathway for children attending the NPCC is presented. This pathway has a significant focus on the prevention of dental disease and in ensuring all children receive timely intervention as necessary.

Our review of oral health suggests that although the overall dmft of 5-year-old children in the study was equivalent to children of the same age in the National Survey, the treatment index of the children attending the NPCC far exceeds that of the general population. Furthermore, the proportion of children attending the NPCC who have excellent OH far exceeds those whose oral hygiene requires improvement. It is reassuring to observe that across all age groups studied, a high proportion of the children in our cohort were dentally fit.

Disclosure of Interest: None Declared

18-7-168

VIRTUAL PLANNING SEQUENCE FOR THE TREATMENT OF HEMIHYPERPLASIA

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Introduction & Objectives: Hemihyperplasia (hemihypertrophy) is a developmental disorder characterized by facial asymmetry, the enlarged area may vary from a single digit, a single limb, or unilateral facial enlargement to involvement of half the body. The objective of this study is to present the virtual planning sequence for the treatment of hemihyperplaisa.

Material & Methods: A 35-year-old woman was diagnosed with hemihyperplasia. A step by step treatment sequence was planned using computer assisted simulation technique. In the first step, the skeletal asymmetry was calculated, including enlargement of half mandible in its 3 dimensions, latero-deviation of the mandible to the left side, maxillary and zygoma unilateral hypertrophy, thickening of the orbital lateral wall and inferior edge without any enlargement of the orbital cavity. Maxillary Le Fort I osteotomy for decanting, zygomatic arch reduction and condylectomy, and mandibular sagittal split osteotomy, and trimming of mandibular body were then planned. In the second step, the soft tissue asymmetry was calculated by 3dMD system. A face-lift surgery was designed for facial symmetry.

Results: The maxillary Le Fort I osteotomy and mandibular sagittal split osteotomy were completed by using digital wafers. Zygomatic arch reduction and condylectomy guided by navigation system were also finished at the same time. After one-year follow-up, the result of CT scanning showed good symmetry of skeleton. The soft asymmetry was showed by the stereography in 3dMD system. A face-lift surgery was performed.

Conclusion: The study suggests that Computer-aided virtual planning and navigation are a valuable assistance to improve functional and esthetic results for hemihyperplasia surgery.

Disclosure of Interest: None Declared

18-7-169

ABLEPHARON MACROSTOMIA: LOWER LID RECONSTRUCTION AND A REVIEW OF THE LITERATURE

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Introduction & Objectives: Ablepharon macrostomia syndrome is a rare diagnosis with one of the most devastating features being the absence of eyelids which can result in exposure keratopathy, corneal ulcers and potential blindness. Several methods have been described for eyelid reconstruction. This is the first report of middle lamellar reconstruction with rib cartilage and fat grafting for lower lid support in a patient with ablepharon macrostomia. The purpose of this study is to report a case of ablepharon macrostomia and review the literature on surgical treatment options for eyelid reconstruction.

Material & Methods: A literature review was performed. All English language publications regarding ablepharon macrostomia and surgical treatment options for eyelid reconstruction were included.

Results: Case report: A 9 year-old female with a history of ablepharon macrostomia was referred to the craniofacial team with a chief complaint of bilateral lower lid ectropion causing exposure keratitis and decreased vision. Skin grafts and local flaps had failed to correct her symptoms. She underwent rib cartilage grafting for tarsal plate reconstruction, and fat grafting to her lower lids and cheeks to provide enhanced lower lid support. Nine months post-operatively she reports improved eyelid closure, decreased keratits and improved vision.

Literature review: A total of 11 citations were identified from the literature search. Five articles met our inclusion criteria. The most common technique for eyelid reconstruction is skin grafting followed by local skin flaps. With regards to immediate protection of the cornea, early amniotic membrane grafting over the cornea and suturing the conjunctiva over the cornea in order to prevent exposure have been discribed.

Conclusion: Eyelid reconstruction remains a cornerstone of treating patients with ablepharon macrostomia. To our knowledge this is the only reported case of using rib cartilage grafts for tarsal plate reconstruction and fat grafting for lower lid support in patients with ablepharon macrostomia.

Disclosure of Interest: None Declared

18-7-170

CONGENITAL INFILTRATING LIPOMATOSIS OF THE FACE: STATE OF THE ART AND CASE REPORT

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Introduction & Objectives: Congenital facial lipomatosis corresponds to adipose tissue that infiltrates the facial structures at different depths, usually affecting only one half of the face. It is a rare condition, with approximately only 60 reported cases to date. Given its low incidence there is no treatment guideline consensus. We report two cases in our Hospital with different treatments conducted on each patient.
Material & Methods: The first case is a 2 year old girl, who received initial treatment in another hospital, she presents recurrence and progressive growth of a left cheeck mass. She required two surgical excisions. The second case a 7 month old boy with a rigth cheeck stationary mass, without functional limitations, in whom observation and expectant treatment was decided.
Results: To this date, there have been less than 60 reports of cases with congenital infiltrating facial lipomatosis. Various treatment options are described, from no surgical and surgical managment. The most frequently describes is the surgical reduction of the mass. Nevertheless there is no consensus or treatment guideline.
Conclusion: Congenital facial lipomatosis is a rare condition, with uncertain evolution. It has a unclear etiology, and its treatment is determined by the experience of each Hospital. We present two cases with conservative versus surgical treatment, finding a better result in the latter.

Disclosure of Interest: None Declared

18-7-171

SURGICAL APPROACH OF INFANTILE HEMANGIOMAS OF THE NOSE

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Introduction & Objectives: Infantile hemangioma (IH) is the most common vascular tumour of childhood. When affecting the nasal structures, treatment during active phases is more indicated than simple clinical observation, due to functional problems and the disfiguring potential of the lesion. This study aims to evaluate surgical approach of nasal infantile hemangioma, searching for a standardized treatment.

Material & Methods: A retrospective study was performed and records of 25 patients surgically treated by the senior author between 1999 and 2018 were analyzed. Follow up ranged from 15 to 84 months (mean=44.7). Age at surgery, evolutive phase, location, size, depth, number of procedures and data regarding surgical management were evaluated. Management was dictated by definition of affected units, skin quality, incisions over hidden areas and maintenance of nasal structure.

Results: Age of first intervention ranged from 1 to 11 years old (median= 3). Early intervention included 3 patients on proliferating phase and 9 in involuting phase. Thirteen patients were treated lately, in involuted phase. Number of interventions ranged from 1 to 4 (mean= 1,5). The tip of the nose was the most common location (n=19). More than one affected unit was observed in 16 patients. Diameter of hemangiomas ranged from 10 to 80mm (mean= 30,4mm). Surgical approach by direct excision (transtumoral) was performed in 12 patients and open rhinoplasty incisions were used in 13 patients. Total excision in the first intervention was performed in 10, and 15 patients were initially treated by partial excision. Normal skin was preserved even if in excess. Hemangiomas located at the dorsum and lateral aspect of the nose were approached by direct incision, maintaining the scar on the midline, or on the aesthetic dorsal line of the nose. Open rhinoplasty access, without violation of cartilage, was the preferred option for hemangiomas with a deep component located in the lower third of the nose. After resection, interdomal sutures were performed to reestablish shape and structure of the nose. In patients with skin excess in the supratip area, resection of affected skin was indicated after full nasal development, as well as frontal flap for total nose reconstruction.

Conclusion: The ideal time for surgical indication in nasal hemangioma is still controversial in literature. The benefit of early surgical intervention, even for small lesions, is to reduce the damage caused by proliferation tissue, avoiding damage to nasal cartilage growth. Special care must be directed to skin resection, avoiding iatrogenic deformities caused by insufficient nasal lining.

A. Patient with 3 years old, involuting phase **B.** After first intervention **C.** After second intervention **D.** After full nasal growth, presented with alar retraction and lack of nasal projection **E.** Resection of scarred tissue and frontal flap with structural costal cartilage grafts **F.** 1Y 3 mo post op.

Disclosure of Interest: None Declared

DAY18 - STATION 8 - HEMIFACIAL MICROSOMIA/ROBIN

18-8-172

EFFICACY OF ARTHROPLASTY OF THE TEMPEROMANDIBULAR JOINT AND INSERTION OF A MATTHEWS DISTRACTOR AS TREATMENT FOR ANKYLOSIS OF THE JOINT. A CASE SERIES

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Introduction & Objectives: Temperomandibular Joint (TMJ) ankylosis is a condition in which the bony or fibrous adhesion of the anatomic joint components results in loss of function of the joint. This is particularly distressing and debilitating for the patient, affecting speech, ability to receive adequate nutrition and causing severe facial deformity in many cases. Frequently, these patients struggle to maintain good oral hygiene, resulting in additional pain, oral disease and ultimately, a poor aesthetic profile. Although relatively rare, ankylosis can result from trauma, infection, previous TMJ surgery, congenital deformities or systemic diseases such as rheumatoid arthritis.
Material & Methods: A retrospective chart review was carried out documenting the cases of three patients who attended a single centre (MMUH) for management of ankylosis of the TMJ. Consent for chart review and use of photographs was sought and gained from each of the patients involved. Charts were obtained, records reviewed and each of the cases written up for presentation in a case series.
Results: 3 patients underwent surgery for arthroplasty of the TMJ and insertion of Matthews Distractor devices (2 patients unilateral application, 1 patient bilateral). These patients were then followed up post-operatively. All patients were followed up over the post-operative period and have experienced significant improvements in their vertical mouth opening. These improvements have been maintained to present.
Conclusion: Success at relieving TMJ ankylosis varies by treatment modality. Common surgical approaches have included coronoidectomy, gap arthroplasty, interpositional arthroplasty and low ramus osteotomy. Each of these methods has had a varied amount of success, and no method has been proven consistently superior to the others. Low ramus osteotomy does appear to be an effective surgical intervention.
We describe 3 cases in which, ankylosis of the TMJ was relieved surgically by arthroplasty of the joint and insertion of a Matthews distractor. The Matthews distractor allows movement and physiotherapy post-operatively whilst maintaining the space created surgically. This prevents impingement upon the tissues placed between the glenoid fossa and the mandible, which appears to prevent relapse and further ankylosis of the joint. Very few studies to date have documented the use of the Matthews distractor device following interpositional arthroplasty of the TMJ.

Disclosure of Interest: None Declared

18-8-173

CRANIAL ANCHORED MANDIBLE DISTRACTION OSTEOGENESIS (CAMO)

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Introduction & Objectives: Multiple or large distance mandibular distraction osteogenesis (MDO) in the older child is often complicated by iatrogenic temporomandibular (TMJ) pathology. The transmission of significant force to the TMJ in these particular patients is due to the greater distance of distraction required and the relative inelasticity of the soft tissue envelope. We present a technique of a successful asymmetrically vectored large distance MDO in a 13-year-old female with bilateral craniofacial macrosomia with Goldenhar syndrome.

Material & Methods: A 13-year old African American female with dento-facial deformity secondary to Goldenhar syndrome presented without previous treatment. She experienced significant social barriers along with the development of mild sleep apnea symptoms. The patient's right mandibular ramus and condyle exhibited comparatively greater hypoplasia accompanied by a significant deviation of the chin to the right. She demonstrated unrestricted jaw range of motion with adequate incisal opening. She had a Pruzansky type II mandibular condyle on the right and a type I on the left.

We recommended bilateral asymmetric MDO to correct her mandibular deformity with external offloading of the TMJ to prevent iatrogenic pathology. Intraoperatively, short oblique sagittal split mandibular osteotomies were performed bilaterally, and internal curvilinear mandibular distractors were placed in a standard fashion. Both TMJs were stabilized with a Cranio-Mandibular fixator (KLS Martin). The footplate was secured to the temporal bone through a post-trichial incision and the proximal mandibular segment with Molina Pins (KLS Martin). Distraction was subsequently performed at a rate of 1 mm/day without latency period. Angle's occlusion, facial angle, and evidence of TMJ pathology were assessed.

Results: The left mandible was distracted a total of 14 mm and the right a total of 20 mm over the first 14 and 20 postoperative days, respectively. The patient reported no TMJ pain during distraction and a tolerable amount of tension in the temporal region. Angle's Class 2 malocclusion was intentionally overcorrected to mild Class 3 occlusion. Overjet decreased from 11.53 to -3.65 mm. Facial angle improved from 81 to 85 degrees. The device was removed uneventfully after a 3-month consolidation period. There was no evidence of TMJ pathology postoperatively on physical exam or imaging.

Conclusion: Cranial Anchored Mandible Distraction Osteogenesis (CAMO) allows for successful large distance MDO in older patients without iatrogenic TMJ pathology and less pain during distraction. Further research and clinical trials, which we are performing, need to be performed in order to determine this technique's ultimate utility as it relates to the treatment of micrognathia and the asymmetric mandible.

Disclosure of Interest: None Declared

18-8-174

LIMITATIONS OF DISTRACTION - A CHANCE FOR RECONSTRUCTION

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Introduction & Objectives: In patients with craniofacial microsomia and Treacher Collins syndrome, mandibular and maxillary osteotomies in combination with distraction osteogenesis can lead to satisfactory results in mild to moderate cases. However in severe cases, these traditional techniques are often insufficient to normalise skeletal proportions. In addition the soft tissue deficiency makes the malformation even more apparent.

Material & Methods: We present two patients with hemifacial microsomia type III, who underwent as first stage bimaxillary osteotomy and mandibular reconstruction with a microvascular iliac crest free flap. In one patient a temporomandibular joint prostheses was inserted. As second stage the soft tissue deficiency was corrected by microvascular SIEA / DIEP flap.

In addition we present one patient with severe Treacher Collins syndrome who underwent tracheostomy after birth because of the severe midface and mandibular hypoplasia and choanal atresia. To restore TMJ function and to enable mandibular growth, bilateral reconstruction was performed with a microvascular metatarsophalangeal joint II transfer of the respective side. Subsequently the patient underwent mandibular and midface distraction with external distractors and repair of the choanal atresia. The patient could be decannulated and feeding could be trained from gastrostomy to oral feeding.

Results: In the presented two cases of hemifacial microsomia, normalisation of the skeletal proportions could be achieved by orthognatic surgery and bony mandibular reconstruction. Restoration of facial symmetry was only possible by a combination with microvascular soft tissue reconstruction.

In the severe case of Treacher Collins syndrome, the mandibular support and stability achieved by the bilateral microvascular joint transfer established a basis for the later distraction. The airway could be enlarged sufficiently to enable decannulation.

Conclusion: The presented cases illustrate, that reconstructive surgery adds valuable possibilities for the treatment of severe craniofacial deformities. Aesthetic and functional outcomes can improve considerably by the right combination of techniques.

Disclosure of Interest: None Declared

18-8-175

ERROR ANALYSIS OF A SURGERY SIMULANTION SYSTEM FOR UNIDIRECTIONAL MANDIBULAR DISTRACTION OSTEOGENESIS

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Introduction & Objectives: Distraction osteogenesis has become an important treatment in the management of patients with hemifacial microsomia since it was introduced in 1992. A surgical planning software enables surgeons to do a virtual osteotomy and distraction simulation before surgery. The preoperative virtual planning provides valuable information, such as the site of the osteotomy, distance to be distracted, and position of the distractor. However, in clinical practice, the outcome does not often replicate the simulations. Our aim was to investigate the errors of the simulation system using reverse derive method.

Material & Methods: Five patients with unilateral mandibular micrognathia were involved and studied on computed tomographic (CT) scans taken at 2 time intervals: at the end of the latent period, and at the end of consolidation. Virtual osteotomy plane and distractorwere manipulated in software to match the actual position of the osteotomy plane and distractor at the end of the latent period. Actual distraction distance was measured at the end of consolidation. The mandibular distraction osteogeneisis simulation was performed according the actual distraction distance using ProPlan CMF 3.0 (Materialise, Leuven, Belgium). The superimposition of the simulation model and the actual model at the end of the latency period was performed according to cranium. Selected landmarks, such as the actual genion (Gn), simulated genion (Gn*) and upper first molar's mesial buccla tip (U6), were defined on the 3-dimensional model, and we measured the distancebetween genion to midsagittal plane(Gn to SP; Gn* to SP), distance between upper first molar to actual and simulated lower occlusion plane(U6 to LOP; U6 to LOP*) and angle between actual and simulated lower occlusion plane (LOP to LOP*) .

Results: The mean distance between genion to midsagittal plane is 2.19±1.36mm(Gn to SP) and 6.21±0.8mm(Gn* to SP). The mean distance between upper first molar to actual and simulated lower occlusion plane is 3.68±1.24mm(U6 to LOP) and 13.84±1.75mm(U6 to LOP*). There was a significant difference between the simulated and actual groups ($p < 0.001$). The mean angle between actual and simulated lower occlusion plane is 7.7±5.5°(LOP to LOP*) .

Conclusion: This study indicates that the unidirectional mandibular distraction simulation system dose not coincide the actual outcome. The actual movement of mandibular fragments during distraction osteogenesis is complex. The path of movement of the bone is affected by many factors, including stretching of the masticatory muscle and changes in the rotation point.

Disclosure of Interest: None Declared

18-8-176

MAXILLOFACIAL DEFORMATION IN CONTRALATERAL CONTROL SIDE IN HEMIFACIAL MICROSOMIA

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Introduction & Objectives: The purpose of this study was to test the hypothesis that not only the affected side but also contralateral control side were deformed in patients with Hemifacial microsomia (HFM).

Material & Methods: Eight patients were classified as Pruzansky / Kaban classification type I, IIA, or IIB HFM. Cephalograms and CT scan were taken prior to orthodontic/surgical treatment, and maxillofacial morphology were measured in two-dimension in each face (right side face/left side face). Middle/lower/posterior facial height, Orbital position and nasomaxillary height were evaluated and compared affected side and contralateral control side. And those data were compared with three-dimensional images.

Results: Orbital position in affected side were higher than that of contralateral control side. Lower facial height in type I were short while type IIA and IIB were long. Posterior facial height in most cases (7 in 8 cases) were short in affected side. Nasomaxillary height were shorter on the affected side in all eight HFM patients regardless of the severity of the HFM. Moreover, nasomaxillary region in contralateral control side were vertically elongated while in affected side were depressed except microgenia cases.

Conclusion: Our previous report showed the three-dimensional deformity; the control-affected differences in cranial / nasomaxillary / mandibular region. However, there were no standard value in three-dimensional to evaluate their size for setting the treatment goal, and those were evaluated based on orbitomeatal plane. In this study, we asked each patients to stand with natural standing position when we took cephalogram. With this cephalogram, we could evaluate clinical maxillofacial characteristics and could set the goal of their orthodontic/surgical treatment in proportion to patient's natural standing position. Practically, nasomaxillary region in contralateral control side were vertically elongated. It mean that contralateral control side were also deformed and were not so-called "control" side at all in HFM. CT scan data were also useful for evaluating volumetric soft/hard tissues while cephalogram not. Cephalogram (2D) data could return profits to the CT scan (3D) data for setting multilateral orthodontic/surgical treatment goal in HFM.

Disclosure of Interest: None Declared

18-8-177-N / S7B-09

SURGICAL CORRECTION OF SEVERE MANDIBULAR HYPOPLASIA IN HEMIFACIAL MICROSOMIA AT THE AUSTRALIAN CRANIOFACIAL UNIT

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Introduction & Objectives: Repair of the severe mandibular deformity in hemifacial microsomia (HFM) remains a challenge and there is limited information in the literature regarding long term outcomes. The aim of this study was to evaluate long-term outcomes following mandibular surgery in patients with severe HFM treated at the Australian Craniofacial Unit.

Material & Methods: Twenty six patients with severe mandibular hypoplasia (SAT 3+/Pruzansky-Kaban classification: IIB/III) were included in this retrospective study. Ten patients underwent treatment using a costochondral graft (CCG) and the remainder underwent free Deep Circumflex Iliac Artery (DCIA) flap. Architectural and aesthetic parameters were evaluated preoperatively, postoperatively, and at the end of the follow-up period.

Results: Overall results showed significant improvement of occlusal cant, commissural line tilt and chin deviation for all patients at end of follow up period. Within the CCG cohort, two patients had infection followed by resorption and/or ankyloses requiring repeat CCG. Two patients had overgrowth of their graft requiring genioplasty at growth completion. Four patients had undergrowth and persisting occlusant cant requiring orthognathic surgery for correction. Within the free flap cohort, no further revisions were required to address skeletal status. Three patients had further surgery involving debulking of the free flap.

Conclusion: Hemifacial microsomia continues to be a challenging disorder to treat. The use of costochondral grafts remains a useful technique in the severe mandibular deformity. Despite this, there is unpredictable growth pattern, high complication rates and high likelihood of needing revision surgery. Secondary surgery should ideally be performed at time of growth completion. Free tissue transfer is an excellent option for patients with severe mandibular deformities presenting at maturity.

Disclosure of Interest: None Declared

18-8-178

PROSPECTIVE RANDOMIZED CONTROLLED CLINICAL TRIAL FOR THE TREATMENT OF MASSETER HYPOPLASIA IN HEMIFACIAL MICROSOMIA

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Introduction & Objectives: To make a prospective study for masseter hypoplasia patients of Hemifacial Microsomia (HFM), observe the neuromuscular electrical stimulation (NMES) effect in clinical and optimize the treating parameters.

Material & Methods: 12 HFM patients treated in Shanghai Ninth People's Hospital were included and divided randomly in two groups. 6 children in the experimental group (Group A) were treated with 30 minutes of NMES per day, 5 days per week. Another 6 patients in contract control group (Group B) did muscle exercises actively. Quantitative analysis was taken before and 6 weeks after the intervention. Asymmetry index of the average potential (AIAP) was the primary outcome parameter recorded the EMG data calculated by (unaffected- affected)/ (unaffected + affected) *2.

Results: In resting condition, AIAP is 49.54% before the intervention, 36.89% after the intervention in Group A; 40.58%, 31.11% in Group B respectively. In contracting condition, AIAP is 98.77%, 37.32% in Group A; 83.58%, 54.86% in Group B respectively. The AIAP was reduced after the NMES compared to baseline, with a significant increase in the activity of the masseter muscle in the affected side.

Conclusion: Neuromuscular electrical stimulation is a safe intervention. NMES has a positive effect on HFM patients with masseter hypoplasia.

Disclosure of Interest: None Declared

18-8-179

CURRENT TRENDS IN SURGICAL AIRWAY MANAGEMENT OF NEONATES WITH ROBIN SEQUENCE

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Introduction & Objectives: Robin sequence is defined by the clinical triad of micrognathia, glossoptosis, and upper airway obstruction, and is frequently associated with cleft palate and failure to thrive. Though the efficacy of certain surgical interventions to relieve airway obstruction has been well established, algorithms dictating decision making and perioperative protocols are poorly defined.

Material & Methods: A 22-question survey was sent via e-mail to members of the American Cleft Palate-Craniofacial Association and International Society of Craniofacial Surgeons. Questions were related to surgeon experience in treating neonates with Robin sequence, and specific perioperative protocols.

Results: One hundred fifty-one responses were collected. Most respondents were surgeons practicing in North America (82.8%), in a university hospital setting (81.5%) and had completed a fellowship in pediatric plastic surgery or craniofacial surgery (76.2%). Preoperative protocols varied widely by years in training and location of practice. Although 78.8% of respondents always performed direct laryngoscopy, only 49.7% of respondents routinely obtained preoperative polysomnography. Mandibular distraction osteogenesis was the most common primary surgical airway intervention reported by 74.2%, with only 12.6% primarily utilizing tongue-lip adhesion. Slightly less than half of respondents ever performed tongue-lip adhesion. Operative selection was influenced by surgeon experience, with 80% of those in practice 0–5 years primarily utilizing mandibular distraction, compared with 56% of respondents in practice >15 years.

Conclusion: This study documents wide variations in preoperative, operative, and postoperative protocols for the surgical airway management of neonates with severe Robin sequence. These results underscore the need to acquire more objective data, to compare different protocols and outcome measures.

Disclosure of Interest: None Declared

18-8-180

ORTHODONTIC ELASTIC TRACTION(ET) ASSISTED THE HEMIFACIAL MICROSOMIA (HFM) TREATMENT DURING ACTIVATION PERIOD OF DISTRACTION OSTEOGENESIS(DO) FOR HFM

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Introduction & Objectives: To evaluate the elastic tractor's treatment effect for HFM during distraction osteogenesis.

Material & Methods: All patients were used the same model of ET(KaVo Kerr, Germany) ; Mimics software (3D image measurement software) was used to calculate and measure the facial asymmetry. The 3D image was based on the CT image, all those CT image were from Department of Radiology, Shanghai Ninth People's Hospital. And used AutoCAD, PATRAN, NASTRAN softwares to study the stress distribution and displacement of different distract directions on mandibular corpus by finite element method. Experiment group' patients received orthodontic elastic traction during early phase of activation period of DO and the controlling group's patients received routing orthodontic treatment. All patients's received CT test at first visit, DO retractor was stopped to activate (1 month after DO surgery), six months after removal of tractor surgery.

Results: length change rate of mandibular in vertical direction from base line to one month after the DO surgery is 0.824±0.146 in experiment group and 0.6875±0.235 in controlling group, P=0.005. There was significant statistic difference. Distance of lower dental midline to sagittal plane at one month after DO surgery is 2.485±1.411 in experiment group and 3.938±2.293 in controlling group, at 6 months after removal of tractor surgery the Distance of lower dental midline to sagittal plane is 1.064±0.699 in experiment group and 2.004±1.368 in controlling group P1=0.00.P2=0.00 P3=0.026. There was significant statistic difference. At one month after DO surgery in the cant of mandibular occlusal plane is -4.887±3.126 in experiment group and -0.177±4.029 in controlling group, and at 6 months after removal of tractor surgery is -3.041±1.784 in experiment group and 2.198±1.903 in controlling group P1=0.00.P2=0.00 p3=0.000 There was significant statistic difference. The height of orthodontic splint at Initial placement (1 month after the DO surgery) in experiment group is 7.161±1.783; in controlling group is 5.948±1.088, P=0.001. There was significant statistic difference.

Conclusion: The ET assisted DO treatment can level the mandibular occlusion plane to a greater extend and create bigger posterior open bite, which provides enough space for vertical alveolar-maxilla growth

Disclosure of Interest: None Declared

DAY18 - STATION 9 - RESEARCH

18-9-181

THE EFFECT OF HAEMOSTATIC AGENTS ON WOUND HEALING IN CROUZON MICE

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Introduction & Objectives: Direct observation of evolving Neurosurgical practice during combined transcaranial procedures for children with craniosynostosis has noted an increased use of haemostatic agents. To investigate if there is any impact of these agents on transcranial wound healing, in those with underlying mutations, mice with fgfr2 mutation were used to investigate changes in bone production as part of the healing process

Material & Methods: Balb C mice with FGFR2 knock in mutation underwent a critical sized 3mm craniectomy of the parietal bone. The defect was closed and culled at three months and 3d micro CT scans undertaken to measure bone regeneration. This acted as baseline data and the experiment repeated placing either Surgical, Bone wax or Gelosin into the cranial defect. The post-operative animal husbandry was the same for all groups. The mice were culled three months postoperatively and micro3D CT scans undertaken of the cranial defect and histology of the soft tissues overlying the cranial defect undertaken. These were then compared to the animals who had craniectomy alone.

Results: Twelve adult male mice underwent craniectomy, while twelve underwent craniectomy with surgical and six underwent craniectomy with Gelosin. A further six mice underwent craniectomy with bone wax applied to the bone edges.

The micro 3DCT scans for all three groups demonstrated reduced bone regeneration in comparison with craniectomy alone.

Conclusion: This is a pilot study, but the initial results suggest that the use of haemostatic agents can impact on the post-operative bone healing process, and that Craniofacial teams undertaking transcranial surgery should be aware of this.

Disclosure of Interest: None Declared

18-9-182

DO MURINE MODELS WITH BOTH FGFR2 AND TWIST MUTATIONS HAVE A WORSE PHENOTYPE?

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Introduction & Objectives: Previously we have identified patients with mutations with co-existing underlying FGFR2 and TWIST mutations1. These appeared to exhibit either an Apert of Crouzon phenotype and it was unclear if they had a more severe phenoptype or worse clinical outcome than those with just an underlying FGFR2 mutation. Using murine models of co-exiting fgfr2 and twist mutations we wished to investigate the resulting phenotype morphologically to assess the craniofacial manifestations and to study the impact on other aspects of the animal and its skeleton.
Ref: ANDERSON, P.J., NETHERWAY, D.J., COX, T., ROSCIOLI, T., DAVID, D.J. (2006)
Do Craniosynostosis phenotypes with both *FGFR2* and *TWIST* mutations have a worse prognosis?
J. Craniofac. Surg. Vol. 17(1): p166 -172.
Material & Methods: Using established murine colonies of male fgfr2 knock in mutation and female twist knock out mutation breeding colonies were established
Results: To date six mice with characteristic craniofacial and skeletal features on both mutations have been born. They have all undergone post-mortem mico3DCT which demonstrates profound changes in the cranium, maxilla and mandible compared to their unaffected littermates, and also littermates affected by the fgfr2 gene alone. The micro 3DCT demonstrated a pan-synostosis but In comparison, organ histology has failed to find any discernible differences in organ histology.
Conclusion: These results demonstrate that the effect of co-existing mutations in these two genes has a profound adverse effect on the development of the craniofacial skeleton, which will be of interest to those craniofacial biologists studying complex craniosynostosis.

Disclosure of Interest: None Declared

18-9-183

MULTISUTURAL SYNOSTOSIS AND SEVERE CRANIOFACIAL ASYMMETRY IN HUWE1-SYNDROME

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Introduction & Objectives: Only a few patients with a HUWE1 mutation and craniosynostosis have been described so far. The phenotype of these patients appears to be fairly consistent.
Material & Methods: In this paper we describe a 3-year old patient with HUWE1-based syndromic craniosynostosis and the treatment.
Results: A female patient was diagnosed with metopic and coronal suture on the left side for which an endoscopic assisted stripcraniectomy was performed at 5 weeks of age, in a different center. The left lambdoid suture was partially fused, but not excised at that time because of doubt of its patency. Within a few months time, the suspicion of raised ICP rose based on severe scalloping on the X-skull on the left side, although no papilloedema was seen. The girl presented for a second opinion at our center given the persistent severe craniofacial asymmetry. At the age of 8 months, she underwent a FOA and left sided occipital vault remodeling at our center. During surgery the severe scalloping of the skull with bony defects was evident. Genetic studies revealed a *HUWE1* mutation. A second open procedure was performed to further improve the asymmetry.
Conclusion: The severe phenotype of HUWE1-based syndromic craniosynostosis is illustrated. Initial treatment of this severe deformity with stripcraniectomy appeared to have no benefits.

Disclosure of Interest: None Declared

18-9-184

NOVEL VARIANT IN FGFR2 RESPONSIBLE OF FAMILIAL SCAPHOCEPHALY

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Introduction & Objectives: Scaphocephaly is the most common type of craniosynostosis, occurring in about 55 % of all cases and familial cases represent just 5% of the total. Exceptional mutations in fibroblast growth factor receptor 2 (*FGFR2)* were described in familial scaphocephaly cases, as exceptional variants in *SMAD6*, novel gene recently identified in non-syndromic midline craniosynostosis. Besides, the FGFR2 mutations are a common cause of several craniosynostosis syndromes as Crouzon syndrome. Mutations have been located predominantly in hotspots in immunoglobulin domain and concentrated in exons 8 and 10. In our cohort of 30 patients with familial scaphocephaly, we applied a Next Generation Sequencing of panel of coding genes involved in syndromic craniosynostosis. Therefore, our approach allowed to identify a novel heterozygous Pro23His variant in FGFR2 gene associated to familial scaphocephaly

Material & Methods: Targeted NGS sequencing of panel of genes involved in craniosynostosis was performed on Miseq sequencer (illumina) with surelectQXT reagents (agilent). Data were analyzed with SeqNext (JSI Medical), Variantstudio (Illumina) and Surecall (Agilent) softwares.

Results: Index case was infant who displayed an isolated scaphocephaly diagnosed at the birth and required a surgery that was performed at 6 months. The premature fusion of sagittal suture was isolated without intellectual disability. The familial history indicated that his maternal uncle displayed a similar phenotype. The molecular analysis showed a novel variant in exon 2 of FGFR2 at heterozygous level in index case and his asymptomatic mother. This variant was located in extracellular domain of FGFR2 correspond to binding site of FGF ligands. Also, this variant was classified as pathogenic based to in silico predictive software

Conclusion: In our case, the patient presented a mild phenotype without no sign of typical Crouzon syndrome. Crouzon syndrome has a high penetrance and an extreme clinical variability. Also, the sagittal suture is generally affected in Crouzon syndrome. Therefore, the presence of scaphocephaly could correlated with the observed phenotype. This observation highlights the need to seek variant in FGFR2 gene in case of scaphocephaly with familial history.

Disclosure of Interest: None Declared

18-9-185

MUTATION SPECTRUM INCHINESE PATIENTS WITH CRANIOSYNOSTOSIS

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Introduction & Objectives: As the lack of genetic testing in Chinese patients with craniosynostosis, we first established a patient cohort without prior molecular diagnosis in China. We aimed to assess the impact of a targeted gene sequencing for the genetic diagnosis, and to describe the characteristics of mutation spectrum in Chinese patients.

Material & Methods: We designed a 17-gene panel and performed sequencing in 148 patients clinically diagnosed as craniosynostosis. Variants were identified by a bioinformatic pipeline, silico prediction, Sanger validation and ACMG standards.

Results: A total of 77 cases were identified with pathogenic or likely pathogenic variants, including 64 syndromic patients and 11 non-syndromic patients with significantly different diagnostic yields of 91 % (64/70) and 16% (11/68) respectively. We totally identified 81 pathogenic /likely pathogenic /uncertain variants in 9 genes (EFNB1, ERF, FGFR1, FGFR2, FGFR3, POR, TCF12, TGFBR2, TWIST1). Eleven novel variants were identified in twelve cases, and six probands inherited variants from unaffected parents.

Conclusion: Our custom sequencing panel can provide reasonably high-yield diagnosis in Chinese patients firstly performed genetic test, especially in the syndromic forms. The gene distribution of variants and the FGFR2 mutation spectrum of Chinese craniosynostosis patients are generally similar to those of Caucasian patients. However, the differences and novel findings suggested great potential of study in Chinese patients.

Disclosure of Interest: None Declared

18-9-186

SWEENEY-COX SYNDROME: A CASE REPORT. SURGICAL CONDUCT

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Introduction & Objectives: Sweeney-Cox is a syndrome that involves craniofacial, skeletal, genitourinary and gastrointestinal malformations based on the missense mutation of the TWIST1 gene.

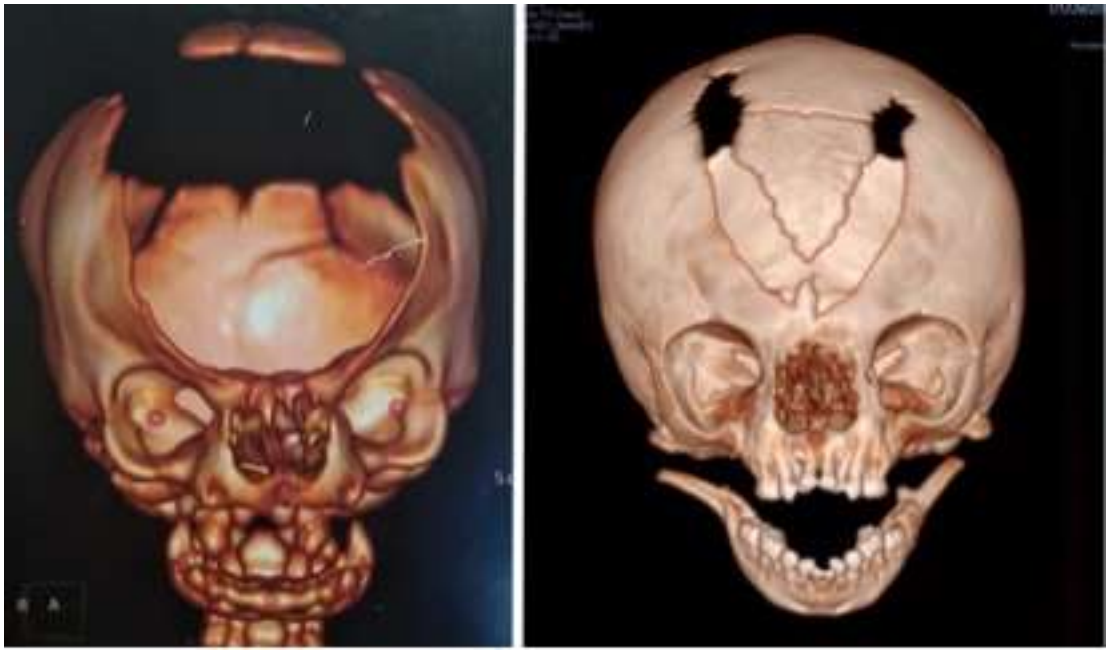
Clinical case report describing and exploring scarce information about this rare and uncertain conduction syndrome.

Material & Methods: Case report of Sweeney-Cox syndrome, submitted to tracheostomy and gastrostomy in the first month of life, and after craniofacial surgical interventions that include: temporal bone transposition with internal distractors (Lauritzen's springs) by craniosynostosis of the coronal / lambdoid sutures, reconstruction of the body and mandible ramus with costal graft and facial advancement with maxillo-mandibular osteotomies.

Results: Good ossification of the skull and good mandibular development, with reestablishment of airway in the oropharynx, being able to withdraw the tracheostomy. He presented good structural and cognitive evolution.

Reconstruction of the growing facial skeleton is challenging. The absence of osteogenic matrix suggested by the cranial bone aplasia justified the bone transposition with the use of internal distractors (Lauritzen's springs). The use of rib graft for mandibular reconstruction already has foundations in literature and adequate results. The mandibular osteotomies allowed the anatomical advancement of bone and muscle structures in the tongue floor, being also in accordance with the literature. Finally, maxillary osteotomies were chosen with the mobilization of the orbital medial walls due to bone scarcity in the middle third, with an improvement in hyperteleorbitism.

Conclusion: This is a rare, yet elucidated, syndrome with multiple malformations and the need for multidisciplinary interventions, aiming to provide structural and cognitive growth with fewer sequelae.



Disclosure of Interest: None Declared

18-9-187

EXOME SEQUENCING IN CRANIOSYNOSTOSIS AT THE NORWEGIAN NATIONAL UNIT FOR CRANIOFACIAL SURGERY

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Introduction & Objectives: Craniosynostosis occurs in 1 in 2000 liveborn children. Genetic heterogeneity is well-established; 70 genes are currently known to be associated with craniosynostosis. Accurate diagnosis and molecular classification is important for optimal treatment, prognosis, counselling and clinical follow-up.

Material & Methods: Approximately 70 individuals, including a third of who have craniosynostosis, are referred to the Norwegian National Unit for Craniofacial Surgery annually. Since 2016 we have offered exome-based gene panel analysis for syndromic craniosynostosis after negative routine genetic testing (*FGFR2, FGFR3, TWIST1*). The panel includes 109 genes associated with craniofacial disorders, 70 of which are associated with craniosynostosis. Forty-eight individuals have been analyzed with the gene panel only (n=42) and/or whole-exome-sequencing (WES) (n=6).

Results: We identified a likely pathogenic variant in thirteen individuals (27 %) in ten different genes. Seven of the genes were included in the panel. Seven individuals had variants in genes in keeping with the clinical phenotype (*EFNB1, ERF, IL11RA, IFT122*). Three individuals had a variant in a gene commonly associated with craniosynostosis, but with atypical presentations (*FGFR2, FGFR3*, *TWIST1).* By WES we detected two disease causing variants in genes for which an association with craniosynostosis is currently not firmly established (*CDK13, EHMT1*), and one disease causing variant in the *AHDC1* gene, recently published as a craniosynostosis gene. We detected two variants of unknown significance in two different genes (*MSX2, NFIX*). In addition, we detected a variant in a gene of unknown significance (*AGBL4*) which has a single match in GeneMatcher and may be a candidate gene for craniosynostosis.

Conclusion: Our experience is consistent with previous reports of genetic heterogeneity in craniosynostosis and supports the use of diagnostic next generation sequencing.

Disclosure of Interest: None Declared

18-9-188-N /19-12-310

CROUZON WITH ACANTHOSIS NIGRICANS: A RARE VARIANT OF CROUZON SYNDROME DUE TO FGFR3 MUTATIONS - FUNDAMENTAL AND CLINICAL APPROACHES

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Introduction & Objectives: Crouzon syndrome acanthosis nigricans (CAN) is a rare craniosynostosis syndrome characterized by a typical Crouzon craniofacial phenotype associated with specific skin lesions. CAN is caused by a missense mutation of *FGFR3* gene (A391E), while more common forms of Crouzon syndrome are due to *FGFR2* mutations. We have developed a mouse model of this condition with ubiquitous expression of the mutation in order to better understand the mechanisms of the pathology and investigate the possibilities for targeted treatments.

Material & Methods: A specific mouse model of CAN was developed and investigated using molecular and morphometric techniques. Cell cultures from bone cells harvested on patients with CAN syndrome were used in order to assess bone formation processes in this condition.

Results: CAN mouse models replicate several, but not all, phenotypic traits of patients with CAN. This approach underlines the advantages and the limits of mouse models for the understanding of craniosynostoses and for the design of specific FGFR inhibitors.

Conclusion: - - - -

Disclosure of Interest: None Declared

18-9-189

THE RETENTIVITY OF OSTEOGENIC CAPACITY IN THE PREFABRICATED PERIOSTEOFASCIAL FLAP USING THE VASCULAR TISSUE TRANSFER

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Introduction & Objectives: The creation of the prefabricated periosteofascial flap using the vascular tissue transfer has been reported successful. But its osteogenic capacity still remain unclear. This study was designed to investigate the osteogenic retentivity of the prefabricated periosteofascial flap.

Material & Methods: Twenty New Zealand white rabbits were used in this study. On the calvarial periosteum, a vascularized periosteofascial flap (N=10) was prefabricated by transposition of the central artery and vein of right ear with 4 weeks of implanted periods. A 2 x 2 cm sized flap was harvested as an island flap based on the transposed pedicles. At that time, 2 x 2 cm sized conventional rectangular periosteofascial flap (N=10) was elevated in the control group. In both group, calvarial bone defect in 15 mm of diameter was made below the flap, and the defects were filled with demineralized bone matrix (DBM). Then, the flap was replaced in place. After a follow-up of 6 weeks, angiography, 3-dimensional computed tomography, radiodensitometry, histological analysis were carried out for the assessment of osteogenic retentivity in both groups.

Results: Microangiographic findings shows that a mature new vascular network was well established in the prefabricated flap. Widespread communication between the pedicle and new vessels are observed over the flap. The ratio of volume change in bone defect is slightly higher in the control group (38.9±18.51%) than the experimental group(38.7±11.90%). There is no statistical difference between the two groups. The radiodensity of the bone defect is slightly more radiopaque in the control group (333±158.73) than the experimental group (295±123.04). There is no statistical difference between the two groups. It was found in histological assessment that the implanted demineralized bone matrix was substituted with new bone sporadically in the defects. Additionally, new vessels filled with angiographic dye were observed in the bony defect area as well as the periosteal fascia. These findings suggests that angiogenesis of prefabricated periosteofascial flap was accomplished.

Conclusion: We believe that this study confirms the stable vascularity of prefabricated periosteal flaps, allowing an osteogenic capacity that is comparable to conventional periosteal flaps. It can thus be concluded that prefabricated periosteofascial flaps created via vascular tissue transfer can retain the osteogenic capacity of the original periosteum,

Disclosure of Interest: None Declared

DAY18 - STATION 10 - CRANIOFACIAL TRAUMA

18-10-190-N / 19-11-299

SPORTS-RELATED INJURIES IN THE PEDIATRIC POPULATION: ANALYSIS OF FACIAL FRACTURE PATTERN AND MANAGEMENT STRATEGIES

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Introduction & Objectives: Sports-related injuries such as facial fractures are potentially debilitating, and may lead to long term functional and aesthetic deficits in a pediatric patient. In this study, we analyze sports-related facial fractures in the urban pediatric population in an effort to characterize patterns of injury, and improve management strategies and outcomes.

Material & Methods: A retrospective chart review was performed for all facial fractures resulting from motor vehicle collisions with pedestrians in the pediatric population at a level 1 trauma center in an urban environment (University Hospital in Newark, NJ) from 2002 to 2012. Patient demographics were collected, as well as location of fractures, concomitant injuries, and surgical management strategies.

Results: Seventeen pediatric patients were identified as having sustained a fracture of the facial skeleton due to sports injury. Mean age was 13.9 years old. A total of 29 fractures were identified. Most common fracture sites included the orbit (n=12), mandible (n=5), nasal bone (n=5), and zygomaticomaxillary complex (n=3). The most common concomitant injuries included skull fracture (n=3), intracranial hemorrhage (n=4), and traumatic brain injury (n=4). One patient was intubated upon arrival to the emergency department. Hospital admission was required in 13 patients, four of which were admitted to an intensive care setting. Nine patients required operative intervention. Mean length of hospital stay was 2.4 days. No patients expired.

Conclusion: Sports-related facial fractures are potentially debilitating injuries in the pediatric population. Analysis of fracture pattern and concomitant injuries is imperative in order to develop effective management strategies and prevention techniques.

Disclosure of Interest: None Declared

18-10-191-N / 19-9-288

IMPLICATIONS OF FACIAL FRACTURE IN AIRWAY MANAGEMENT OF THE ADULT POPULATION: WHAT IS THE MOST EFFECTIVE MANAGEMENT STRATEGY?

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Introduction & Objectives: Facial fractures are a harbinger when it comes to airway management. Facial fractures can cause airway obstruction or preclude the use of intubation. We aim to examine the etiologies, types of facial fractures, and the risk factors that may lead to requirement of an advance airway.

Material & Methods: A retrospective chart review was performed of all facial fractures in the adult population in a level 1 trauma center in an urban environment (University Hospital in Newark, NJ). Patient demographics were collected, as well as location of fractures, concomitant injuries, and course of hospital stay.

Results: During the period examined, 2,626 patients were identified as greater or equal to 18 years of age and with facial fracture. Among these patients, 443 received airway management. Mean age was 34.21 (range 18 – 95) years, with a male predominance of 91.9%. One hundred nineteen patients were intubated on, or prior to, arrival to the trauma bay. One-hundred and three patients required surgical airways on arrival to the trauma bay, and 91 of these patients were also reported to have been intubated prior to arrival. There was a total of 741 fractures identified on radiologic imaging. The most common fractures observed were orbital fractures, frontal sinus fractures, and nasal fractures. Mean Glasgow Coma Scale on arrival was 9.45 (range 3 – 15). Gunshot wound was also the most common etiology among those who were intubated and those who received a surgical airway. The most common concomitant injuries were TBI, intracranial hemorrhage, and skull fracture. Forty-one patients expired, most of which were intubated during their hospital course.

Conclusion: There is a dearth of literature detailing standardization of airway management for patients who present with facial fractures. The difference between intubation and surgical airway is often a subjective judgement call, but the authors believe that a more streamlined process can be elucidated after analyzing previous trends as well as variabilities in patient survival and prognosis.

Disclosure of Interest: None Declared

18-10-192

PEDIATRIC FACIAL FRACTURES, CHARACTERISTICS AND PATTERNS IN THE UNITED STATES: A SURVEY OF RECENT TRAUMA QUALITY IMPROVEMENT PROJECT (TQIP) DATA

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Introduction & Objectives: Trauma involving the facial bones has been shown to be associated with high severity in previous studies. Characteristics of facial fractures in adults have been well described in the adult population, less so in the pediatric literature. Our investigation further aims to define these epidemiological measures using the most recent data.

Material & Methods: Characteristics of facial fractures among children and adolescents (ages 0-18 years old) has been previously examined using the National Trauma Data Bank (NTDB) between the years of 2001-2005. Our investigation uses 2016 data the Trauma Quality Improvement project (TQIP) Databank to study facial fracture pattern, mechanism of injury, and demographic descriptive data to characterize pediatric trauma patients.

Results: A total of 51,168 pediatric trauma patients were identified. Among these patients 2,878 (5.6%) presented with facial fractures. Among patients with facial fractures, fracture pattern differed by age. Mandibular fractures were more common in the 0-1 age category while nasal bone fractures were most common among 15-18 category (Table 1). When stratified by mechanism, MVA was the most common among patients with facial fractures (Table 2). The most common type of facial fracture identified was maxillary/malar fractures (35.1%) followed by mandibular (34.4%) and nasal bone (26.6%).

Conclusion: Facial fracture patterns in pediatric patients differ by various age groups and mechanism of injury. Contrary to previous studies showing central facial fractures are more common among younger age groups, our investigation suggests this may not be the case.

Table 1. Frequency of facial fracture type by age

Age Group	Nasal (%)	Mandible (%)	Max/Malar (%)	Orbital (%)	Dental (%)	Zygomatic (%)
0-1 (N=93)	21.5	31.2	26.9	23.7	15.1	16.1
2-4 (N=293)	32.8	24.9	35.2	27.0	15.4	12.6
5-9 (N=617)	30.1	24.3	34.5	28.0	21.9	12.5
10-14 (N=794)	35.4	22.5	33.9	24.6	22.0	9.4
15-18 (N=1081)	37.6	30.9	36.9	24.1	18.7	14.2

Table 2. Frequency of facial fracture type by mechanism

Mechanism	Nasal	Mandible	Max/Malar	Orbital	Dental	Zygomatic
MVA (N=134)	39.6	23.1	44.8	23.9	26.9	11.2
Fall (N= 24)	29.2	29.2	25	25	37.5	4.2
Bicycle (N=8)	0	25	37.5	25	50	0
Assault (N=3)	66.7	33.3	0	0	33.3	33.3

Disclosure of Interest: None Declared

18-10-193

VISUAL PERCEPTION OF ASYMMETRY IN PARRY ROMBERG DISEASE: A PRE- AND POST-SURGICAL EYETRACKING ANALYSIS

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Introduction & Objectives: An objective outcome measure following facial reconstructive surgery is elusive. This study focuses on a cohort of patients with Parry Romberg disease, and examines viewers' visual perception of affected faces both prior to and following surgical intervention using eyetracking technology. While measured eyetracking data reflects spatial attention and scanpath of an image over time, the subjects were also asked to provide ratings of presumed character traits for each image. Spontaneous eyetracking data was then correlated to social impression formation.

Material & Methods: Pre and post-surgical (>3 months) photographs were obtained from 6 patients with unilateral hemifacial atrophy who underwent reconstruction with some combination of fat grafting, acellular dermal matrix, alloplastic implant, and/or free tissue transfer.

40 observers examined all images while an infrared eye-tracking camera continuously recorded their eye movements. The observers were then asked to rate each image for five character attributes (attractiveness, trustworthiness, sociability, physical fitness, and capability).

Results:

(i) The facial areas of gross asymmetry drew the most visual attention (i.e. visual fixations).

(ii) The rating of character attributes improved significantly in 1/6 patients, and this correlated with a reduction in measured visual fixations in the lookzones that were most asymmetric pre-operatively.

(iii) The ratings of character attributes decreased in two patients following surgery, and this correlated with a heightened visual attention toward the affected lookzones[MS1] .

(iv) Two patients shows no change in ratings, and this correlates with no difference in lookzone visual fixations.

(v) Our eye tracking methodology reveals normalization of gaze attention following successful surgical intervention, while demonstrating no improvement in the cases found to be grossly non-beneficial. Normalization in eyetracking patterns was linked with improvement in impression of character attributes.

Conclusion: We provide preliminary data illustrating a novel and objective technique to evaluate the perception of facial difference seen in Parry Romberg disease. Changes in spatial attention as reflected by eyetracking data appear to be coupled to changes in character assessment.

The value of this work is in providing objective evidence of the alteration in visual perception and the associated social impression that is elicited by facial difference. This information may benefit patients and caregivers by better focusing their surgical decision-making priorities.

Disclosure of Interest: None Declared

18-10-194-N /19-5-249

QUANTIFYING NORMAL HEAD FORM AND CRANIOFACIAL ASYMMETRY OF ELEMENTARY SCHOOL STUDENTS IN TAIWAN

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Introduction & Objectives: To define normal craniofacial form in growing children is important when it comes to reconstruction of craniofacial anomalies. Previous works have delivered detailed description on craniofacial form, yet most of them were conducted with conventional methods such as anthropometry, cephalometry and photography, which proved to have certain degree of drawbacks. In this preliminary study, we aim to report normal craniofacial form and quantify craniofacial asymmetry of healthy children in Taiwan by implementing 3D stereophotogrammetry technique.

Material & Methods: Healthy elementary school children(n=652) aged from 6 to 12 in Taiwan with no known craniofacial anomaly were recruited. After 3dMD scanning procedure, 32 landmarks were placed on the 3D cranial images of these children manually. Thin-plate spline algorithm based on landmarks and closest point matching were applied to deform a symmetric three-dimensional template into the scale of each scanned images. Mean asymmetry and characteristic data of the skull and facial areas were calculated using 3dMDvultus and MATLAB. Average head shape models were also presented.

Results: The mean skull asymmetry of all the subjects was 2.47± 1.26 mm (range, 0.89 to 10.30 mm), and the mean facial asymmetry was 0.96± 0.53 mm (range, 0.31 to 3.65 mm). When divided by sex, the mean head asymmetry was 2.32± 1.12 mm for male and 2.62± 1.37 mm for female, and mean facial asymmetry was 0.93± 0.50 mm for male and 0.98± 0.56 mm for female subjects. There were no significant differences in the mean skull or facial asymmetry between sex. Certain craniofacial areas over the right side were found to be more protruded than left side on the average head shape model for all the subjects.

Conclusion: Defining normal head form and the extent of craniofacial asymmetry in healthy children could offer great value in clinical practice. Using advanced and precise 3D imaging technique, we concluded that the baseline craniofacial form of the elementary school children in Taiwan is slightly asymmetric with a tendency of more protruded right head. Future projects are still in progress to enroll more pediatric population to create a larger database and a more representative average model.

Disclosure of Interest: None Declared

18-10-195

CHALLENGES OF PEDIATRIC NASO ORBITO ETHMOID FRACTURES

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Introduction & Objectives:

Naso Orbito Ethmoid Fractures in the pediatric population present specific challenges related to a different anatomy and structural buttress support, the need for precise three dimensional restoration and preserving potential for future growth. The edges of the fracture fragments have a greenstick component that makes estimation of pre-injury anatomy more difficult.

Material & Methods: Photogrammetric methods and Machine Learning algorithms were used to reconstruct pre-morbid Anatomy from pre-injury photographs and CT data. 3D printed models provide an immediate visual feedback about size and orientation of fragments that is complementary to Virtual Surgical Planning. Finally Augmented Reality Hologram Overlay of planned reconstruction was used as operative assistance.

Results:

Increased surgeon confidence, shorter operative times and excellent post-operative results were observed in an example case. Forehead contour projection is a critical component of correction, and medial canthal anatomy and stability is expected in patients older than 3 years. A previously unrecognized secondary deformity is discussed, resulting in loss of vertical height of the medial orbit, resulting in a medial canthus located cephalad to the lateral canthus with a resultant tendency for antimongoloid slant.

Conclusion:

Novel technological tools are immediately applicable to complex pediatric facial fractures. An unrecognized secondary deformity is discussed involving loss of vertical height of the medial orbital wall. Selective use of cantilever grafts in infant NOE fractures needs further investigation.

Disclosure of Interest: None Declared

18-10-196

PATTERNS OF NASOORBITOETHMOID FRACTURES IN THE PEDIATRIC POPULATION

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Introduction & Objectives: There is an absence of literature regarding nasoorbitoethmoid (NOE) facial fractures. While NOE fractures are uncommon, there are a significant number in the pediatric population. These fractures also often occur in conjunction with other facial fractures because the NOE region adjoins the nose, orbit, maxilla, and cranium. They can also be a harbinger for more serious concerns such as traumatic brain injury and intracranial hemorrhage. For this reason, NOE fractures can be highly complicated and a challenge to manage. We aim to define the etiologies and patterns of nasoorbitoethmoid fractures to guide hospital and surgical management strategies.
Material & Methods: Facial fractures at University Hospital (Newark, NJ) were reviewed retrospectively between years 2001 and 2014 following the International Classification of Disease (ICD-9) codes. The population reviewed included patients 18 years of age or younger who sustained nasoorbitoethomoid fractures and were received at University Hospital's urban, level 1 trauma center. Patterns within this population such as demographics, other facial fractures sustained, concomitant injuries, complications, and surgical management strategies were assessed.
Results: From 2001 to 2014, 15 pediatric patients were identified as having sustained a NOE fracture. Four (26.7%) of the patients were female and 11 (68.8%) of the patients were male. Average age was 11.40. The most common etiologies recorded were motor vehicle accident (n=8), pedestrian struck (n=3), and assault (n=2). Orbital fracture (n= 13), nasal fracture (n=13), frontal sinus fracture (n=10) were the most commonly associated facial fractures sustained alongside NOE fracture. Several patients sustained traumatic brain injury (n=11) and loss of consciousness (n=13). The mean Glasgow Coma Score was 10.5. In addition, 8 required intubation and 5 required a surgical airway. Thirteen of the patients were admitted to the ICU and 11 required surgical management for their fractures. Titanium plates were most commonly used (n=7) for surgical management. Alternatively, medpor implants were used for 1 patient and resorbable implants were used for 2 patients.
Conclusion: Nasoorbitoethmoid fractures are prevalent in a significant number of pediatric patients, however, there is limited literature describing these fractures in children. We aim to provide deeper insight regarding NOE fractures and various associated patterns. Our study will help identify pediatric patients who are more likely to present with a NOE facial fracture, commonly associated injuries, and the surgical techniques most commonly utilized at an urban level 1 trauma center. It is imperative that these patterns are studied to optimize fracture management and consequently reduce morbidity and mortality of pediatric patients.

Disclosure of Interest: None Declared

18-10-197

ESTABLISHING A PROTOCOL FOR CLOSED TREATMENT OF MANDIBULAR CONDYLE FRACTURES WITH DYNAMIC ELASTIC THERAPY

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Introduction & Objectives: Treatment of mandibular condyle fractures is controversial. Open treatment can achieve anatomic reduction but risks joint capsule circulation and facial nerve injury. Traditional closed treatment avoids these risks but involves prolonged maxillomandibular fixation and increased incidence of ankylosis. Elastics have the potential to allow for customizable management of a healing fracture with the ability to alter vector and degree of traction to restore vertical height and occlusion with decreased risk of ankylosis. The purpose of this investigation was to determine the clinical efficacy of dynamic elastic therapy in closed treatment of mandibular condyle fractures.
Material & Methods: Condylar fractures were treated with class II elastics ipsilateral and class I contralateral to fracture with sufficient vector to re-establish centric occlusion and midline congruency. Class III elastics were used contralaterally if required and class II elastics bilaterally for bilateral fractures. Patients were followed until fracture healing with sequential advancement from fixation to guiding to supportive elastics. Patients were advanced by titrating to any dental midline incongruence and chin deviation on mouth opening. Occlusion, facial profile and temporomandibular dysfunction was also assessed at longer term follow up. (Figure 1)
Results: Six patients were treated with this protocol with 6 months follow up. Fracture patterns included displaced and dislocated intracapsular and extracapsular fractures. All patients had resolution of objective centric occlusion with no subjective malocclusion, chin deviation, facial asymmetry, nor TMJ symptoms at completion of treatment.
Conclusion: This preliminary data demonstrates a safe and efficacious protocol for closed treatment of mandibular condylar fractures with dynamic elastic therapy.

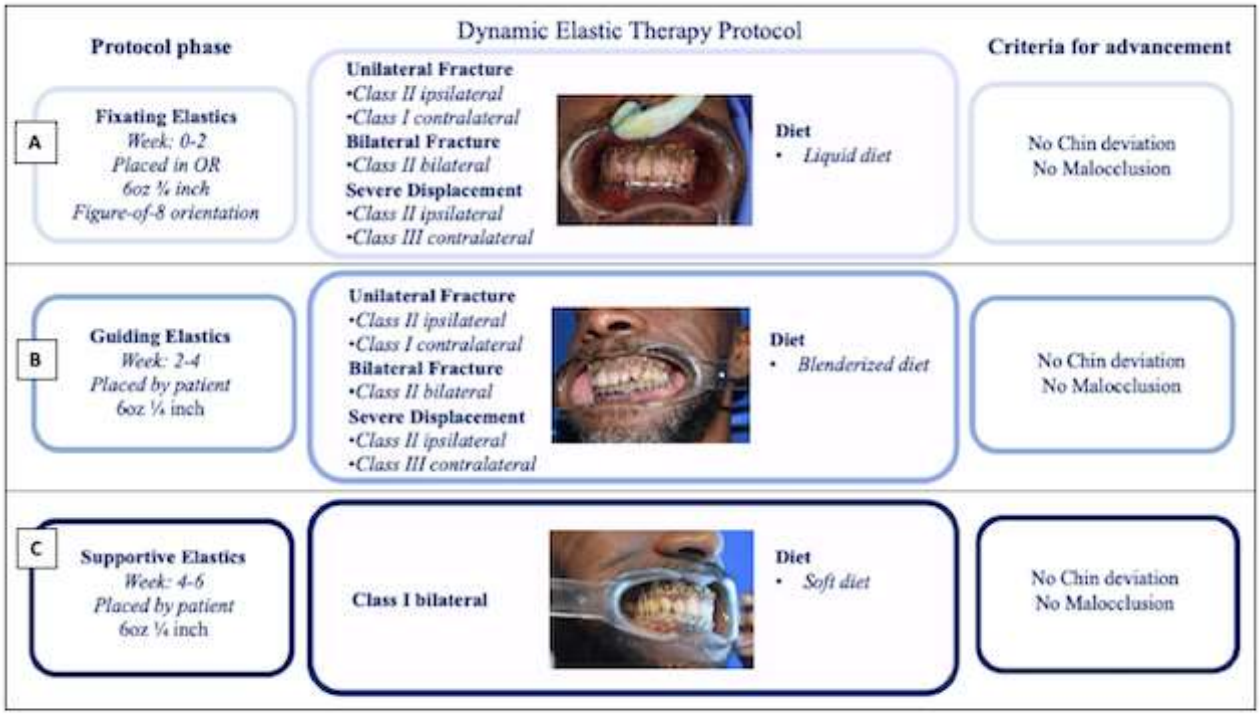

Figure 1. Dynamic Elastic Therapy Protocol. This protocol consists of three stages: fixating therapy (A), guiding therapy (B), and supportive therapy (C).

Disclosure of Interest: None Declared

18-10-198

PERIORBITAL AND GLOBE INJURIES IN PEDIATRIC ORBITAL FRACTURES: A RETROSPECTIVE REVIEW OF 116 PATIENTS AT A LEVEL 1 TRAUMA CENTER

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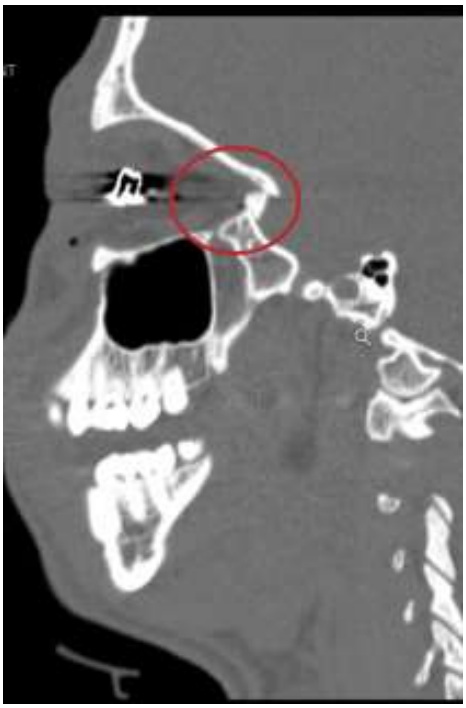
Introduction & Objectives: Pediatric orbital fractures are a unique subset of fractures that often present with concomitant injuries to the periorbital structures and the globe. Recent literature has focused on surgical timing, indications, and treatment options in pediatric patients with comparison to treatment algorithms in adult patients with orbital fractures. However, there is a paucity of literature discussing the incidence and management of the soft tissue and ocular injuries in pediatric patients. The goal of this study is to examine the incidence and management of these injuries at our institution in order to gain a better understanding of how to approach pediatric patients with orbital fractures.

Material & Methods: An IRB-approved retrospective review of all facial fractures in pediatric patients at an urban level 1 trauma center was performed for the years 2002 to 2014. Patient demographics were collected, as well as orbital fracture type, mechanism of injury, concomitant injuries, ophthalmologic documentation, imaging, and surgical records.

Results: One hundred sixteen pediatric patients over a twelve-year period sustained an orbital fracture. There were 31 females and 85 males, the median patient age was 14. The most common mechanism of injury was motor vehicle accident (23%), followed by assault (21%) and pedestrian struck (19%). The orbital floor was the most commonly observed orbital fracture site, with 56 fractures observed in our series. The most common concomitant injuries observed in these patients was skull fractures and intracranial hemorrhage. Thirty-three patients (28%) had a documented periorbital/globe injury sustained at the time of orbital fracture. The most common periorbital injury was entrapment related to orbital floor patients, observed in 8 patients- all requiring surgical management. Complex eyelid lacerations were observed in 7 patients, two patients required canthal repositioning. There were 5 cases of lacrimal/canalicular injury, 5 cases of traumatic optic neuropathy, and 3 cases of hyphema. Two patients had ruptured globe requiring enucleation.

Conclusion: Periorbital soft tissue and globe injuries associated with orbital fractures occurs in a substantial number of pediatric patients. Further research should be performed to better understand the appropriate management of these injuries in conjunction with surgical management of the fractures.



Disclosure of Interest: None Declared

DAY18 - STATION 11 - CLEFT LIP PALATE

18-11-199

REVISION RATES OF CLEFT LIP AND NASAL DEFORMITIES IN NASOALVEOLAR MOLDING VERSUS LIP ADHESION

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Introduction & Objectives: Nasoalveolar molding (NAM) and lip adhesion (LA) are two methods used to reduce the severity of a cleft deformity. Previous studies have demonstrated that NAM improves nasolabial esthetics through lengthening of the columella, improvement of nasal asymmetry and alar form, and reduction of tension on the lip segments prior to surgical closure. Benefits of LA include fewer appointments, lower cost, and decreased reliance on parental compliance. However, the effect of LA on nasolabial esthetics remains unclear, since LA does not directly address the nasal deformity or reduce tension on lip segments. Previous research has demonstrated that NAM reduces nasal revision rates when compared to a non-NAM sample. However, no studies have compared revision rates in NAM and LA groups. The purpose of this study is to compare revision rates of cleft lip and nasal deformities in patients who underwent NAM versus LA.
Material & Methods: This retrospective study analyzed revision rates in 49 patients ages 7-15 who received NAM and 18 patients ages 8-18 who received LA at a single center. These groups were subdivided into NAM + gingivoperiosteoplasty (GPP) (22 subjects), NAM - GPP (27 subjects), LA + GPP (2 subjects), and LA - GPP (16 subjects). Chi square and Fisher's exact test were used to analyze lip, nasal, and lip and nasal revision rates in NAM and LA groups and subgroups.
Results: When comparing overall revision rates (lip, nasal, or lip and nasal revision performed/recommended vs. no revision indicated) in NAM and LA groups, there was no statistically significant difference in revision rates between the two groups (p=0.42). Similarly, there was no statistically significant difference in revision rates between the NAM and LA groups when revision type (lip revision vs. nasal revision vs. lip and nasal revision performed/recommended vs. no revision indicated) was considered (p=0.27). Additionally, there was no statistically significant difference in revision rates (lip, nasal, or lip and nasal revision performed/recommended vs. no revision indicated) between the NAM+GPP, NAM-GPP, LA+GPP, and LA-GPP groups (p=0.69).
Conclusion: Based on this sample, there is no statistically significant difference in rates of lip, nasal, or lip and nasal revisions performed or recommended in patients ages 7-18 who received NAM or LA, with or without GPP. Future research efforts should evaluate skeletally mature patients and strive to eliminate possible bias due to variations in initial cleft severity, multiple surgeons and surgical techniques used for LA and initial repair, and variable compliance with NAM appliance.

Disclosure of Interest: None Declared

18-11-200

SECONDARY CLEFT RHINOPLASTY IN 1720 PATIENTS: ARE NATIONAL PRACTICES CONSISTENT WITH GUIDELINES?

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Introduction & Objectives: Cleft nasal deformity has psychosocial and functional long-term impact. Limited studies of national practice patterns for secondary cleft rhinoplasty exist.

Material & Methods: Data was extracted from NSQIP-P. Secondary cleft rhinoplasty patients were isolated by CPT codes 30460 (Tip Rhinoplasty) and 30462 (Rhinoplasty with septal work and/or osteotomy). Frequency statistics were utilized to analyze demographics, comorbidities, surgical factors, and outcomes. Chi-squared analysis and Fisher's exact test were used for analysis.

Results: A total of 1720 patients underwent secondary cleft lip rhinoplasty nationally between 2012 and 2016. Mean patient age was 9.3 ± 5.3 years. Unilateral cleft rhinoplasty patients were older (9.0 years) than bilateral patients (7.8 years) (p=0.001). Rib grafting was performed in 6.3% of patients at a mean age of 10.6 years with a higher proportion of Asian and female patients. Auricular grafts were more commonly performed by ENT surgeons. The most common adjunct procedures included secondary cleft lip revision (33.1%) and tympanostomy tube placement (10.2%). When subdividing by type of cleft rhinoplasty, tip rhinoplasty was performed at a mean age of 7.3 years compared to rhinoplasty with osteotomies and a major septal component at 12.1 years ($p<0.001$).

Conclusion: Secondary cleft rhinoplasty is indicated for severe nasal deformity, airway obstruction, and/or psychosocial distress. In the largest national study to date, the majority of cleft rhinoplasties were found to be in skeletally immature patients. Although patients undergoing rib grafts or rhinoplasties with nasal osteotomies or septal resection were older, these procedures are performed in a majority pre-adolescent population.

Disclosure of Interest: None Declared

18-11-201

CONGENITAL MUSCLE HYPOTONIA IS ASSOCIATED WITH PLATYBASIA: A NOVEL PATHOANATOMIC BASIS FOR RECALCITRANT VELOPHARYNGEAL INSUFFICIENCY

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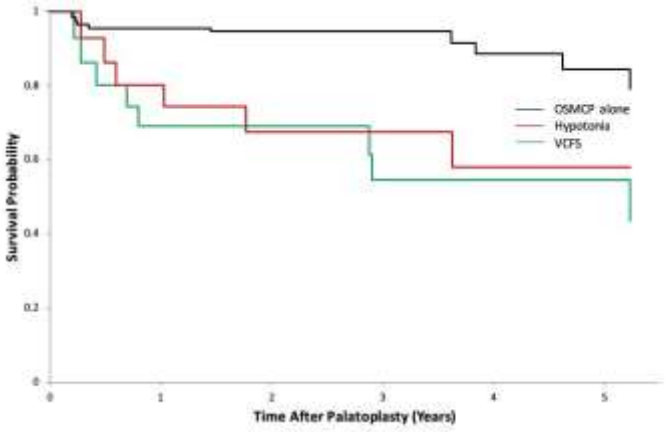
Introduction & Objectives: Pharyngeal muscle hypotonia leads to weak and inefficient velopharyngeal port closure, predisposing to velopharyngeal insufficiency (VPI). Pharyngeal muscle hypotonia is a frequent manifestation of Velo-Cardio-Facial Syndrome (VCFS). Also common to VCFS is platybasia, or abnormally obtuse cranial base angle (CBA), which increases the size of the velopharyngeal port. Both, platybasia and hypotonia, are believed to cause high recurrence rates of VPI following surgery in VCFS patients. To discern the individual role of platybasia and hypotonia on speech outcomes, we examined CBA and lateral pharyngeal wall motion among three groups of patients with VPI: 1) **VCFS** (platybasia + hypotonia); 2) **Non-VCFS hypotonia**; and 3) **OSMCP alone** (absent platybasia and hypotonia).
Material & Methods: We present a retrospective analysis of 124 patients with OSMCP who underwent Furlow palatoplasty for VPI (2004 – 2016; follow-up>0.5 years). In all patients with hypotonia, *FISH* testing confirmed *22q11.2* deletion (VCFS group) or lack thereof (non-VCFS hypotonia). CBA (basion-to-sella turcica-to-nasion) was obtained from standardized sagittal magnetic resonance images. Lateral pharyngeal wall motion (%) was obtained using videofluorscopy. Postoperative perceptual hypernasality and total Pittsburgh Weighted Speech Score (PWSS) were analyzed. Surgical failure was defined as both PWSS ≥7 (i.e., VPI) and recommendation for secondary speech surgery by speech pathologist and surgeon.

Results: All patients underwent Furlow palatoplasty (mean follow-up=3.3 years). The '**VCFS**' (*n*=14) and '**Hypotonia**' groups (*n*=14) had significantly more obtuse CBA, less lateral wall motion, persistent hypernasality, worse postoperative PWSS, and higher rates of surgical failure compared to '**OSMCP alone**'(*n*=100; see Table & Kaplan-Meier Survival curve).

	CBA	**Lateral Wall Motion (%)**	**Hypernasality** (max=4)	**Postoperative PWSS**
OSMCP alone	130.6° (0.9)	78.0 (2.7)	0.8 (0.9)	3.6 (0.4)
VCFS	**135.7° (2.4)***	**50.0 (8.7)***	**2.2 (0.4)***	**10.9 (2.1)***
Hypotonia	**136.8° (2.0)***	**33.6 (11.8)***	**1.7 (0.4)***	**8.1 (2.0)***
Mean values (±SE); *(*p*<0.05) vs. OSMCP alone				

Conclusion: While platybasia is characteristic of VCFS and negatively impacts velopharyngeal valving, an unexpected and novel finding is that platybasia occurred frequently in patients with non-VCFS hypotonia. Our findings are important because: (1) hypotonia-related VPI seems to be as common as VCFS-related VPI; and (2) VPI recurrence rates were relatively high similar to VCFS when treated with Furlow Palatoplasty. The mechanism whereby pharyngeal hypotonia and platybasia are closely related is still unclear but is not specific to VCFS. Our findings can help guide surgical decision making for future management of VPI-related hypotonia.



Disclosure of Interest: None Declared

18-11-202

THE CORRELATION BETWEEN SPEECH OUTCOMES AND THE AMOUNT OF MAXILLARY ADVANCEMENT AFTER ORTHOGNATHIC SURGERY IN PATIENTS WITH CLEFT LIP AND PALATE

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Introduction & Objectives: The purpose of this study is to evaluate the factors affecting the speech outcome following Le fort I conventional osteotomy(CO) or Le Fort I distraction osteogenesis(DO) in patients with cleft lip and palate at a single institution.

Material & Methods: Cleft lip and palate patients who underwent orthognathic surgery between 2010 and 2015 were retrospectively reviewed. Data included age at orthognathic surgery, sex, cleft lip and palate type, type of orthognathic surgery, the amount of maxillary advancement and speech assessment. Speech outcomes were classified into 2 categories according to perioperative change in Pittsburgh Weighted Speech Scale (PWSS) scores; "Speech deterioration", "Speech preservation". "Speech deterioration" was defined as increased PWSS score postoperatively, and "Speech preservation" was defined as decreased or no change in PWSS score.

Results: Total 44 patients were identified including 33 patients who underwent CO and 11 patients who underwent DO. The mean age was 19.4 ± 1.4 years. The mean period time of speech evaluation after orthognathic surgery was 1.0 ± 0.46 year. The mean amount of maxillary advancement was 7.2 ± 3.2 mm showing significant correlation with speech outcomes (p= 0.012). In CO group, the patients with maxillary advancement of 1~5mm maintained their speech completely and 44% of patients who underwent maxillary advancement of 6~8mm showed deterioration of speech. In DO group, patients with maxillary advancement of 9~10mm maintained their speech completely, but 50% of patients with 11~12mm advancement deteriorated their speech and 100% of patients with 13~16mm advancement deteriorated their speech. Amount of maxillary advancement and speech outcomes showed statistically significant correlation in both CO and DO groups (p=0.04, 0.029).

Conclusion: In general, increased amount of maxillary advancement resulted in worse speech outcomes. However, specific range of maxillary advancement (1~5mm in CO group and 9~10mm in DO group) did not significantly affect the speech outcome.

Disclosure of Interest: None Declared

18-11-203

PARAMEDIAN CLEFT OF THE LOWER LIP: A FIRST CASE DESCRIBED IN THE LITERATURE

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Introduction & Objectives: Clefts of lower lip and mandible are extremely rare, with about 80 cases reported in the literature. Almost universally, these isolated cases of lower facial cleft occur through the midline of the lip and/or mandible. These are rare facial clefts and more precisely Tessier n°30. The etiopathogenesis corresponds to a lack of fusion between first pharyngeal arches.

We described the first case of para-commissural cleft of the lower lip in a young child. We wondered about the etiology of this particular cleft because the embryological theory can hardly explain it.

Material & Methods: A 2 year-old boy was referred to our department in the Woman-Mother-Child University Hospital in Lyon, FRANCE, with a right paramedian cleft of the lower lip and labial incompetence. He is from a trichorionic triamniotic triplet pregnancy after ovarian stimulation. A multifetal pregnancy reduction (MFPR) was realized to reduce the number of fetuses in a triple pregnancy to two because one of the fetuses had significant abnormalities. This act was realized at 11 weeks of amenorrhea. It consists in inserting a needle through the woman's abdomen and into the uterus to the selected fetus with ultrasound as a guide.

We realized a review of literature on similar cases of paramedian cleft of the lower lip and on the risks of multifetal pregnancy reduction.

Results: No article in the world literature finds a similar case of paramedian cleft of the lower lip. We correct this cleft of the lower lip with a double plasty of Malek. The functional and aesthetic result is satisfactory.

Procedures as multifetal pregnancy reduction, chorionic villus sampling or amniocentesis are at risk for congenital anomalies. A case of aplasia cutis congenital and congenital paraplegia have been described after MFPR. Many congenital anomalies like limb reduction, cleft lip with or without cleft palate have been described after chorionic villus sampling.

MFPR is usually done, between the 9th and 12 th weeks of gestation which is the period of facial prominences fusion. The needle could hurt the fetus and cause a facial cleft.

Conclusion: This presentation does not call into question MultiFetal Pregnancy Reduction which is an accepted procedure nowadays. MFPR allows to increase the chance of a successful, healthy pregnancy during a high risk multifetal pregnancy. However, this act is not devoid of risk. In our present case, MFPR could explain the etiopathogenesis of this paramedian cleft of the lower lip because it is the only significant antecedent of this child. And it would be the first case report.

Disclosure of Interest: None Declared

18-11-204

SECONDARY CORRECTION OF WHISTLING DEFORMITY IN BILATERAL CLEFT LIP; REVISION OF OUR CASES

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Introduction & Objectives: Whistling deformity is a sequel of a primary surgical repair of bilateral cleft lip that leads to vertical tissue deficiency and a non-functional orbicularis oris muscle in the medial portion of the upper lip. The ethiology consist on an improper anatomical repair of the vermillion and filtrum, and the absence of continuity of the orbicularis oris muscle. This defect also can be accentuated due to improperly lateral attachment of muscles, producing a bulge in the lateral lip segments.
Material & Methods: We present eight patients who required surgical correction of their whistle deformity. All of them presented a tight and wide filtrum, and inadequate muscle repair of the orbicularis oris muscle. All of them were unable to whistle and presented unsatisfactory aesthetics and functional results of their primary lip repair. The surgical repair consists in a reduction of the prolabium tissue and an anatomical muscular reattachment with additional narrowing of the alar base when required.
Results: Eight patients aged between 5 and 14 years were treated in our Maxillofacial Surgery department between 2010 and 2018. All patients had satisfactory results with no intra or postoperative complications. There was a significant decrease of the philtrum width and increase of length and improvement of the vermillion shape. All the patients refer a very good to excellent improvement on their lip function and shape.
Conclusion: The use of the prolabial skin to reconstruct the central part of the lip is an ancient technique that is not currently in use because it leads to an unnatural shape and poor function of the lip. This problem has been solved in a single operation restoring both orbicularis oris and lip function and normal anatomy, with good aesthetic and functional results in our patients.

Disclosure of Interest: None Declared

18-11-205

A STUDY TO REVEAL VARIATION OF THE COMMON FACIAL VEIN, INCLUDING ITS RELATION TO IMPORTANT LOCAL STRUCTURES, WITH REGARD TO FACIAL RECONSTRUCTION

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Introduction & Objectives: Recipient vessel selection for free flap reconstruction depends on numerous factors and may be limited due to previous treatment. Currently, little evidence is available regarding the anatomy and reconstructive potential of the common facial vein (CFV), a tributary of the internal jugular vein (IJV). The aim of this project was to investigate the CFV and its tributaries in cadaveric specimens, to consider the CFV as a potential recipient vein in free flap reconstruction.
Material & Methods: The study was conducted by dissecting 17 embalmed neck hemi-sections in the Keele University Medical School Anatomy Suite. Our primary endpoint was to describe the gross anatomy of the CFV in terms of diameter and relation to surrounding structures. Specimens were of white Caucasian origin ranging from 66 to 97 years of age and 10 of the hemi-sections were left-sided. Measurements were collected relating to the CFV and its surrounding structures.
Results: Most notably, we found the mean diameter of the CFV to be 5.9 (± 1.8) mm and the mean distance of the CFV insertion point into the IJV from the level of the hyoid bone was 8.0 (± 4.0) mm.
Conclusion: The diameter of the CFV could accommodate for end-to-end anastomoses to be formed with the IJV system, as well as end-to-side anastomoses. The diameter also suggests the vein to be appropriate for microvascular anastomosis with commonly used free flaps. Furthermore, the results propose that the CFV can be found within 1.2 cm of the level of the hyoid bone, knowledge of which could reduce operative time and site morbidity. These findings support the CFV as a potential recipient vein in free flap reconstruction of the head and neck.

Disclosure of Interest: None Declared

18-11-206

PRACTICAL APPLICATION OF AUGMENTED REALITY IN CRANIOFACIAL SURGERY

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Introduction & Objectives: Augmented Reality (AR) is gaining acceptance within industry as a valid training tool and technical aid in task performance. AR visors are transparents screens that do not block the surrounding scene, and allow projection of relevant information into the operator's field of vision. Their form factor is compatible with current surgical setups in that they resemble "splash shields" and allow hands-free operation. AR data can be overwhelming and distracting. Furthermore, continuous AR can have a dizzying and nauseating effect. Thus careful selection of data to display and judicious triggers for selected displays are critical to minimize distractions, reduce side-effects, and optimize computational needs. We present our experience with practical incorporation of AR in Craniofacial Surgery.

Material & Methods: Selected information for display/overlay: Volumetric ("3D")Superimposition of CT-generated Vascular Anatomy (CT Venogram), Lateral Ventricle and Third Ventricle, Osseous Contour of the forehead ("Real Contour") and Virtual Surgery Generated Osseous Contour After Fronto-Orbital Remodeling ("Desired Contour"). Additionally, the ability to display a CT scan cross section at specified locations (eg: The tip of the Bovie Cautery) was set as an engineering requirement. Intraoperative AR-specific set-up includes: AR headset, Graphics Workstation, Wireless Routing, Multiple Kinect surface scanning cameras and directional audio microphones.

Results: Data complexity requires outsourcing of 3D models to a Graphics Workstation with wireless transmission to the headset. Several simultaneous computer tracking processes are discussed. Voice Controlled triggers and Proximity Triggers incorporate well to the surgical workflow. Semi-manual registration is feasible in the craniofacial area due to the profusion of external landmarks. Wide surgical exposure (widefield draping) are necessary to allow real-time reconstruction of the scene and real time registration.

Conclusion: AR has immediate applications in Craniofacial Surgery. We have identified several low-complexity computational processes that run paralled to the surgical workflow and provide relevant information to the operator. Future, higher complexity processes incorporating real time scene reconstruction, pose reconstruction (of surgical instruments library), deformable model registration (patient soft tissues), motion tracking of the operator and assistants could allow further practical applications, and provide building blocks for a universal dataset of surgical interventions.

Disclosure of Interest: None Declared

DAY18 - STATION 12 - CRANIOSYNOSTOSIS/ COGNITIVE

18-12-208

EVALUATION OF A PEDIATRIC FACIAL PARALYSIS EDUCATION AND FAMILY SUPPORT DAY

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Introduction & Objectives: Facial paralysis impairs the mimetic functions of the facial musculature. In pediatric patients, free functioning muscle transfer neurotized with an intact contralateral facial nerve is the gold standard for smile reanimation. In response to requests from families of children with facial paralysis for greater contact with other families, the Division of Plastic and Reconstructive Surgery at the Hospital for Sick Children hosted an inaugural "Facial Paralysis Family Day." The objective of this day was to create an opportunity for current and former patients of the program to come together with their families to meet, exchange stories, and build support networks.

Material & Methods: This study was a Quality Improvement Project to conduct a needs assessment and evaluate the feasibility and satisfaction of implementing a family support intervention for individuals living with facial paralysis. The first phase consisted of a pre-event survey questionnaire to conduct a needs assessment of interested families and tailor the organization of the event. The second phase consisted of a post-event evaluation questionnaire.

Results: The needs assessment demonstrated that families were most interested in learning about advances in medicine, engaging in therapy and coping sessions and meeting other young adults who have had smile reanimation surgery. The post-event questionnaire indicated that 100% of attendees enjoyed Family Day and 95% would attend next year. The questionnaire also indicated that Family Day addressed the key needs identified, with excellent ratings for the presentation discussing advances in medicine (100% rated "good" or "very good"), the therapy sessions (92% rated "good" or "very good"), the coping sessions (100% rated "good" or "very good") and the presentations by patients and their families about smile reanimation surgery (100% rated "good" or "very good.") Lastly, attendee comments indicated that families found it highly valuable connecting and networking other families. Two areas of improvement revealed by the post-event questionnaires were elaborating further on medical advances in the field and facilitating interactions between families using structured techniques such as icebreakers.

Conclusion: This inaugural Facial Paralysis Family Day provided patients and families living with facial paralysis an opportunity for education, support and networking. Attendees especially valued the opportunity to meet other adolescent and adult patients and their families also living with facial paralysis. Overall, this event was well regarded by attendees and will likely be repeated at our institution and serve as a valuable resource for other hospitals planning to organize a similar family day for facial paralysis patients.

Disclosure of Interest: None Declared

18-12-209

CHILDREN'S UNDERSTANDING OF THEIR CRANIOFACIAL DIAGNOSES

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Introduction & Objectives: Children with craniofacial diagnoses often require long term complex care with multiple specialists. Frequent surgeries and office visits can be overwhelming and confusing to both children and parents. While parents may understand the purpose of multiple appointments, it is not known how children comprehend their medical care.

The purpose of this study is to explore children's understanding of their craniofacial diagnoses and whether differences in understanding exist among children with different diagnoses. We also explore the desire to receive additional information and the preferred format for patients at a tertiary referral center in the United States.

Material & Methods: From 2016-2017, 100 patients age 5 to 18 years voluntarily participated in a one-time survey during their regular craniofacial clinic evaluation. Questions included reason for clinic visit, child's awareness and knowledge of diagnosis, if child received information about diagnosis from parent/caregiver, if peers questioned them about their diagnosis, and child's desire to learn more about diagnosis including preferred format of education.

Results: : The mean age of pediatric responders was 9.5 yrs; 54% male, 46% female and 52% Caucasian. Diagnoses included 60% cleft lip with or without cleft palate, 11% cleft palate, 21% craniosynostosis, 8% craniofacial syndrome.

The majority of patients (87%) stated their parents had talked to them about their medical condition, with 59% clarifying their parents explained some information about the medical condition. Almost one third responded they did not retain that information. A greater proportion of children with craniosynostosis did not know their medical condition compared to other groups. 60% of patients who received education regarding their medical condition were able to name / partly name / explain their diagnosis. 45% did not receive any information from parents and did not know their medical diagnosis. 62% wanted to learn more about their difference. Talking to parents was the most endorsed option of learning (79%), followed by reading a book (64%), talking to the doctor (54%), and watching a video (51%). When surveyed if peers asked about their condition, 49% responded affirmatively.

Conclusion: Pediatric craniofacial patients' whose parents involved them in discussing their diagnoses demonstrated increased awareness of reasons for medical appointments and treatments. Most children indicated their desire to learn more about their craniofacial conditions. Health care providers should talk to parents at office visits to insure they are regularly providing their children with developmentally appropriate education about their diagnosis and to offer opportunities for parents and their child to learn more about the child's diagnosis.

Disclosure of Interest: None Declared

18-12-210

SENSITIVITY AND SPECIFICITY OF PARENTAL REPORT OF CONCERN FOR IDENTIFYING HEARING AND LANGUAGE DIFFICULTIES IN INFANTS WITH CRANIOFACIAL DIAGNOSES

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Introduction & Objectives: Previous research has identified that the clinical symptoms of hearing loss in infants, particularly otitis media with effusion, are not easily identified by parents. Late diagnosis of hearing loss associated with otitis media with effusion can have implications for children's communication development. We present the first known study into the sensitivity and specificity of parental concern and hearing and communication development in children with craniofacial diagnoses.

Material & Methods: A prospective study of parental concern related to hearing and communication development in infants, indicated on the Oxford Craniofacial Unit Pre-Clinic Questionnaire (June 2017–December, 2018) was undertaken. Parents completed the questionnaire at their child's multidisciplinary craniofacial clinic appointment. All children subsequently underwent assessment of their language and hearing prior to their craniofacial surgery as part of the Oxford Craniofacial Unit pre-operative assessment protocol.

The areas of concern were then correlated with the results of a standardised, guided parent questionnaire related to children's communication development, and the child's audiological assessment. To investigate the predictive value of parental concern related to hearing loss and communication difficulties, sensitivity and specificity values were calculated.

Results: Communication assessment data were available for 46 infants: (18 females, 28 males). 26% (n=4) of parents had concerns about their child's communication development. Results indicated that 22% (n=10) children had early communication difficulties. The sensitivity of parental concern about communication difficulties was low 22% and specificity was 11%. A significant association was found between the parents with no concerns about their child's language development and age-appropriate communication results (*p=0.0326*).

Hearing data were available for 41 infants: 12% (n=5) of parents had concerns about their child's hearing. Analysis of audiology assessments indicated that 29% (n=12) infants had hearing difficulties. The sensitivity of parental concern about hearing impairment was low at 8%; specificity was 10%. No significant association was found between parents who did not have concerns about their child's hearing and had appropriate hearing (*p=0.5263*).

Conclusion: Results reinforce the importance of hearing and communication screening in infants, because if parental concern alone was relied on, 92% (n=11/12) of children with hearing difficulties and 66% (n=8) of children with communication difficulties would have been missed.

Disclosure of Interest: None Declared

18-12-211

THE SENSITIVITY AND SPECIFICITY OF PARENTAL REPORT OF CONCERN FOR IDENTIFYING LANGUAGE DISORDER IN CHILDREN WITH CRANIOFACIAL DIAGNOSES

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Introduction & Objectives: In the United Kingdom, the four NHS-designated Craniofacial Units currently undertake regular surveillance of children's speech and language at key developmental milestones in accordance with a national protocol, and as required when indicated by clinical need.

The current study aimed to determine whether parental concern with regard to communication is sufficiently specific and sensitive enough to determine the presence of language disorder in children with craniofacial conditions.

Material & Methods: A retrospective review of parental concern related to hearing, speech development, behaviour, physical development, concentration, school and friendships indicated on the Oxford Craniofacial Unit Pre-Clinic Questionnaire (June 2017 – July 2018) was undertaken. The areas of concern were then correlated with the results of a standardised, guided parent questionnaire about children's language development, the Children's Communication Checklist - 2 (CCC-2) (Bishop, 2003), to determine whether parental concern is specific and sensitive enough to identify language disorder in children with craniofacial anomalies.

Results: Participants were 94 monolingual English-speaking children (males=65; females=29), age range 4;00 to 13;00 years old (mean age=8;07 years old), receiving active care at the Oxford Craniofacial Unit (June, 2017 – July, 2018).

Results indicated that parental concern about behaviour was the most important factor in identifying language disorder (*p=0001*); as was concern relating to school work (*p=004*) and concern relating to concentration (*p=002*). There was a relationship between the child's father being the informant and behaviour being concerned when compared to other domains (Odds Ratio = 24.0 95% CI (1.7 to 341.0) (*p=0.019*).

The strongest predictors of language disorder were if the child was currently receiving additional support, and had an additional diagnosis. A regression model containing 3 variables of parental concern about behaviour, access to additional support and the presence of an additional diagnosis, was useful as a diagnostic tool to predict language disorder, with good sensitivity (78.8%), specificity (80.3%) and model discrimination (AUC = 0.865 95% CI (0.78 to 0.95). Importantly, parental concern about speech development alone was not sufficiently sensitive or specific to identify language disorder.

Conclusion: Results reinforce that pre-clinic questionnaires are useful for identifying areas of parental concern. Results also indicate that parental concern alone is not sufficient to identify language disorder, and that formal assessment is required. The link between behaviour difficulties and language previously reported in the literature is reinforced.

Disclosure of Interest: None Declared

18-12-213-N / 17-5-040

ORBITAL ASYMMETRY IN INFANTS WITH ISOLATED UNI-CORONAL SYNOSTOSIS PRIOR TO SURGERY

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Introduction & Objectives: Infants with isolated uni-coronal synostosis (UCS) have craniofacial asymmetry including the orbital region. One of the goals of surgery is fronto-orbital normalization. The aim of this study was to quantify the amount of asymmetry of orbital volume in infants prior to surgery.

Material & Methods: Seventy-one infants with isolated UCS (20 males and 51 females), referred to a single craniofacial clinic during the period from 2008 to 2018, were included in the study. All infants had a pre-surgical CT scanning (mean age 7.5 months; SD 3.2 months; range 0.5-13 months). An age-matched control group (n=17; mean age 6.4 months) without UCS or any other craniofacial deformities, but where craniofacial CT scanning had been performed for other reasons, was employed. Segmentation of the orbits was performed in the CT data using a semi-automatic software tool. Volumes of the segmented regions on the ipsilateral (Vi) and contralateral sides (Vc) were calculated and the amount of asymmetry was defined as A=Vi/Vc. Intra-observer reliability was determined by applying Cronbach's alpha coefficient.

Results: The gender distribution in the UCS sample was F:M = 2.6:1 showing a significant gender difference. The synostosis of the coronal suture was significantly more frequent on the right than on the left side (right:left = 2.0:1) with no gender difference. In the UCS group, mean Vi as well as mean Vc increased by about 50% within the first year of life. A similar increase was observed in the control group. In the UCS group, mean Vi was significantly smaller (about 10%) than mean Vc ($p<0.01$). The UCS group showed a significantly ($p<0.0001$) higher amount of orbital asymmetry (mean of A: 0.91; SD 0.04; range 0.8-1.1) than the control group (mean of A: 1.00; SD 0.04; range 0.9-1.1). The amount of asymmetry in the UCS group was not correlated with age and was not significantly different ($p>0.05$) according to either gender or side of coronal synostosis. Intra-observer reliability was 0.99.

Conclusion: Infants with UCS have a pronounced orbital asymmetry, in terms of orbital volume, with a significantly smaller ipsilateral orbit.

Disclosure of Interest: None Declared

18-12-214

LARGEST REPORTED ODONTOGENIC MYCOBACTERIUM ABSCESSUS OUTBREAK AND TREATMENT OF A PEDIATRIC PATIENT WITH EXTENSIVE MANDIBULAR OSTEOMYELITIS

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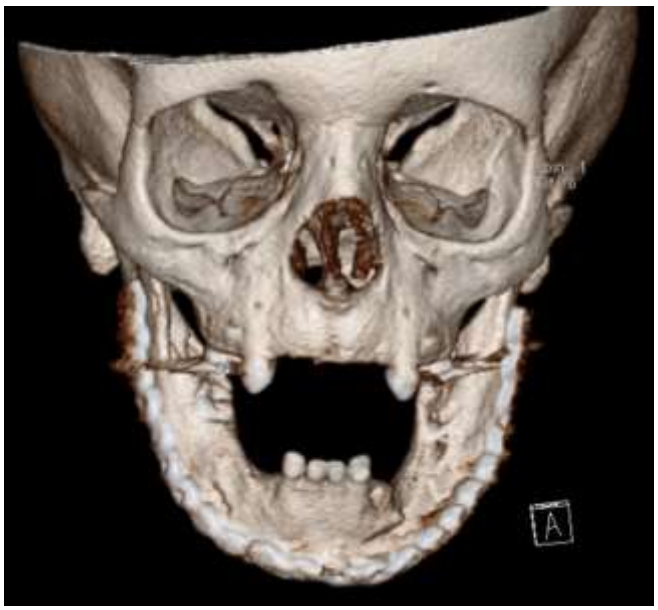
Introduction & Objectives: In 2016, water lines at a children's dental clinic in Orange County, California were contaminated with Mycobacterium abscessus (MA), a non-tuberculosis rapidly-growing mycobacterium. The objectives of this study were to assess the clinical impact of this outbreak and to determine the appropriate treatment for this, otherwise rare, aggressive dento-maxillo-mandibular infection.

Material & Methods: Mandatory reporting and active case finding directed by the Public Health Department was conducted in collaboration with community Pediatric Infectious Disease physicians for patients who underwent dental pulpotomies at the contaminated Dental Clinic from January 1 to September 6, 2016. Review of clinical, laboratory, and imaging records was performed. One case who required extensive debridement and reconstruction of the mandible was reviewed in detail.

Results: 1,089 patients were at risk; 71 cases (22 confirmed and 49 probable) were identified. Median affected age was 6 years (range 2–11). Symptoms began at a median of 85 days (range 1–409) after pulpotomy. Oral pain and/or swelling were reported in 79% (21% were asymptomatic). Of the 71 cases, 70 were hospitalized and underwent surgical debridement(s). Permanent teeth were lost in 45/65 patients who needed dental extraction (range 1–6 teeth per patient). Intravenous antibiotics were administered to 32 (45%) cases for a median length of 137 days (range 113–282 days). One selected case of a 3-year old patient is presented. CT maxillofacial demonstrated osteomyelitis extending from the right mandibular angle to the left ramus with multifocal periapical lucencies. CT chest and neck revealed numerous pulmonary nodules and bilateral cervical lymphadenopathy. Extraction of several involved teeth, bilateral selective neck dissection, and extensive mandibular debridement was performed, followed by mandibular stabilization with a custom pre-bent 2.0-mm locking plate. CT images one year post operative showed clearance of infection and sufficient bony stability. Subsequent removal of hardware and bone grafting was performed and the patient is doing well.

Conclusion: This MA odontogenic outbreak is the largest ever reported. The selected case experienced a significant delay in targeted therapy, leading to extensive mandibular involvement. In the event of a future odontogenic mycobacterium outbreak, the experience at our institution can inform multidisciplinary treatment approaches. Prophylactic extraction of primary teeth that received pulpotomies with contaminated water should be performed. Early and thorough debridement of affected bone, including enucleation of secondary teeth, should be performed if necessary for early source control.



Disclosure of Interest: None Declared

18-12-215

DIRECT TO SURGERY? SURGICAL OUTCOMES IN PEDIATRIC PATIENTS WITH INFANTILE HEMANGIOMA: A RETROSPECTIVE CASE-CONTROL STUDY

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Introduction & Objectives: The effects of medical pre-treatment prior to surgical excision of infantile hemangiomas (IH) remains understudied. This study aimed to determine if there was a significant difference in surgical complications between direct to surgery and prior medical pre-treatment of patients with infantile hemangiomas.

Material & Methods: A retrospective chart review was conducted at a pediatric tertiary center between 2007-2018. Children 0-18 years who underwent surgical resection (confirmed GLUT-1 positive IH by immunostaining) were included. Visceral and congenital hemangiomas, PHACE and Kasabach-Merritt syndromes were excluded. Pre-treatment was the primary predictor for post-surgical complications (wound dehiscence, infection, scarring, repeat surgery). Pearson's chi-squared test and Fisher's exact test were used for statistical analysis. Literature meta-analysis was additionally performed.

Results: Our institution identified 185 IH patients, 85 (46%) underwent surgical resection. Of these, 32.9% had pre-treatment (PT) (8.24% propranolol, 9.41% topical timolol, 12.94% steroids, 2.35% laser); 67.1% had no pre-treatment (NPT). Pre-surgical lesion size was comparable (median size 5cm^2, p=0.829). Surgical outcomes between PT and NPT were comparable for wound dehiscence, infection, scarring, and repeat surgery (p=0.162, 1.0, 1.0, 0.483), including pooled complications (p=0.448). Where documented, PT had higher functional improvement (p=0.039). Results were comparable when selecting for beta-blockers versus NPT (wound dehiscence p=0.573, infection p=0.468, scarring p=0.679, functional improvement p=0.005, repeat surgery p=0.672). Meta-analysis included 7 studies and 169 patients, 39.1% PT and 68.1% NPT. Most common PT was systemic/intralesional steroids. Five received beta-blockers. All patients had functional improvement where recorded. Complications were slightly higher for PT (p=0.041).

Conclusion: Incidence of surgical complications is comparable between direct to surgery and medical pre-treatment patients. This data supports early surgical management in appropriate patients, and our study proposes adding direct to surgery as a valid treatment arm in hemangioma protocols. Future directions include defining appropriate candidates for direct to surgery inclusion on our institution's treatment algorithm.

Disclosure of Interest: K. Grunzweig: None Declared, N. Goel: None Declared, C. Wee: None Declared, A. Kumar Conflict with: Polarity TE

18-12-216

CONTEMPORARY CRANIOFACIAL MANAGEMENT AND OUTCOMES OF FRONTO-ETHMOID 'IVORY OSTEOMA'

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Introduction & Objectives: Fronto-ethmoid 'Ivory Osteomas' are rare, benign, slow growing tumours. They have a slight male preponderance (M: F ratio 1.5-2.0:1) with the frontal sinus the most common site for their development. Lesions are often identified as incidental findings on routine radiographic imaging. Surgical intervention is indicated for large, symptomatic lesions, which can present with symptoms such as facial pain, headache, diplopia, vertical dystopia and orbital proptosis.

Material & Methods: The operative records of all 'Ivory Osteomas' treated at the Birmingham Supra-Regional Craniofacial Unit between 2010-18 were reviewed and are presented as a case series. The commonest presenting complaints were orbital related symptoms (predominantly proptosis, vertical dystopia and diplopia). Information collected included demographic details, surgical approach and method of reconstruction of the resulting cranial defect utilised in each case.

Results: A total of five cases (males 2: females 3, age range of 15-41 years) underwent operative intervention during this time period. All patients were managed via a multidisciplinary team approach (MDT) and resection was via an open coronal approach in all cases. In all but one case (requiring cranialisation), the frontal sinus was preserved. Reconstruction in all cases utilised existing autologous frontal bone panels removed during initial access to lesions. There were no post-operative complications or recurrences.

Conclusion: Large 'Ivory Osteoma' pose a challenge surgically in optimising the approach, resection and aesthetic reconstruction of the cranial defect and we therefore recommend that these patients be managed via an MDT utilising an open surgical approach.

Disclosure of Interest: None Declared

DAY19 - STATION 1 - NEURO/CRANIOSYNOSTOSIS

19-1-217

IATROGENIC PAN-CRANIOSYNOSTOSIS AFTER CA REPLACEMENT THERAPY: TWO CASES OF THE HYPOPHOSPHATASIA

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Introduction & Objectives: Relatively rare congenital bone metabolic disease, one to 100,000 - 150,000 birth, hypophosphatasia is diagnosed in infancy, by a low calcification of the bone, or rickets-like symptom on X-ray, and a decreasing serum alkaline phosphatase (ALP) level of the blood. Pyrophosphoric acid, accumulated by a slow-up of ALP, thereby inhibits calcification, and decreases local phosphorous density causing rickets-like change, bone distortion, limbs shortening, hypercalcemia, bone pain, and so on. The prognosis varies by types, and the treatment has not been established, except Ca replacement therapy.

Material & Methods: Pan-craniosynostosis, as an unfavorable side effect of this symptomatic therapy, has not been well known even by the experienced craniofacial surgeons, probably because it is thought to be a part of bone transformation, when noticing its mysterious discrepancy of hard cranium with fragile limb bones, or unfortunately not encountered by a poor prognosis.

The author's purpose is to present the rare experiences to treat surgically two cases of iatrogenic pan-craniosynostosis after Ca replacement therapy for the diagnosis of hypophosphatasia.

Results: Case 1: 2 year-old female, severe perinatal type, with a gradually developing oxcephaly, transferred from 400km distant prefecture for a treatment. X-ray showed a whole skull filled with thumb printings with no sutures. The conventional forehead advancement was planned, and the neck is firmly hold during surgery, because cervical vertebrae seemed fragile against frequent convulsions. The brain was ballooning out via osteotomized gap of the cranium, proving ICP was increased. When the osteotomy went down to pteryon on both sides, the frontal bones pushed forward spontaneously.

Case 2: 2 year-old female, moderate infantile type, with a small head, short stature, and mild mental retardation. X-ray findings were same as first case. Posterior calvarial expansion was performed for releasing the increased ICP. Post-operative change was evident; she become capable of stand and calmness, and learned to say two words sentences.

Conclusion: Some report in Japan, this iatrogenic complication may be appeared in 15.5% after providing Ca drugs. And we, craniofacial surgeons need to know this causal relationship in medication to hypophosphasia and craniosynostosis.

Disclosure of Interest: None Declared

19-1-218

ATLANTOAXIAL ROTATIONAL SUBLUXATION. A RARE COMPLICATION AFTER PEDIATRIC CRANIOFACIAL PROCEDURES. A SINGLE SURGEONS EXPERIENCE SPANNING 3 DECADES

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Introduction & Objectives: The management and presentation of post-operative neck pain and immobility after pediatric craniofacial procedures is not well described. This is an infrequent condition that has been reported in patients with otopharyngeal surgeries such as tonsillar abscesses. The presence of acquired torticollis in a child should arouse the suspicion of atlantoaxial rotatory subluxation. If atlantoaxial rotatory subluxation occurs in the setting of a head and neck infection, it is called Grisel Syndrome. We present a series of pediatric patients who presented within the acute postoperative period with pain and immobility of their neck after an elective craniofacial procedure.
Material & Methods: A retrospective chart review of the senior surgeon at a single institution was performed over the last three decades. Demographics, procedures performed, and management of torticollis and atlantoaxial rotatory subluxation were included for review.
Results: 3 patients were identified with acute unilateral neck pain and immobility after a craniofacial procedure. The average age of surgery was 8 years. Patient 1: 9 year old with Saethre-Chozen syndrome. Patient 2: 6 year old with Crouzon syndrome. Patient 3: Craniofacial Microsomia (see figure 1). The average time of surgery was 4.5 hours. All patients were noted to have a side preference or neck tilt on post op day 1. Initial treatment of NSAIDS, muscle relaxants, and soft collar was ineffective. All 3 patients were admitted a inpatients for cervical traction. The average time for inpatient traction was 8 days. The average amount of outpatient halo treatment was 39 days (see chart).
Conclusion: Atlantoaxial rotary subluxation is a very rare complication after craniofacial procedures in the pediatric population. Any pediatric patient with acute perioperative neck immobility and pain should be evaluated for this condition. Initial management involves management of acute torticollis with NSAIDS, muscle relaxants, and cervical support. Prompt consultation with cervical spine surgeons is indicated to determine if inpatient traction is required or intraoperative manipulation. Often when the diagnosis of atlantoaxial rotary subluxation is made, there is a significant amount of outpatient treatment with a halo device.

Figure 1: Demographic of patients suffering from atlantoaxial rotational subluxation

	Age of Procedure	Syndrome	Procedure	Inpatient Traction (Days)	Days in Halo	OR Manipulation
Patient 1	9	Saethre-Chozen	FOA	6	36	no
Patient 2	6	Crouzon	Monobloc Distraction	8	60	yes
Patient 3	10	CFM	Rib Graft to mandible	10	22	yes

Disclosure of Interest: None Declared

19-1-219

FRONTO-ORBITAL ADVANCEMENT AS A TREATMENT FOR RECURRENT VPS FAILURE

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Introduction & Objectives: Ventriculoperitoneal shunt (VPS) placement is a common treatment for hydrocephalus. However, shunt failure often occurs, and can require multiple VPS revisions. We share our experience with a 6-year-old girl who underwent numerous VPS revisions before a fronto-orbital advancement cranial vault expansion was performed to improve ventricular compliance and eliminate the need for further VPS revisions.
Material & Methods: A 4-year-old girl with a history of Dandy-Walker Malformation, recurrent seizures, and 12 VPS revisions presented to our clinic for evaluation. The patient was overall normocephalic, with mild retrusion of the supraorbital rims bilaterally, and posterior occipital flattening. A fronto-orbital advancement cranial vault expansion was performed electively in an attempt to avoid further shunt failure. A standard bicoronal approach was used and the bandeau was advanced bilaterally. An EVD was also placed at this time.
Results: Postoperatively, unsuccessful weaning of the EVD mandated the placement of a VPS. Following this, the patient was discharged without evidence of neurological deficits. At 18 months follow-up, the patient had not required further surgical revisions of her shunt, which is the single longest amount of time she has gone without a revision.
Conclusion: While cranial vault expansion has been used to prevent further shunt failure and manage elevated ICP in pediatric patients, these cases involved either syndromic or iatrogenic craniosynostosis, not patients who were overall normocephalic. In patients with a history of recurrent shunt failure, cranial vault expansion could be considered to improve compliance of the ventricles and reduce the need for VPS revision.

Picture 1:

Disclosure of Interest: None Declared

19-1-220

RELATION BETWEEN INTRACRANIAL STRUCTURAL CHANGE AND DEVELOPMENTAL OUTCOMES AFTER DISTRACTION METHOD FOR BI-CORONAL SYNOSTOSIS

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Introduction & Objectives: Cranioplasty for patients with craniosynostosis can provide not only cosmetic improvement but also intracranial structural change. However there have been no reports about intracranial structural change after cranioplasty for bi-coronal synostosis.We previously reported postoperative change of CC ratio in patients with craniosynostosis including bi-coronal synostosis. CC ratiomeans ratio of occipitofrontal diameter to maximum length of the corpuscallosum measured on MRI imaging.In this study, we tried to clarify the relationship between intracranial structural change and developmental outcomes more than three years after distraction method.

Material & Methods: Nine patients of bi-coronal synostosiswere treated using distraction methodin our hospital between 2010 and 2018. Syndromic craniosynostosis and patients with chromosomal abnormality were excluded. Finally, 6 patients were eligible for this study.The CC ratio obtained from 178 pediatric patients with normal MRI findings of the brain was also measured as normal control.

Results: There were five male and one female patients. Mean and median age at operation was 26.5 months and 20 months, respectively. Four patients with bi-coronal synostosis were categorized in group A and two patients with bi-coronal and sagittal synostosis werecategorized in group B. Pre and postoperative mean CC ratios in group A was 36.0% (ranging from 34.6% to 37.1%) and 39.1% (ranging from 38.2% to 40.2%), respectively. The CC ratio of normal control was gradually increasing as age. The preoperative CC ratio of the patients with bi-coronal synostosis was lower than the control at any age. The ratio was normalized after surgery. No remarkable change of pre and postoperative mean CC ratios was observed in group B (39.6% ranging from 39.3% to 39.9% vs. 39.9% ranging from 39.6% to 40.3%). All patients were going to ordinally elementary school or kindergarten in group A, and all of patients in group B were going to special support school.

Conclusion: Postoperative cranial longitudinal elongation was obtained in both groups. Increasing CC ratio that reflected intracranial especially intra axial elongation was observed group A only. Normal development was achieved among all patients in group A. Although relation between normalization of the CC ratio and brain function is unknown, longitudinal elongation enough to normalize the CC ratio couldlead to good development after cranioplasty.

Disclosure of Interest: None Declared

19-1-221

SERIAL VISUAL EVOKED POTENTIALS FOR ASSESSMENT OF VISUAL FUNCTION IN CRANIOSYNOSTOSIS

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Introduction & Objectives: We aimed to evaluate the effect of craniofacial surgical intervention on the visual pathway function by comparing pre-to post-operative pattern visual evoked potentials (pVEP).

Material & Methods: A retrospective review was conducted on patients with craniosynostosis who had pre-and post-craniofacial surgery pVEP testing. The amplitude and latency of pVEP P100 component were measured and used to grade responses according to previously published classification (Thompson and Nischal-2006). Pre-and post-operative amplitude and latency and grade were compared.

Results: The study identified 63 patients (mean age at preoperative pVEP of 16.9 months, range 2 months–10 years). Preoperatively, 33 patients (52.4%) had abnormal pVEP. Nine patients had evidence of intracranial hypertension, and of these 8 (88.9%) had abnormal pVEP. Within 6 months postoperatively, 24 of 33 patients (72.7%) with abnormal preoperative pVEP developed normal postoperative pVEP, while all 30 patients with normal preoperative VEP maintained their normal results postoperatively. Significant improvement in pVEP latency in patients with broad or delayed latency waveforms was evident for subjects with preoperative grades 2-4 *(grade 2; p=0.015, grade 3; p=0.029, grade 4; p=0.007),* while significant postoperative increase in amplitude was significant for patients with abnormally low amplitude grade 3 and 5 waveforms *(grade 3; p=0.011, grade 5; p=0.029).*

Conclusion: Serial pVEP testing represents a useful tool for early detection of visual pathway dysfunction and follow up visual pathway function in craniosynostosis. Surgical intervention for craniosynostosis can result in reversal of preoperative pVEP abnormalities seen in these patients, resulting in normalization of pVEP waveform, amplitude and latency, depending on the preoperative pVEP abnormality.

Disclosure of Interest: None Declared

19-1-223

ABNORMAL COAGULATION AFTER CRANIOSYNOSTOSIS SURGERY

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Introduction & Objectives: Craniofacial surgery in children is often associated with large volume haemorrhage. Efforts to reduce this have focused upon surgical technique, coagulation testing and pharmacology through use of tranexamic acid. Despite this, transfusion of blood and/or products is often necessary. However, abnormalities in coagulation may persist into the post-operative period. We sought to review the intra-operative administration of blood and products, characterise the coagulation abnormalities occurring in fronto-facial advancement (FFA), total calvarial re-modelling (TCR), anterior cranial remodelling (ACR) and posterior vault expansion (PVE) surgeries.

Material & Methods: Retrospective review of all children presenting for FFA, TCR, ACR and PVE at a national craniofacial centre over 12 months. Anaesthetic charts were interrogated and matched with laboratory samples taken post-operatively. Data collected included age and weight at time of surgery, volume of red blood cells and products transfused, post-operative haemoglobin and coagulation screen values.

Results: 20 PVEs, 11 TCRs, 4 ACRs and 4 FFAs were performed. 7/20 (35%) of PVE children required red cell transfusion, with a median volume of 19.8 ml/kg transfused. None of those transfused had normal coagulation on D1 post-operatively. Only 15% of all children had normal coagulation on D1. 65% had abnormally low fibrinogen on D1 post-operatively, with 75% having a prolonged prothrombin time and 35% abnormal activated partial thromboplastin time. None of the transfused children had normal D1 coagulation. Median haemoglobin concentration in PVE children on D1 was 92.5 g/dL.

Among non-PVE patients, normal coagulation was present in only 25% on D1. 7 patients were hypofibrinogenaemic and a further 5 having a prolonged prothrombin time. Intra-operative cell salvage was used in 6 cases, all patients were over 25 kg. None of those receiving salvaged blood required homologous transfusion. A median volume of 17.2 ml/kg of homologous red cells were transfused to non-PVE children. The patient that did not receive blood intra-operatively had the lowest D1 haemoglobin. There was no significant difference between cell salvage and non-cell salvage groups with respect to D1 haemoglobin or presence of hypofibrinogenaemia.

Conclusion: Abnormal coagulation profiles are common among children undergoing craniofacial surgery. The exact aetiology of this is uncertain with further work necessary to determine this. There is a diversity of abnormalities present. The clinical significance of these abnormalities and correlation with post-operative haemorrhage remains to be determined. Point-of-care coagulation testing (ROTEM®/TEG®) is likely to be the optimal modality for defining the coagulopathy that develops intra-operatively.

Disclosure of Interest: None Declared

19-1-224

LONG TERM QUALITY OF LIFE AND COMPLICATIONS WITH SYNDROMIC CRANIOSYNOSTOSIS

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Introduction & Objectives: Although studies have analyzed long-term stability of cranioplasty and midface distraction with craniosynostosis, to date nobody has investigated long-term quality of life and complications in adults with syndromic craniosysotosis. The purpose of this study was to investigate the long term life in adult syndromic craniosynostosis.

Material & Methods: Among syndromic craniosynosotosis patients, the patients who had been performed cranioplasty and midface advancement and they were over 20 years of age were included in this study. We investigated the inconvenience in dailylife and the disease currently undergoing treatment as well as the presence of marriage and children.

Results: Crouzon syndrome were 9, Apert syndrome were 5, and Pfeiffer syndrome were 4 aged 22-48 years old (mean 31.4±9.2 years old). Amongthem, only one case of Crouzon syndrome is marrying, and there was only the same case where there is a child. Four cases of coronary disorder were observed in Crouzon syndrome. In Apert syndrome, two cases had visual fieldcontraction, one case with Pfeiffer syndrome and cataract was recognized. No dental problems were observed in either case.

Conclusion: Only one case is marrying, which was a small proportion compared with the average age of marriage in Japan. Significantly, it was high rate of the orbital problems that caused inconvenience in any disease. Even after completion of the series of treatments, the importance of ophthalmological follow up was suggested.

Disclosure of Interest: None Declared

DAY19 - STATION 2 - SYNDROMIC CRANIOSYNOSTOSIS

19-2-225-N / S4B-11

TWO AND THREE SEGMENTS SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION: A CLINICAL TRIAL

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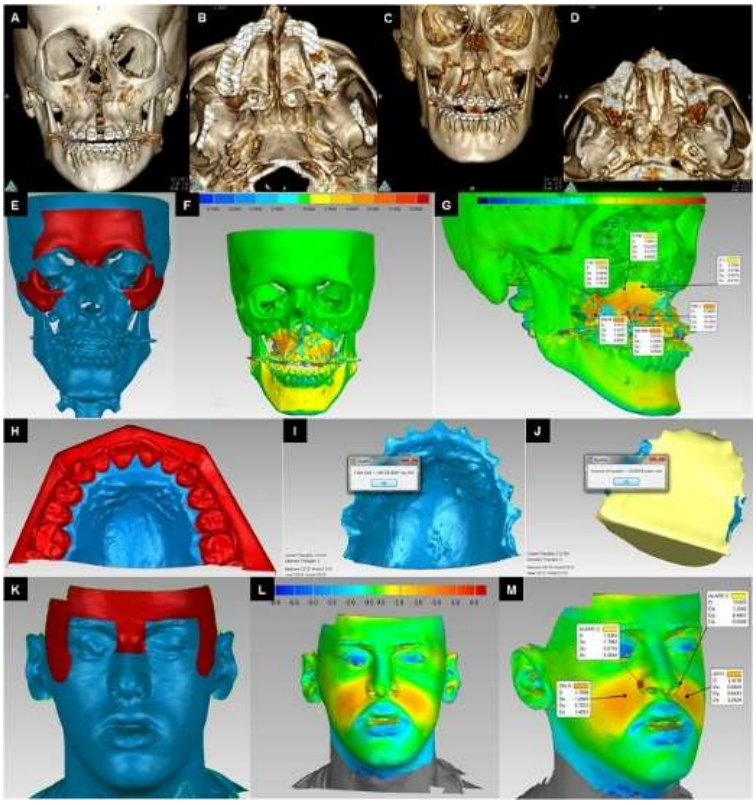
Introduction & Objectives: The literature shows no consensus on whether 2- or 3-segment SARME is the best operative technique. The aim of this study was to compare 2S and 3S.
Material & Methods: Thirty two adult patients with transverse-maxillary-deficiency ≥ 5mm were randomly assigned to groups 2S (n = 16) and 3S (n = 16). Physical and psychological assessments were carried out before SARME (PREVIOUS-PRE) and in one of the following points in time: expansion accomplishment completion (EAC), four, six and ten months after EAC. Quality of Life (QoL) was assessed according to Oral Health Impact Profile (OHIP-49) and Brazilian Orthognatic Quality of Life Questionnaire (B-OQLQ). The maxillary expansion symmetry was evaluated by computed tomography superimposition, stability of changes in palate area was measured on digital dental casts and changes in nose width and paranasal region were analyzed by examining superimposed scans of patient's face (Fig. 1).
Results: None of the tools assessing QoL showed any statistically significant difference in total scoring when comparing groups 2S and 3S. No statistically significant difference in mean values of asymmetry was found between both groups. The mean increase in palate area remained stable in both groups. The mean increase of nose width was greater (p = 0.17) in group 2S (2.73mm) than in group 3S (1.92mm). No differences between both SARME techniques were found regarding paranasal changes excepting for changes along X-axis (transversal) which were greater for in group 3S (p = 0.014).
Conclusion: Both operative techniques had positive impact on QoL as assessed in the present study with 3S SARME producing a diastema associated with lower levels of aesthetic stress; both techniques produced similar levels of asymmetry after expansion, the increase in palatal area remained stable in both techniques, the major alterations in the paranasal regions occur in the anteroposterior direction and 2S SARME produced a larger increase in nose width. Clinical Trials -NCT02179593 "Effectiveness of SARPE with 3 and 2-segment technique: a randomized clinical trial".



Disclosure of Interest: None Declared

19-2-226- N / 18-3-130

BEYOND VIRCHOW: UNDERSTANDING THE GROWTH VECTORS OF ISOLATED SAGITTAL SYNOSTOSIS IN INFANTS

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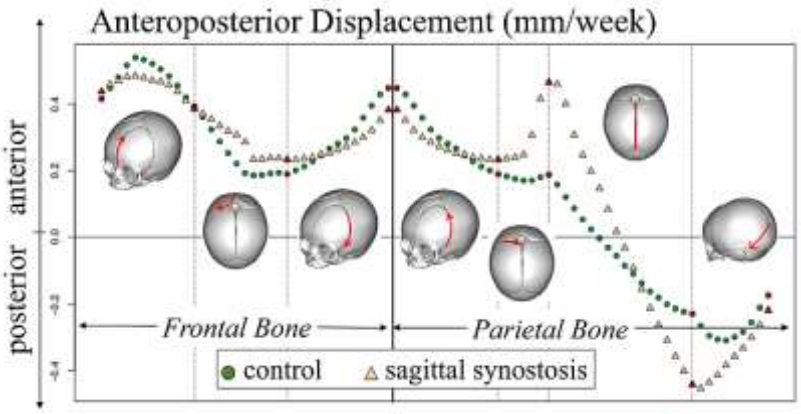
Introduction & Objectives: Virchow's rule of 1851 explains the scaphocephaly of sagittal craniosynostosis (SCS) but does not describe the unique compensatory growth in surrounding areas. Our objective was to quantify the differential osteogenesis at major sutures in the first six months of an SCS series using data-driven methodology.

Material & Methods: 81 pre-operative CT exams of SCS patients less than six months old and 117 normal age-comparable CT exams were annotated with standard craniofacial landmarks. We applied diffeomorphic registration algorithms from ANTs image analysis toolbox to produce normal and SCS population shape templates. Growth lines were fixed to anatomical landmarks and population shape templates were warped to match the model predictions for each week of age up to 6 months. The growth at the suture sites were quantified at equally-spaced points along the edges of the frontal and parietal bones.

Results: Bone deposition at the coronal sutures was primarily directed anteriorly into the frontal bone in both groups. At the confluence of the metopic and coronal sutures, inward growth was greater in SCS resulting in earlier closure of the anterior fontanelle. The fused parietal bone plate demonstrated increased rate of bone deposition in an anterior-posterior direction, but decreased superoinferior and mediolateral growth compared to normal. The majority of the posterior growth was at the confluence of the sagittal and lambdoid sutures.

Conclusion: Our results using novel shape analysis methods are consistent with clinical observations reported by Delashaw, Persing and Jane in 1991. They support the theory that SCS results in asymmetric bone deposition at contiguous sutures that is directed away from the fused bone plate at a greater rate the more proximal to the point of fusion.



Disclosure of Interest: None Declared

19-2-227

THE MIDFACE REVISITED: OUTCOMES OF INTRACRANIAL VERSUS SUBCRANIAL APPROACHES TO THE FRONTOFACIAL SKELETON

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Introduction & Objectives: Craniomaxillofacial procedures with intracranial approaches can be effective for correcting craniofacial dysplasias through multidimensional movement. However, these procedures are often avoided due to high reported rates of complications. The purpose of this study is to compare intracranial and subcranial procedures to confirm outcomes and safety.

Material & Methods: Retrospective review was performed of patients who underwent frontofacial procedures between 2009 and 2018. Intracranial cohort included monobloc distraction alone or with facial bipartition (FB), FB alone and box osteotomy. Subcranial cohort included Le Fort III distraction, advancement and combination procedures with Le Fort I. Demographics, prior craniofacial surgery, operative events, complications rates, and long term outcomes were compared between cohorts. Statistical significance was determined using student's t-test at $\alpha<0.05$.

Results: Thirty-five subcranial and 30 intracranial patients were included. Subcranial patients were older (13.3±5.2 vs 10.3±4.0 yrs, $p<0.05$). Otherwise cohort demographics were similar. No significant difference was found in rates of prior craniomaxillofacial ($p=0.193$) or intracranial surgery ($p=0.340$). However, prior fronto-orbital advancement was more common in intracranial patients (63.3% vs 37.1%, $p<0.05$). Dural tears were more frequent in intracranial patients (53.3% vs 5.7%, $p<0.0001$). No significant difference was observed in fibrin glue or post-operative drain use. Table 1 list additional operative variables. Complications occurred in 6.7% of intracranial and 14.3% of subcranial patients ($p=0.319$). Two (3.1%) patients (one in each cohort) had CSF leak managed conservatively. One wound infection (1.5%) and three reintubations (4.5%) occurred in subcranial patients. One intracranial patient required reoperation for loose hardware. No cases of bleeding, seroma, or vision loss were observed. Length of stay (9.0±5.5 days) and follow-up (3.2±2.6 years) were equivalent between cohorts and no difference was observed in long term complication rates.

Table 1	Subcranial (n=35)	Intracranial (n=30)	Total (n=65)	p-value
Surgery time, hr(SD)	7.1 (3.2)	7.9 (1.2)	7.4 (25)	0.145
Estimated blood loss, mL(SD)	890 (522)	848 (476)	872 (498)	0.715
Transfusion, mL(SD)	590 (504)	741 (421)	662 (470)	0.205
Tranexamic acid, n(%)	7 (20.0)	15 (30.0)	22 (33.8)	0.012

Conclusion: Intracranial frontofacial procedures are not only effective but also as safe as subcranial techniques. Given the low associated risks, intracranial frontofacial procedures should be included in the management algorithm for complex craniofacial syndromes.

Disclosure of Interest: None Declared

19-2-228

IS IT SAFE TO USE FRONTO-FACIAL MONOBLOC ADVANCEMENT AND CUTTING GUIDES ON ADULT PATIENTS WITH A CROUZON SYNDROME?

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Introduction & Objectives: Patients with Crouzon syndrome are mainly treated during childhood by fronto-facial monobloc advancement to avoid ophthalmic, neurologic and maxillary complications. There is no reported case of a surgery on a Crouzon syndrome on adult patients in the literature. However, when faced to two cases of adult patients showing severe quality of life deterioration, our team decided to make an attempt using monobloc advancement technique. The objectives of this presentation is to assess the relevance of such an approach.
Material & Methods: Two women aged 41 and 56 presented an untreated Crouzon syndrome and suffered of exorbitism, intracranial hypertension with chronic headaches and hypoplastic maxillary. We decided to perform fronto-facial monobloc advancement with internal distraction despite their advanced age using planned surgery and cutting guides.
Results: Distraction began seven to ten days after surgery and was of 15 mm. Distractors were taken off at 6 months. Surgical treatment corrected chronic headaches, ocular symptoms due to exorbistism and hypoplastic maxillary. Patients were very satisfied with the functional and aesthetic results. We noticed that this heavy surgery was more difficult to bear by these cases than by pediatric patients.
Conclusion: Adults with craniofacial malformations have a lower self-esteem, lower quality-of-life, and less satisfaction with their facial look as compared to individuals without facial malformations. There is also an increased risk of psychosocial problems. Despite post-operative difficulties and minor complications, our two patients were very satisfied with the functional and aesthetic results. This leads to the conclusion that surgically addressing a Crouzon syndrome on adult patients via monobloc advancement is appropriate and secure when performed by a trained team.

Disclosure of Interest: None Declared

19-2-229-N / 19-8-280

APERT SYNDROME MANAGEMENT: ROLE OF POSTERIOR DISTRACTION AND MONOBLOC FACIAL BIPARTITION DISTRACTION

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Introduction & Objectives: This study aimed to review 11-year experience on Apert syndrome managment, showing a treatment redirection caused by posterior distraction osteogenesis, monobloc with facial bipartition and distraction osteogenesis and a 5 digit-separation regimen for hands reconstruction.
Material & Methods: A retrospective study was conducted on consecutive patients diagnosed by our multidisciplinary craniofacial team as having Apert syndrome who underwent surgery between 2007 and 2018. Patients with incomplete medical records and/or incomplete postoperative follow-up (< 12 months), and those who underwent immediate monobloc advancement or immediate subcranial Le Fort III were excluded from the study. Demographic data (patient gender and age when the procedure was performed), diagnosis, surgical-related data and outcome data (perioperative and long-term complications and need for additional surgery), were verified via medical records, clinical photographs, radiographic images, and interviews with all of the included patients. Management of each complication was also detailed.
Results: The present study included 69 patients who were diagnosed with Apert syndrome. Mean follow-up was 4.7 years. Patients underwent decompressive craniectomies (n=5), fronto-orbital advancement (n=9), posterior distraction (n=9), Le Fort III (n=5) and monobloc advancement (n=10). The average age for each surgery was 1.73, 1.86, 1.28, 14.40, and 10.11 years, respectively. The average length of hospital stay was 5.94 days for craniofacial surgery. Average intraoperative transfusion was 28.62 ml/kg. Mean distraction advancement was 14.21 mm. (Table 1). 210 surgeries in 69 patients were performed for digits separation. The mean age at first operation for hand reconstruction regimen was 2.2 years.
Conclusion: Posterior distraction prior to a patient reaching one year of age is a first-line procedure in our surgical regimen for these patients. Our protocol for Apert hand reconstruction enables 5-digit hand for all patients with Upton types I and II hands. Monobloc with facial bipartition and distraction osteogenesis is the procedure of choice for midface advancement.

Patient Characteristic	Decompressive craniectomies	F.O.A.	Posterior distraction	Le Fort III	Monobloc
Total number of patients n	5	9	9	5	10
Age (years)	1.73	1.86	1.28	14.40	10.11
Gender n(%) male/female	4(80)/1(20)	7(77.78)/2(22.22)	3(33.33)/6(66.66)	3(60)/2(40)	3(30)/7(70)
Days of hospitalization	5.00	5.75	5.33	5.40	7.5
Transfusion ml/kg	37.22	45.78	25.17	10.68	20.11
Length of mid face advancement (mm)	N/A	14.44	18.68	9.57	13.61
Type of distractor (%)					
External	N/A	0	100	40	100
Internal	N/A	88.89	0	60	0
Immediate advancement	0	11.11	0	0	0
Major complications** n	0	1	3	1	2
Minor complications*** n	0	3	1	1	3
Mean Follow-up (years)	11.06	5.16	2.23	4.4	5.77

*Surgical, radiologic, endoscopic treatment, or multitherapy required without general anesthesia; Surgical, radiologic, endoscopic treatment, or multitherapy required with general anesthesia; Intensive care unit treatment for single-organ dysfunction required; Intensive care unit treatment for multiple-organ dysfunction required
**Adverse event that alters the standard postoperative course without requiring a specific treatment; Pharmacologic treatment or minor intervention required

Disclosure of Interest: None Declared

19-2-231

FACTORS OF DECANNULATION AFTER LE FORT III DISTRACTION FOR SEVERE SYNDROMIC CRANIOSYNOSTOSIS WITH TRACHEOSTOMY

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Introduction & Objectives: Impaired respiratory function is one of the most crucial factors of syndromic craniosynostosis. The patients with tracheostomy are not uncommon. In such cases, we have applied Le Fort III distraction to remove the tracheostomy tube, and the results so far have been positive. This study analyzes correlations between postoperative upper airway changes, congenital bronchial disorders, micrognathia and the advisability of decannulation.
Material & Methods: Among 36 patients with syndromic craniosynostosis who have undergone Le Fort III distraction since 1998, we selected those who also had preoperative tracheal cannulation for airway obstructions.
For targeted advancement in our surgery, the elongation of maxilla was more advanced towards the U1, ANS, and A points of a healthy adult based on cephalogram results. Consolidation period is 3 months. All patients underwent X-ray cephalography both before and at one year post-surgery. Both pharyngeal airway space (PAS) and post palatal airway (PPA) were evaluated. Total pharynx volume was measured from the hyoid bone to the nasal airspace. Airway morphology was evaluated by bronchoscopy. Statistically significant were evaluated using Mann-Whitney tests with $p < 0.05$.
Results: Eleven of the 36 patients were examined. Mean age at surgery was 9 year old.Five each had Apert and Crouzon syndromes, and one had Pfeiffer syndrome. Seven of the patients underwent decannulation within one year after surgery.For patients who were capable of decannulation, the average change in PAS was +3.7mm, the average change in PPA was +7.57mm.For patients who were not capable of decannulation, the average change of PAS was becoming more narrow, -4.1mm, the average change of PPA was +6.8mm.SNB was significantly under coeval mean +2SD for one patient. P values between both groups were PAS：0.0136 and PPA：0.849. For All patients, rate of the mean change of total volume was +43.1%, rate of the mean change of “A” volume was +26.1%, rate of the mean change of “B” volume was +47.1%.Endoscopic and 3DCT Findings:For 7 patients who were capable of decannulation, congenital lower airway disorder was seen in 4 patients. For 3 patients who were not capable of decannulation, congenital lower airway disorder was seen in 2 patients. Congenital bronchial disorder was not statistically significant.
Conclusion: Le Fort III distraction is effective to achieve decannulation in patients with syndromic craniosynostosis. All patients gained upper airway volume and 7 (63.6%) of 11 patients improved via decannulation after surgery. The decannulation is significantly associated with PAS expansion and micrognathia, but not with upper airway volume and congenital lower airway disorders. Thus, Le Fort III distraction improves the chances of achieving decannulation and therefore, improves patient quality of life.

Disclosure of Interest: None Declared

19-2-232

PREMATURE AGING IN CRANIOFACIAL DYSOSTOSES ASSOCIATED WITH FGFR2 GENE MUTATIONS

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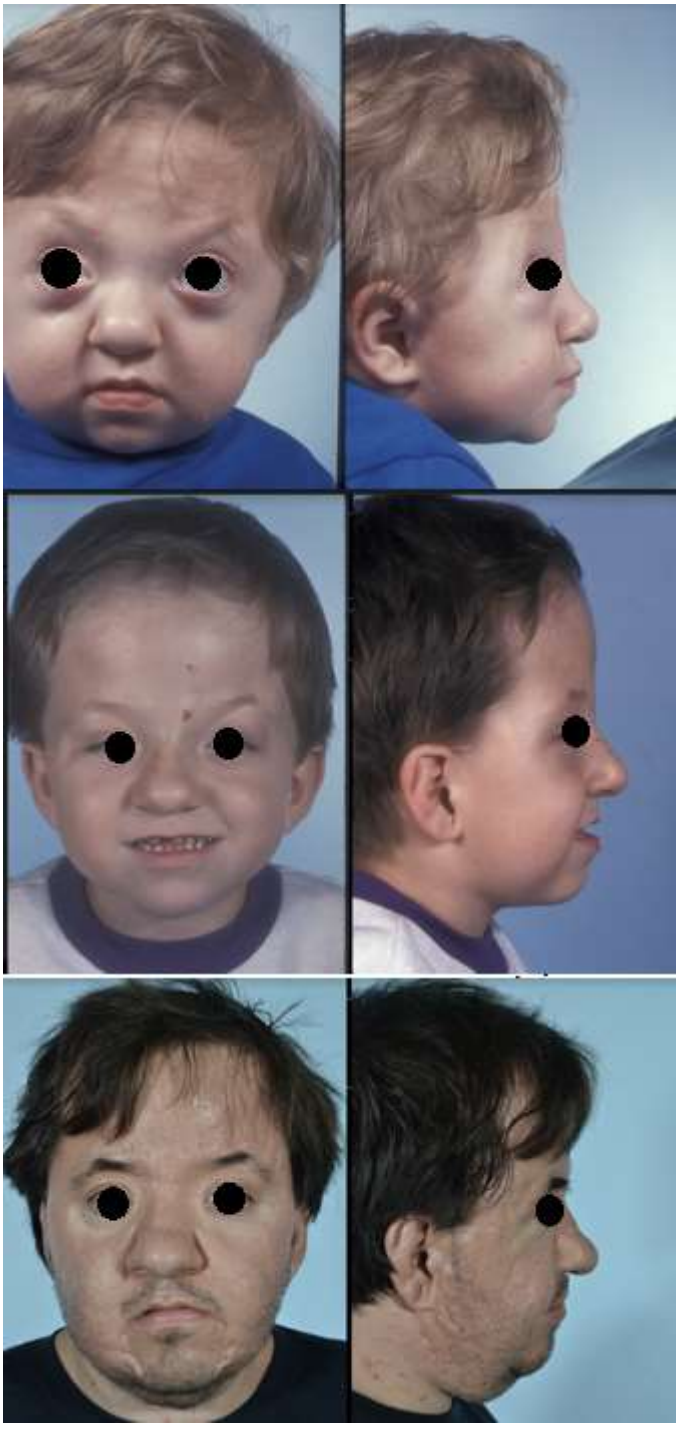
Introduction & Objectives: The treatment algorithm for pediatric craniofacial dysostoses patients entails a posterior distraction or expansion and fronto-orbital advancement at 6 months, a monobloc or facial bipartition at age 6 or 7, and in most cases a Le Fort I at age 17 or 18. What happens next in the treatment algorithm is unknown territory. Guidelines for surgical management of craniofacial dysostosis in aging patients have not been delineated, although the genetic basis of these diseases suggests problems associated with the aging process. Mutations in the fibroblast growth receptor 2 (FGFR2) gene have been identified in craniofacial dysostoses such as Apert, Crouzon and Pfeiffer syndromes, which are conditions causing craniosynostosis. Mutations in the FGFR2 gene have also been associated with premature aging and cell senescence. Premature aging manifests as deterioration of the skin and skeletal problems in aging craniofacial dysostosis patients. While the current craniofacial treatment algorithm gives good results in adolescents, this does not translate to good results in adults due to premature aging, and aesthetic procedures may be indicated at an early age.



Material & Methods: All patients who underwent surgical correction of craniofacial dysostoses syndromes associated with mutations in the FGFR2 gene between January 1, 1975 and January 1, 2018 were identified. Retrospective chart review was conducted to determine eligibility into the study. Inclusion criteria included a diagnosis of Apert, Crouzon, or Pfeiffer syndromes. A cohort of patients with long-term follow-up results (n=30) was identified and outcome measures such as skin quality (the presence of facial rhytides or acne) and follow-up aesthetic procedures were evaluated.

Results: Evaluation of the long-term results of craniofacial dysostosis patients reveals that premature aging is a problem in craniofacial dysostoses patients with FGFR2 gene mutations. Adult patients with good results in adolescence often developed signs of premature aging including loss of skin elasticity, loss of facial volume and facial rhytides. Examination of the senior author's experience revealed that many craniofacial dysostoses patients showed signs of premature aging and some have benefitted from standard aesthetic surgical procedures such as facelifts in their 20s.

Conclusion: This study evaluates patient characteristics and long-term post-operative outcomes relating to premature aging in craniofacial dysostoses patients with FGFR2 gene mutations and provides conclusions on the surgical management of adult craniofacial dysostoses on the basis of the senior author's 44-year experience. Standard aesthetic procedures such as face lifts, brow lifts, nasal bone grafts, and genioplasties are indicated to correct deterioration of the face and maintain good results in adult patients.

Disclosure of Interest: None Declared

19-2-230-N / S2-03

ADAPTED OCCIPITAL DISTRACTION IN SYNDROMIC AND MULTISUTURAL CRANIOSYNOSTOSIS

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Introduction & Objectives: Occipital expansion in syndromic and multisutural craniosynostosis results in a higher increase in intracranial volume when combined with distraction. Distraction can be assisted with distractors or with springs. In this presentation we present our results of occipital spring distraction and the technical adaptions we made over time.
Material & Methods: All cases in which occipital spring distraction was performed between 2010 and 2019 were reviewed with regard to degree of expansion, complications and outcome. For outcome assesment, symptoms of intracranial hypertension, skull shape and tonsillar herniation were determined with the use of photo's, CT scans and MRIs.
Results: A total number of 41 cases were executed: 11 Apert, 17 Crouzon, 2 Saethre-Chotzen, 2 Muenke, 7 multisutural,
2 craniofrontonasal syndrome. In 3 the occipital expansion was combined with foramen magnum (FM) decompression because of a tonsillar herniation. In one patient a persistent csf leak required a reoperation. In two Crouzon patients increased intracranial pressure occured after one year, for which a second occipital expansion was performed. Skull morphology was improved by planning the hinge at the vault instead of the torcula, which also results in the best volume
gain of the posterior fossa. Tonsillar herniation was stable or improved, but reossification of the FM decompression was
much sooner than of the other bone defects.
Conclusion: Occipital spring distraction has a low rate of complications and can be adopted to skull shape, allowing localized volume expansion. It can be combined with foramen magnum decompression although resossification occurs rapid within this specific area. Compared to ocipital expansion without distraction, the prevalence of intrascranial hypertension in the follow-up period is decreased.

Disclosure of Interest: None Declared

DAY19 - STATION 3 - CRANIOSYNOSTOSIS/METOPIC

19-3-233

METOPIC SYNOSTOSIS: PRE AND POST-OPERATIVE EVALUATION OF CRANIOFACIAL DEFORMITY

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Introduction & Objectives: This study was designed to examine quantitatively, the preoperative main changes and postoperative corrections of the deformities of patients with trigonocephaly. Only patients that had undergone pre and postoperative CT scan measurements were included.

Material & Methods: We report on 22 consecutive cases out of 148 children with metopic synostosis who underwent a fronto-orbital advancement associated with a bone graft at the fronto-temporal area to avoid bitemporal depressions. Quantitative assessment of the deformities was carried out on standard axial-sliced CT scan images. The following distances was obtained: the intercoronal; the lateral orbital wall, the intertemporal, and the anterior interorbital. The results were compared with age matched normal standards, and analysed by Student's t tests ($p<0,05$) (Minitab 17 Software). An aesthetic appraisal of the fronto-orbital remodeling and advancement was based on family views

Results: The mean age at surgery was 13,2 months (range 5 – 38 months). Gender distribution male/female was 13/9= 1.44. The preoperative assessment of the tomographic measurements compared to the age matched control, showed: intercoronal 74% of the normal, the lateral orbital wall 85% of normal, the intertemporal 83% of normal, and the anterior interorbital 71% of normal. The post-operative measurement presented with improvement of all distances and comparing to the normal age matched values: intercoronal was corrected to 105%, the intertemporal increased to 104%, the lateral orbital wall improved to 98%, and the anterior interorbital was significantly increased ($P<0,05$) but remained undercorrected at 94% of the normative data. In only two patients some degree of fronto-temporal depression was a concern.

Conclusion: The fronto-orbital remodeling and advancement promotes a true correction of the craniofacial deformities in the metopic synostosis but hypotelorism remains under corrected.

Disclosure of Interest: None Declared

19-3-234

WHAT CRANIOMETRIC MEASURE BEST DEFINES METOPIC SYNOSTOSIS?

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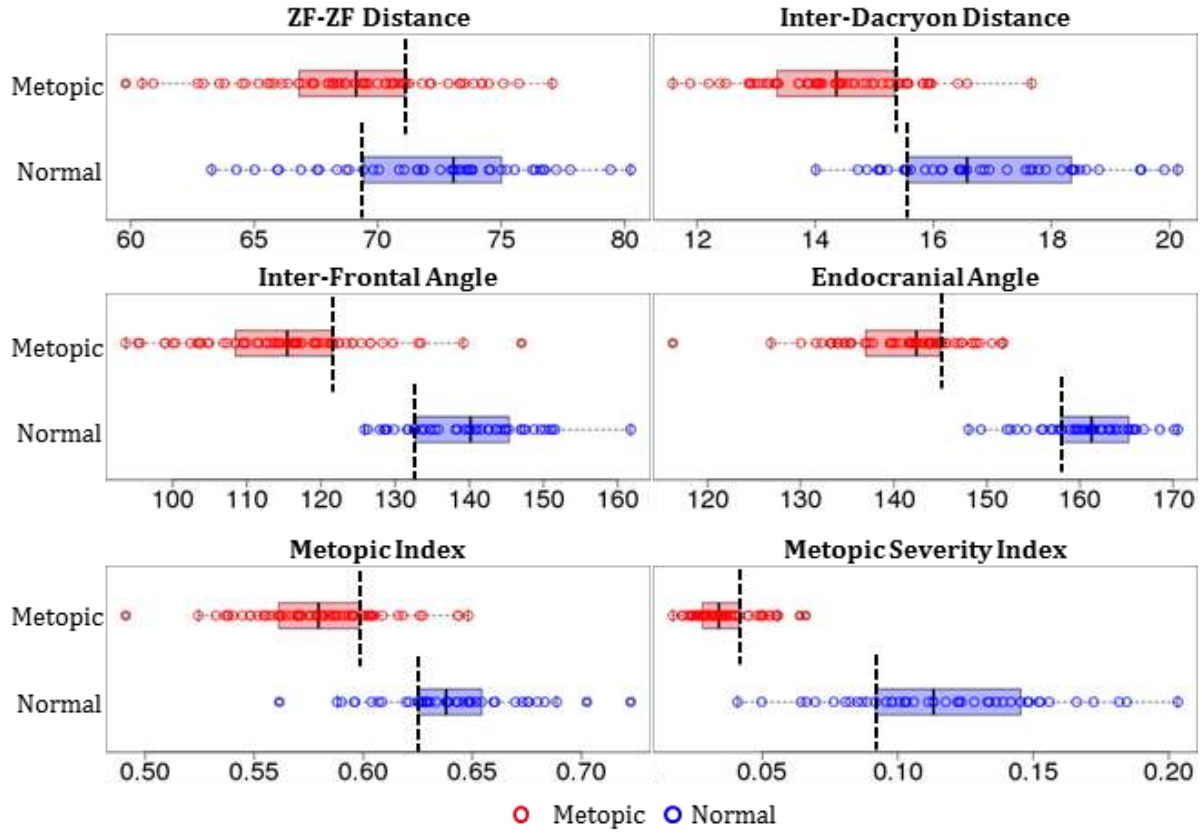
Introduction & Objectives: Metopic synostosis can be a challenging diagnosis, and must be distinguished from metopic ridge and other normal conditions. There are a number of craniometric measures in the literature used to define severity of metopic synostosis and treatment goals to normalize the anatomy. The purpose of this study is to compare the effectiveness of these measures in separating metopic synostosis from normal cases.

Material & Methods: An interdisciplinary team of surgeons and geneticists clinically diagnosed patients with metopic synostosis in preparation for surgical treatment. CT scans of 65 consecutive pre-surgical metopic synostosis cases and 50 age-matched control patients were digitalized and landmarked for six described measures of trigonocephaly: interzygomaticofrontal (IZFD) distance, interdacryon (IDD) distance, interfrontal angle (IFA), endocranial angle (ECA), metopic (MI) and metopic severity (MSI) indices. Statistical t- and U-tests were used, with significance determined as $p<0.05$.

Results: IZFD and IDD demonstrated the least separation of normal and metopic cases and the greatest variability. IFA and ECA had greater separation of the two groups, with ECA having improved selectivity. MSI had the least variation among the metopic cases and the best separation from normal.

Conclusion: Linear distance measures (IZFD, IDD) are not reliable measures of metopic synostosis. Although angular measures (IFA, ECA) separate metopic from normal, ECA had improved definition. Metopic Index was not as effective as ECA, but the most specific measure examined was the Metopic Severity Index (MSI). From our results, we will be using ECA and MSI as reliable measures to diagnose metopic synostosis, and to evaluate success of normalization after surgery.



Disclosure of Interest: None Declared

19-3-235

HOW MUCH ORBITOFRONTAL DIFFERENCE ATTRACTS ATTENTION? USING EYE-TRACKING AS A PROXY FOR PERCEPTION OF DEFORMITY DUE TO METOPIC CRANIOSYNOSTOSIS

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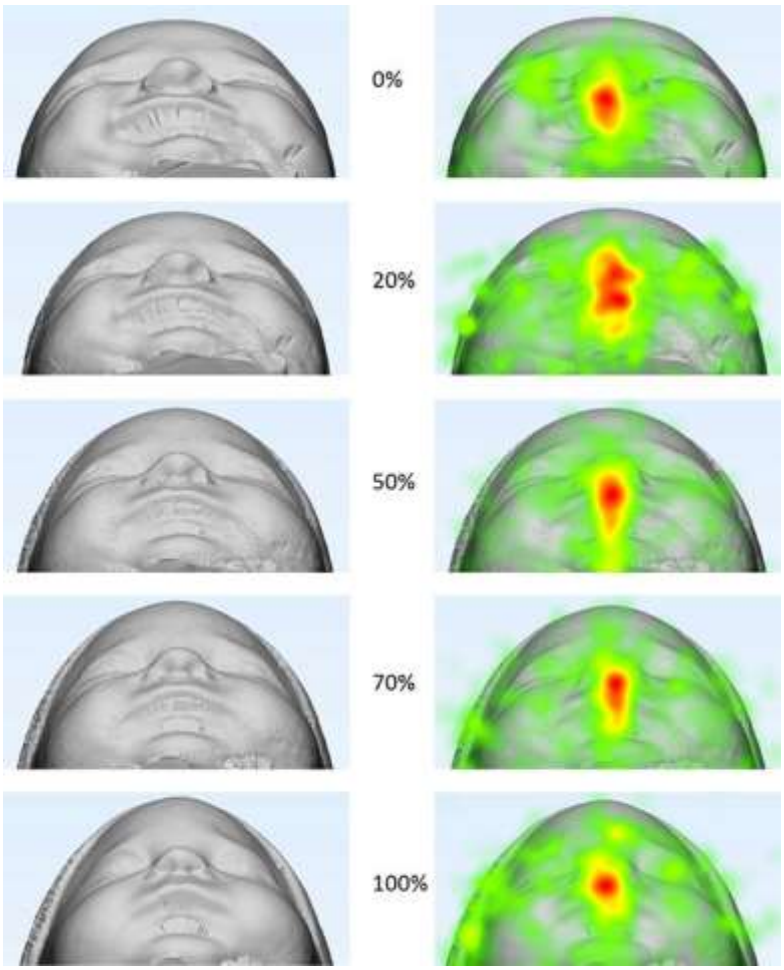
Introduction & Objectives: Premature fusion of the metopic suture leads to a distinctive trigonocephalic head shape. A major goal of surgical treatment is to eliminate social stigmata associated with severe deformity, yet the severity which captures unwanted attention is unknown. Researching this threshold of human attention is important considering that orbitofrontal deformity occurs along a wide spectrum in metopic synostosis, and surgeons intervene at different points. This study aimed to investigate the point at which such deformities are perceived, utilizing eye tracking methodology.

Material & Methods: 3D photogrammetric images of a normal child and a child with severe trigonocephaly were used as endpoints for the orbitofrontal deformity spectrum seen in metopic craniosynostosis. These images were then utilized to mathematically deform, in 10% increments, the amount of deformity between these endpoints, creating a smooth spectrum. This set of images was shown to graduate student subjects from multiple angles (front, bird's eye, worm's eye views) using an eye tracking device (Tobii Technology, Reston, VA). Subjects' gaze patterns were analyzed for total fixation duration on standardized areas of interest (AOIs) related to the midline metopic ridge and the lateral supraorbital areas. Subjects were also asked if each image shown looked "normal" or "abnormal."

Results: 66 graduate students were shown a random order of the images. The average dwell time of the ridge and supraorbital AOIs increased proportional to deformity, with an average of 0.77±0.33 seconds (s) at 0% deformity, 0.85±0.46 s at 50%, and 1.08±0.75 s at 100% deformity. ($p < 0.0001$). Until 90% deformity or greater, there was no significant agreement between subjects' stating abnormality, from any angle. The worm's eye view had the most agreement, with 20% or fewer subjects noting "abnormal" until 90%. At 90 and 100%, 45% ($p=0.005$) and 65% ($p<0.0001$) of participants noted "abnormal," respectively.

Conclusion: Eye tracking can successfully be used as a proxy for attention threshold and perception in evaluating the spectrum of orbitofrontal deformity. The amount of attention given to the deformity increased proportionally with increased severity, and the most sensitive viewpoint was from the worm's eye. Whether surgeons have a lower perception threshold for deformity was not studied, but laypersons noted head shape deformity only when the amount was relatively severe. This points towards the need for more research to elucidate the relationship between gaze and perception of craniofacial abnormalities.



Disclosure of Interest: None Declared

19-3-236

ASYMMETRIC CRANIECTOMY VERSUS VASCULARIZED PERICRANIAL FLAP IN PREVENTING PERSISTENT CRANIAL DEFECTS AFTER SAGITTAL CRANIECTOMY

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Introduction & Objectives: Some craniectomy defects resulting from sagittal craniectomy for craniosynostosis never completely close and may require cranioplasty. We have tried several methods to minimize persistent cranial defects. One has been to create asymmetric craniectomies that are narrower posteriorly. Another has been to strip the outer pericranium from the explanted skull, keep it attached posteriorly, and sew it to the exposed dura as a vascularized flap. This study compares the results of these techniques versus traditional rectangular craniectomy in preventing persistent cranial defects.

Material & Methods: Subjects who underwent primary open sagittal craniectomy with biparietal morcellation (with/without frontal bone remodeling) for single-suture nonsyndromic sagittal synostosis Mar 2013 - Jan 2017 were retrospectively identified from an IRB-approved prospectively-acquired database. Surgeries were divided into 3 categories: 1) standard craniectomy, 2) asymmetric craniectomy and 3) craniectomy with pericranial flap. Charts were reviewed for the number and total area of skull defects at the craniectomy site one year after surgery. Subjects were excluded if there was a dural tear at the craniectomy site, if they had no 1-year followup or if they had unmeasured and/or uncounted skull defects. As only the presenting author used pericranial flaps, and didn't initially always document doing so, standard craniectomies performed by this surgeon were excluded.

Results: We reviewed 121 cases, excluding 75: 34 by the presenting author, 29 with no 1-year followup, 6 with unmeasured/uncounted defects, and 1 in which the subject later developed bicoronal synostosis. This left 28 standard craniectomies, 10 asymmetric craniectomies, and 13 pericranial flaps. One year after surgery, 19 (68%) subjects who underwent standard craniectomy had defects averaging 8.3 cm^2 in total area. 3 (30%) who underwent asymmetric craniectomy had defects averaging 17.1 $cm.^2$ 5 (38%) who had pericranial grafts had defects averaging 5.7 $cm.^2$ The difference in number of subjects with defects was significant between the standard and asymmetric craniectomy groups (p=0.037) and approached significance between the standard craniectomy and pericranial flap groups (p=0.076). There were no significant differences in defect area, age at surgery or craniectomy width between any groups.

Conclusion:

Making the craniectomy narrower posteriorly and sewing a vascularized pericranial flap to the exposed dura may protect against persistent bony defects after sagittal craniectomy with biparietal morcellation. More cases are needed to confirm these conclusions. Longer followup is needed to determine if these techniques lead to lower rates of cranioplasty in children who undergo sagittal craniectomy as infants.

Disclosure of Interest: None Declared

19-3-237

THE METOPIC HINGE: A TECHNIQUE FOR ANTERIOR VAULT REMODELING IN METOPIC CRANIOSYNOSTOSIS

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Introduction & Objectives: The incidence of metopic craniosynostosis has increased over the past several years and it is now cited as the second most common type of craniosynostosis, both in the United States and abroad. Treatment of this condition involves significant surgical intervention, typically performed on children under the age of one. Surgical outcomes such as blood loss and operation time are particularly important for this young age group, and even minor improvements can represent a significant benefit for these children. The hinge technique aims to offer another tool to improve these outcomes. While traditional surgical intervention involves classic fronto-orbital advancement with complete removal of the frontal bandeau, the “hinge” technique maintains continuity with the frontal bar, left pedicelled at the bilateral temporal Tenon’s.

Material & Methods: A retrospective review was performed for children (less than 12 months of age) who underwent anterior vault reconstruction for metopic synostosis between June 2015 and August 2018. Patients were excluded if they had multi-suture craniosynostosis or significant morbidities. Twelve patients were included in the study, six of whom underwent surgery with the addition of the hinge technique (2/3 male, mean age 10 months at surgical intervention), and six whose surgeries did not include the hinge (100% male, mean age 9 months at surgical intervention).

Results: Operative time is significantly decreased when the hinge technique was utilized, with a mean operative time of 159 minutes for hinge patients and 193 minutes for non-hinge patients ($p= 0.049$). Hardware was also significantly decreased from an average of 2.2 plates and 35 screws in non-hinge patients to an average of 1 plate and 20 screws for hinge patients ($p < 0.02$). As a result, the average savings on hardware alone when surgeries were performed with the hinge method was $2,990 per surgery ($p=0.019$). While there was a decreased mean blood loss for hinge patients (458ml for hinge patients, 490ml for non-hinge), this outcome was not statistically significant.

Conclusion: The hinge technique for the treatment of metopic synostosis is associated with a statistically significant improvement in operative time, hardware utilization, and materials cost. This technique appears to improve upon important surgical outcome measures for this population, however further research will be required to better understand all the implications of this technique.

Disclosure of Interest: None Declared

19-3-238-N / S8A-01

THE CC-UK: DEVELOPMENTAL OUTCOMES IN CHILDREN WITH METOPIC CRANIOSYNOSTOSIS AT 7 AND 10 YEARS OF AGE

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Introduction & Objectives: The CC-UK is a nationally-led Psychology screening protocol which collates patient data across the 4 Highly Specialised Craniofacial Centres in the UK (HSCC).

Findings indicate neurodevelopmental test scores within average range for children with single suture Craniosynostosis (SSC). However, risk of delays in development and learning are heightened amongst this group. To date, these findings have included SSC populations as a whole, with little consideration to individual diagnoses. Metopic synostosis (MS) is the second largest cohort of children with SSC. This study is the first to consider the developmental and behavioural outcomes of children with MS at age 7 and 10 years.

Material & Methods: Developmental and behavioural data for MS patients at 7 (N = 68, 70.6% Male) and 10 years (N = 43, 81.4% Male) were collated across the HSCC. Self, Parent and School versions of several validated and standardised measures, as per the CC-UK protocol, were distributed at set age intervals. The significance threshold was set at 0.5. Individuals with syndromic diagnoses, genetic conditions, diagnosed learning disability, co-morbid neurological diagnoses, as well as un-operated patients, were excluded.

Results: Response rates varied across measures and age points (30.2% - 86%). Scores for developmental and behavioural outcomes were analysed for MS children aged 7 and 10 years and compared with normative data of age-matched peers**.** There were no significant differences in cognitive function for both age groups. Significant behavioural and emotional difficulties were reported by parents at 7 ($t = 3.3$, $P=.002$) and 10 years ($t = 3.7$, $P=.001$), and significant emotional difficulties on self-reported measures at 10 years were detected ($P<.05$). School measures at both age points showed no significant differences across all domains.

Conclusion: Findings revealed that children of 7 and 10 years with MS are performing within average range on cognitive developmental measures. Parent-reported measures highlighted significant differences in behavioural and emotional difficulties for children aged 7 and 10 years, with self-report also indicating significant emotional difficulties at aged 10 years. Given that these factors were not found to be significant when completed by school, further consideration to parental factors and environmental influences may be important to consider when tailoring support for MS patients and their families.

Disclosure of Interest: None Declared

19-3-239

THE OBSERVATION OF THE SPHENOID GREATER WING OF TRIGONOCEPHALY PATIENTS WITH COMPUTED TOMOGRAPHIC

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Introduction & Objectives: The sphenoid greater wing is an important component at the temporalis fossae. The patients with trigonocephaly are usually have a narrow temporalis fossae. Thus, it is necessary to explore the characteristic of the sphenoid greater wing.

Material & Methods: Patients with trigonocephaly and computed tomographic scans were accrued from the authors' craniofacial database from January 2014 to December 2016. The angle ▫▫(the bilateral lowest point of the frontosphenoidal suture and the most anterior point at the midline in the same CT slice) and ▫▫(in the above same CT slice the bilateral point of the sphenosquamous suture and the most anterior point at the midline) and the distance AB(between the bilateral lowest point of the frontosphenoidal suture in the above same slice) and CD(between the bilateral point of the sphenosquamous suture in the above same slice)were calculated. The control group was the patients who had the brain trauma without any problems in their CT scans.

Results: Nine patients with trigonocephaly were identified (male 5, female 4). The control group had thirteen patients (male 7, female 6). Average age between trigonocephaly patients (12 ± 6.1 months) and control subjects (16.6 ±4.3 months) had no significant difference (P >0.05). The average of the angle ▫▫ between two groups had no significant difference (trigonocephaly 104.72°±4.64°, control 107.45°±7.17°, P>0.05). So did the angle ▫▫(trigonocephaly 97.18°±3.42°, control 97.41°±6.46°,P>0.05) and the distance CD(trigonocephaly 94.12mm±7.84mm, control 97.67mm±9.49mm,P>0.05). But the distance AB between two groups had the significant difference(trigonocephaly 75.64mm±9.85mm control 81.61mm±6.92mm,P=0.04).

Conclusion: The anterior of the sphenoid greater wing is narrower than the posterior in the trigonocephaly patients.

Disclosure of Interest: None Declared

19-3-240

GENERATING FICTIVE TRIGONOCEPHALY DATA USING A GENERATIVE ADVERSARIAL NETWORK TO PRODUCE DATA TO TRAIN DEEP LEARNING ALGORITHMS

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Introduction & Objectives: Craniosynostosis is a disease in young children caused by early closure of the sutures of the skull. The earlier the diagnosis the more positive the prognosis concerning the complications during and after surgery and the results of surgery. Early diagnosis could be provided by using deep learning techniques such as neural networks to classify the cases based on 2D light photos. Nevertheless, training of neural networks requires a huge amount of data. To cope with this, another deep learning technique can be used, namely a generative adversarial network (GAN). Such a network can generate fictive data similar to the real data. For this research a GAN was constructed to see if it could generate unique fictive heads suitable for training a neural network.
Material & Methods: The data used for this study consisted of 3D data based on preoperative 3D stereophotogrammetry imaging of children with trigonocephaly. Several GANs were trained and qualified by comparing the sizes of the generated heads to the average real head. This resulted in the best version of the network. Next, the data was qualified by having professionals classify the generated heads as real or fake and by testing the generated heads in a neural network to see if the generated heads would be treated differently from the real heads.
Results: Due to a big difference in means and standard deviations only one version of the GAN was used for further qualification. All three tests performed, showed promising results for this network. The sizes of the generated heads were comparable to the sizes of the real heads (a difference of 0.71mm in the mean size and 0,22mm in the standard deviation of this mean), the professionals had difficulty to differentiate between real and fake heads and so had the neural network. The neural network used for testing showed the same accuracy (100%) and loss for both the generated and real heads.
Conclusion: Based on the described qualification tests, the fictive data generated by a GAN could be used to train neural networks to diagnose trigonocephaly.

Disclosure of Interest: None Declared

DAY19 - STATION 4 - CRANIOSYNOSTOSIS/MISCELLEANOUS

19-4-241

ANAESTHESIA FOR CRANIOPAGUS CONJOINED TWINS - LESSONS LEARNED FROM SUCCESSFUL SEPARATION OF 3 SETS IN A SINGLE CENTRE

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Introduction & Objectives: Craniopagus twins (CPT) represent 2% of all conjoined twins. They occur in about 1 per 2.5 million live births. Most are stillborn or die within the first 24 hours of life leaving a minority suitable for surgical separation. Advances in neuro-imaging, neurosurgical and craniofacial surgery and the use of 3D technology have improved outcomes in these patients, however successful separation remains relatively rare and they present an extreme challenge for the anaesthesia team. Anaesthesia for CPT is resource-heavy. There is a requirement for good communication amongst large teams; multiple stages of surgery and multiple pre-separation procedures; one dedicated theatre team for each patient for each procedure. Clinical challenges relate to airway issues due to airway abnormality as well as physical difficulty accessing the airways; the preservation of blood vessels in small children having multiple major surgical procedures; the presence of other abnormalities; multiple and often massive blood transfusion; and the impact of a long hospital stay. A common presentation is with one twin in high output heart failure while the other has end organ under-perfusion. This presents a unique challenge since the management of any complication impacts on both twins in the presence of a shared circulation. This is only resolved by separating and consequently worsens during the long stages of separation and leads to difficult decisions over the timing of surgery.
Material & Methods: A retrospective review of 3 sets separated in 2006, 2011 and 2018/19. Data was collected on the number & timing of procedures; airway issues; anaesthesia complications; blood transfusion; IV access issues.
Results: There have been 3 successful staged separations of CPT at GOSH. All presented with conjoined twin physiology requiring multidisciplinary management. All 3 sets presented some form of airway challenge including one set having elective tracheostomies. All required massive transfusion during at least one stage. All developed vascular access difficulties despite the assistance of interventional radiology and early placement of long term Hickman lines in the most recent set. All required multiple antibiotics for intercurrent infections. 1 set required earlier surgery and was completed in fewer stages due to significant interstage instability. They had at least one anaesthetic complication on one occasion and required CPR on a separate occasion.
Conclusion: Anaesthesia for conjoined twins is very challenging and requires the appreciation and management of complex physiological, anatomical, logistic and surgical issues as well as excellent teamwork.

Disclosure of Interest: None Declared

19-4-242

NASAL RECONSTRUCTION USING A CUSTOMIZED THREE-DIMENSIONAL–PRINTED STENT FOR CONGENITAL ARHINIA

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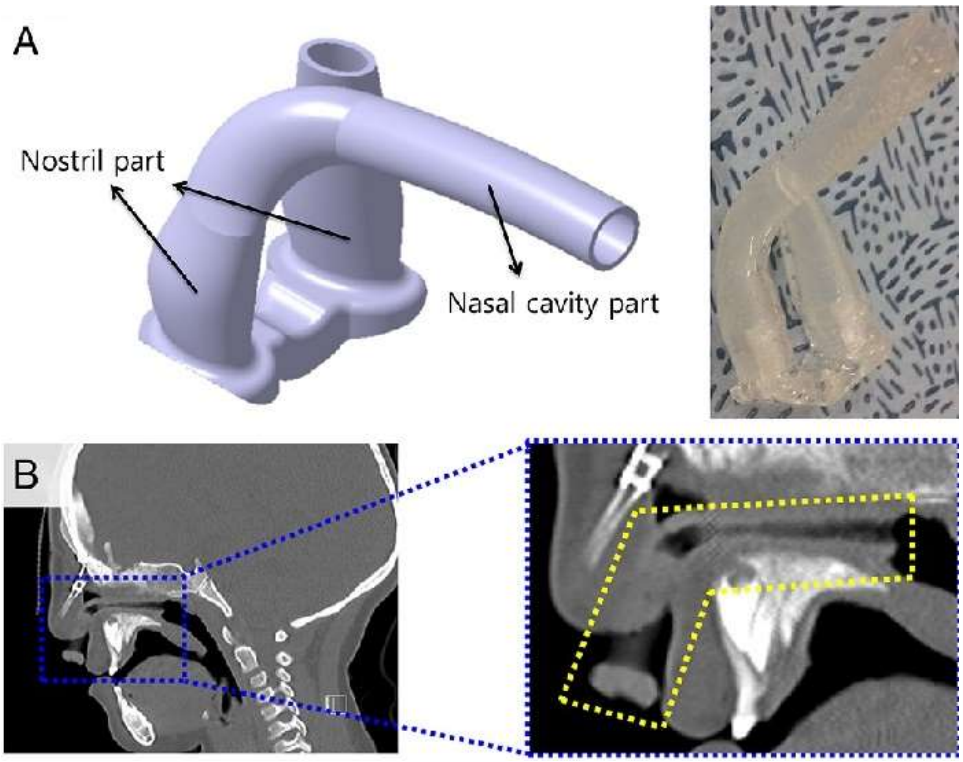
Introduction & Objectives: A male Mongolian child with a complete congenital absence of nose and nasal passage had a poor survival prognosis due to respiratory distress. To enable his survival, a new nose capable of conferring respiratory function was constructed. With implants available on the market, it was impossible to maintain the nasal passage post-operatively. Regarding patient's CT data, we designed a nasal passage stent with the nostril retainer. We would like to share our experience of the treatment of the arhinia patient with the customized nasal stent.

Material & Methods: Le Fort II osteotomy with navigation guided drilling was done for the single central nasal passage formation and midface lengthening. Coastal rib bone graft with forehead flap was used for the external nasal reconstruction. Following reconstructive surgery, the absence of mucoepithelium in the nasal passage can lead to rhinostenosis. To avoid this complication, a custom-made nasal silicone stent was created using three-dimensional (3D) printing technology in conjunction with the patient's computed tomography data. The stent was implanted for 2 months to maintain the shape and size of the nasal passage. At 2 months after stent implantation, the mucoepithelium tissue in the passage had successfully regenerated with no immune reaction.

Results: Three years after stent removal, respiratory function, nasal passage structure, and external nose shape were maintained without additional medical care. As the patient grows, few minor revision operations were done such as metallic plate and screws removal and medial canthoplasty.

Conclusion: Successful nasal reconstruction in an arhinia patient was achieved using a customized, 3D-printed nasal stent. The patient is growing within a normal growth pattern and nasal breathing is possible without any assistance devices.



Disclosure of Interest: None Declared

19-4-243

SURGICAL NEONATAL TREATMENT OF CONGENITAL NASAL PYRIFORM APERTURE STENOSIS (CNPAS): PRESENTATION OF TWO CASES

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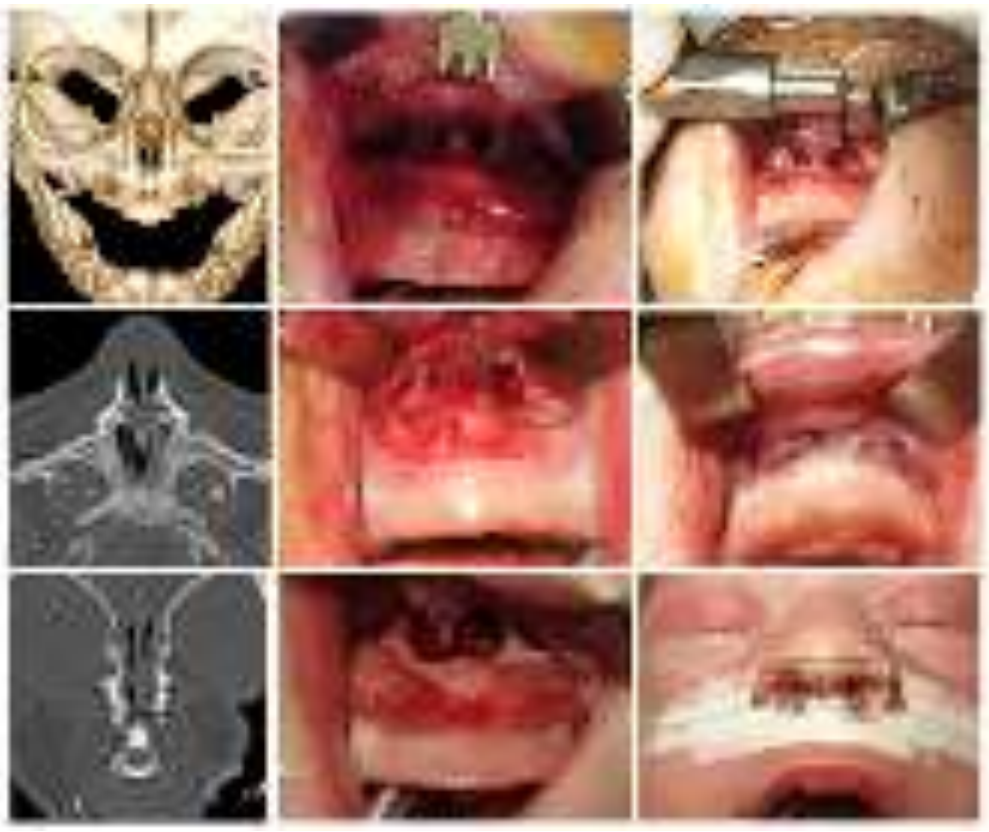
Introduction & Objectives: Congenital nasal pyriform aperture stenosis (CNPAS) is a rare cause of upper airway obstruction in newborns that occurs due to bone overgrowth of the nasal process of the maxilla. It is considered to be a mild form of holoprosencephaly. Management of two cases of this uncommon but life-threatening condition is presented.

Material & Methods: Two cases of full-term female newborns admitted to the intensive neonatal care unit due to respiratory distress are presented. Patients were admitted just after birth with respiratory distress, desaturation episodes and cyanosis, associated to feeding difficulty. First hypothesis was coanal atresia. However, resistance throughout passage of a nasogastric tube or a fiberoptic camera occurred in the nostrils. Patients were later submitted to a craniofacial CT scan, negative for choanal atresia but showing nasal pyriform aperture stenosis and a image of solitary upper central incisor (megaincisor). No other facial anomalies were noted. Clinical measures including use of topical agents, supplemental oxygen and positioning showed poor response and surgical treatment weas indicated. Through a sublabial approach, the pyriform aperture was exposed and a subperiostal dissection wwas performed, leaving the nasal mucosa intact. Treatment of the stenosis was achieved by drilling the nasal floor and lateral walls of the nasal cavity up to the inferior turbinate. Placement of nasal stents assured air flow.

Results: Widening of the pyriform aperture was successful obtained, treating the upper airway obstruction symptoms in both patients. Post-operative CT revealed good outcome as well. Despite resolution of the symptoms it still remains necessary to access long term outcomes after full facial development

Conclusion: Although a rare entity, CNPAS represents an important cause of neonatal nasal obstruction requiring early surgical intervention. Therefore, its differential diagnosis with bilateral choanal atresia should not be underestimated.



Disclosure of Interest: None Declared

19-4-244

PREDICTING BLOOD PRODUCT TRANSFUSION IN CRANIOFACIAL SURGERY PATIENTS USING MACHINE LEARNING BASED ON THE PEDIATRIC CRANIOFACIAL COLLABORATIVE GROUP

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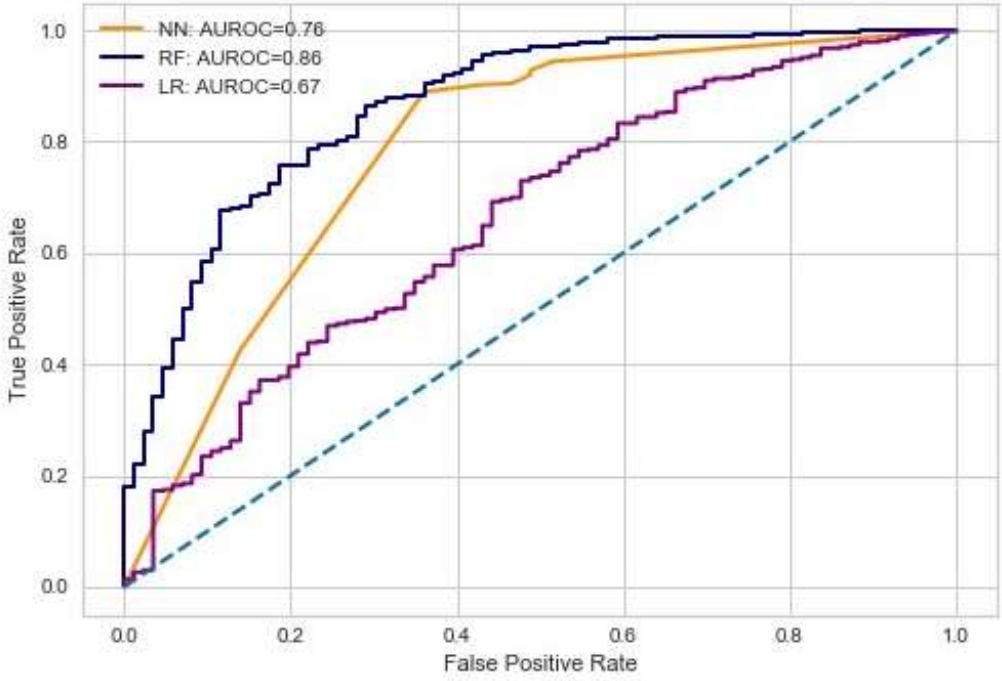
Introduction & Objectives: Craniosynostosis is the premature fusion of one or more cranial sutures that often requires surgical intervention. Surgery often involves extensive osteotomies which can lead to substantial blood loss. Stricker et al reported in children less than 24 months at a rate of 30%, 11% and 5% receive intraoperative erythrocyte contain blood cell transfusion greater than 40 ml/kg, greater than 60 ml/kg and greater than 80 ml/kg respectively. Determining when and quantity to administer blood product to a patient undergoing craniofacial surgery is difficult. The anesthesiologist considers many indices including patient hemodynamics and volume status, end organ perfusion and on-going blood loss. Hence the aim of this study is to apply machine learning modeling on pre-operative data collected in the Pediatric Craniofacial Surgery Perioperative Registry (PCSPR) in order to predict the need for blood transfusion.

Material & Methods: A de-identified PCSPR dataset included data from 2012 through 2018 was analyzed. The dataset included the perioperative data of 2390 subjects. Clinical experts selected a relevant subset of 24 pre-surgery labs and demographic data as input for the model, blood donor exposure is the binary output of the model.

75% of the data was randomly selected for training the model and the rest was used for testing the models. The following three models were built and compared: logistic regression (LR), random forest (RF), and neural network (NN).

Results: Fig. (1) shows the receiver operating characteristic curve for the three models. Based on our results RF model (AUROC=0.86) outperforms the LR (0.67) and NN (0.76) models. The confusion matrix for the RF model is presented in Table (1). We then calculated the c-statistics measures for RF model which has an overall accuracy of 0.91 with 0.96 precision, 0.93 sensitivity, and specificity of 0.70.

Conclusion: Machine learning can help guide us in our preparation for blood management for craniofacial surgeries. More studies need to be completed to verify these prediction models.



Disclosure of Interest: None Declared

19-4-245

EFFECTIVE INTERDISCIPLINARY MANAGEMENT OF CHRONIC OBSTRUCTIVE NASOPHARYNGEAL STENOSIS (NPS): A CASE STUDY

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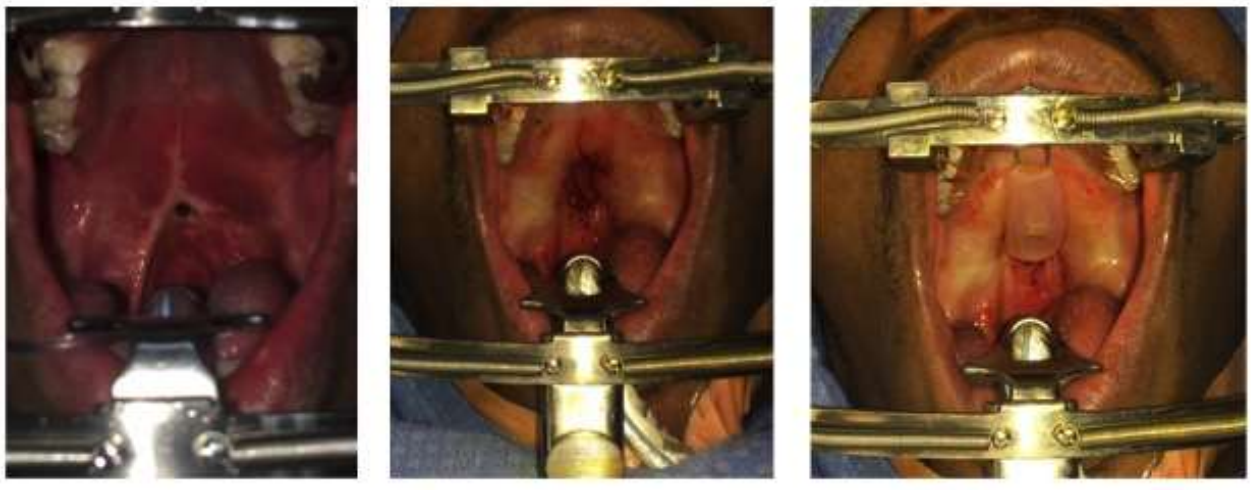
Introduction & Objectives: Severe nasopharyngeal stenosis (NPS) is a rare complication of palatal and/or pharyngeal surgical intervention following the development of hypertrophic scar tissue and lending to critical airway obstruction and abnormal speech resonance. NPS can be psychosocially and functionally devastating, and due to a significant risk of recurrence, a reproducible effective treatment algorithm has not been defined.

We present a case study of a 17-year-old African American male with a history of a congenitally deep pharynx and velopharyngeal insufficiency compounded by developmental delay with dysarthric and apraxic speech characteristics who developed severe NPS following pharyngoplasty. Over a 12-year interval, the patient was cared for by several surgeons, and underwent serial interventions including: 8 palate revisions, 6 revisional pharyngoplasties, and 5 dilatations. After each intervention, the patient's NPS recurred leaving a 2mm symptomatic nasopharyngeal port. The purpose of this presentation is to demonstrate the importance of interdisciplinary cooperation in the development of a prosthetic stent to prevent further stenosis of the nasopharyngeal airway.

Material & Methods: Following interdisciplinary evaluation, consideration was given to a final effort for surgical recreation of the NP port via local tissue rearrangement and concomitant intraoperative fabrication of a custom dental-borne orthodontic obturator. The inside diameter of the stent was designed to achieve a cross-sectional area of 60mm2 which is the minimal cross-sectional area of the liminal valve in an adult. The NP port was surgically-revised to 14mm in diameter (153.9 mm2) and the obturator was revised in real-time for best fit. Post-operatively, the obturator was left for 7 days prior to first removal. The patient and family were counseled on obturator management including twice weekly removal for hygiene with prompt replacement.

Results: Postoperatively, the patient returned to a normal diet within 48 hours without significant nasal regurgitation. Previously, an obligatory mouth breather, the patient reestablished oral competence at night, allowing nasal respiration and mitigating both nasal and oral drooling. The patient tolerated the appliance 24 hours a day. On follow-up intraoral and nasopharyngoscopic examination, NP patency was maintained.

Conclusion: To effectively treat NPS, an interdisciplinary team is imperative. Concomitant surgical revision of the nasopharyngeal port to >150mm2 with custom fabrication of a dental-borne obturator allows for long-term compliance until tissues have stabilized while providing nasopharyngeal patency and drainage without significantly compromising speech.



Pre-op | Surgical Restitution NP Port | Custom Dental-borne Orthotic

Disclosure of Interest: None Declared

19-4-246

THE BRACHIOCEPHALIC APPROACH FOR CENTRAL VENOUS CATHETERS PLACEMENT IN PEDIATRIC CRANIOFACIAL SURGERY

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Introduction & Objectives: The risk of bleeding in the pediatric patient undergoing major craniofacial surgery is high and requires the positioning of a central venous catheter (CVC) for fluids replacement and hemodynamic monitoring. In the young child, the ultrasound-guided approach to the brachiocephalic vein is a direct path to the superior vena cava: simple, rapid, with supraclavicular exit-site that does not interfere with the surgical field and with lower thrombotic and infectious risks than other approaches. The intracavitary ECG (IC-ECG) method allows a real-time evaluation of the correct positioning of the catheter tip in the cavo-atrial junction (CAJ). The use of the subcutaneous anchorage system (SAS) reduces the infectious risk related to the use of surgical sutures and prevents catheter dislocation in non-collaborating patients or at risk for the surgical position. The objective was: to evaluate the safety and clinical efficacy of the brachiocefalic approach and SAS and accuracy of IC-ECG method for positioning CVC in pediatric patients undrgoing craniofacial surgery.

Material & Methods: 73 neonatal and pediatric patients, ASA I-III, undergoing major elective craniofacial surgery, received a CVC, using the technique of brachiocephalic approach and the method of IC-ECG; at the end of surgery fluoroscopy was performed. The accuracy of IC-ECG was defined in comparison with the radiological method. All catheters were secured with the SAS. Safety was assessed by registration of intraoperative complications related to placement or dislocation. Efficacy was assessed by evaluation of time to CVC placement and time to IC-ECG and fluoroscopy execution.

Results: Age 7±5.5 (months, mean±sd); weight 6.1±3.4 (kg, mean±sd). Time to central line placement 10.3±3.6 (minutes, mean±sd); IC-ECG time 1.6±0.8 (minutes, mean±sd); fluoroscopy time 12±5 (minutes, mean±sd). There were no complications related to placement or dislocation. All the catheters tips were correctly positioned in CAJ as confirmed by fluoroscopy.

Conclusion: The ultrasound-guided approach to the brachiocephalic vein allows access to the central venous path in a short time, with no complications or interference on the surgical field and without the risk of dislocation thanks to the SAS. The use of the IC-ECG method allows to identify in real-time the correct position of the catheter tip, reducing intraoperative time without X-ray exposure.

Disclosure of Interest: None Declared

19-4-247

THE EFFICACY OF TRANEXAMIC ACID IN REDUCING BLOOD LOSS AND TRANSFUSION REQUIREMENTS IN CRANIOSYNOSTOSIS SURGERY - A LARGE SCALE COHORT STUDY

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Introduction & Objectives: Blood loss is a potential cause of morbidity and mortality in craniosynostosis surgery. Recent reports have suggested that the use of tranexamic acid (TXA), an antifibrinolytic agent, mitigates this blood loss. In order to evaluate the clinical efficacy of TXA, an outcome-centered retrospective cohort study of patients undergoing craniofacial surgery at a tertiary craniofacial hospital was undertaken. Primary outcomes assessed in the analysis were blood loss and transfusion requirements.

Material & Methods: Two groups undergoing craniosynostosis surgery were compared – those who received intravenous TXA, and those who underwent surgery without TXA. Further subgroup analyses were undertaken comparing the difference in blood loss between craniosynostosis operations. Statistical analysis was performed with Students t test and the Mann-Whitney U tests for non-parametrtic results.

Results: We identified 206 patients who underwent craniosynostosis surgery over an 8 year period between July 2008 and December 2016 at a single tertiary children's hospital; 78 controls received no antifibrinolytic and 128 received TXA. The TXA regimen used was an initial bolus of 15mg/kg, followed by intra-operative infusion of 5mg/kg/h. The demographics of the groups were comparable. Weight-adjusted blood loss for controls was 61.65ml/kg (SD 34.58), compared to 52.05ml/kg (SD 28.90) in the TXA group. Total blood loss was greater in the control group (P=0.0332, 95% CI 0.77-18.43). TXA was found to result in a weight-adjusted calculated blood loss reduction of 9.6ml/kg across all procedures (P=0.0332 95% CI 0.7734-18.4266). The blood loss amongst control populations of spring cranioplasty (SC) was 32ml/kg, compared to 82.6ml/kg in fronto-orbital remodelling (FOR). SC patients who received TXA lost on average 56.1ml less blood, while FOR patients lost an average of 146.4ml less blood. Thus, the absolute blood loss reduction was three times greater for patients undergoing FOR. The reduction in blood loss in FOR patients was close to 1 unit of packed red cells. While intra-operative incidence of transfusion was similar (Control 20.46ml/kg vs TXA 18.78ml/kg, P = 0.4973), there was a significant reduction in postoperative transfusion incidence (27% of controls vs 6% of TXA; P<0.0001). The number needed to treat to prevent giving a unit of blood postoperatively was 4.8. There were no incidences of tranexamic acid-specific complications.

Conclusion: This study found that TXA is a safe and effective method of decreasing blood loss and transfusion requirements in patients undergoing craniosynostosis surgery. The clinical benefit of TXA is particularly evident in the more invasive craniosynostosis surgeries such as Fronto-Orbital Remodelling.

Disclosure of Interest: None Declared

19-4-248

TREATMENT STRATEGY FOR CRANIOSYNOSTOSIS

- SELECTION OF CONVENTIONAL CRANIOPLASTY, SUTURECTOMY OR DISTRACTION OSTEOGENESIS -

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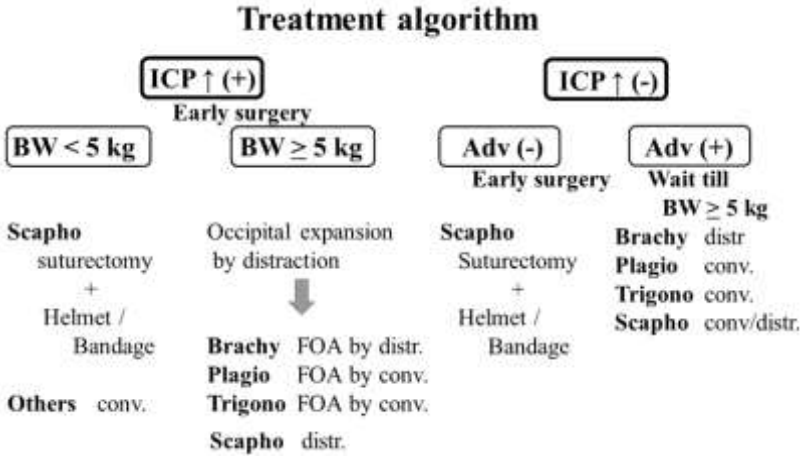
[1]Neurosurgery, Toyama University, Toyama, [2]Plastic and Reconstructive Surgery, [3]Neurosurgery, Kanazawa Medical University, Kahoku, Japan

Introduction & Objectives: Craniosynostosis with just early closure of skull suture is categorized as simple craniosynostosis, and with other congenital anomalies, such as midface hypoplasia, syndactyly and joint contractures, as syndromic craniosynostosis. And some children have a single affected suture, and some have multiple affected sutures. Skull shape is various depend on the affected sutures. We have to treat children under skull growth, and the operation method depends on the age and skull shape. New less invasive treatment method such as distraction osteogenesis and molding helmet has been developed, and treatment strategy has changed. In this study, we looked back the chronological change of treatment methods and propose our treatment strategy.

Material & Methods: We have started to treat craniosynostosis since 1982. We operated 41 non-syndromic patients by conventional cranioplasty (25) or distraction osteogenesis (16), and 15 syndromic patients by conventional (10) and distraction (5).

Results: We introduced distraction osteogenesis in 1997, and used this method aggressively. The distraction osteogenesis is less invasive compared with conventional cranioplasty, because of no dural dissection from skull resulted in shorter operation time and less bleeding. But this method cannot give good enough skull shape for patients with trigonocephaly and plagiocephaly. So, we go back to treat by conventional cranioplasty for these patients. The occipital cranial expansion by distraction gives enough skull volume, and we introduced this method in 2016 especially for syndromic patients.

Conclusion: Our treatment strategy is as follows: 1) for children with elevated intracranial pressure (ICP) need early operation, a) body weight (BW) < 5 kg: suturectomy with helmet or bandage for scaphocephaly, conventional cranioplasty for other skull shapes, b) BW > 5 kg: occipital expansion followed by fronto-orbital advancement (FOA) by distraction for brachycephaly, occipital expansion followed by FOA by conventional for trigonocephaly and plagiocephaly, distraction for scaphocephaly, 2) for children without ICP elevation, a) early surgery for scaphocephaly by suturectomy with helmet or bandage, b) delayed surgery (wait till BW > 5 kg), distraction for brachycephaly, conventional for trigonocephaly and plagiocephaly, either conventional or distraction for scaphocephaly.



Disclosure of Interest: None Declared

DAY19 - STATION 5 - IMAGING/PLANNING

19-5-249-N / 19-12-307

EVALUATION OF CLINICAL OUTCOMES OF 3D PRINTING GUIDES COMBINE WITH NAVIGATION TECHNIQUE IN REDUCTION OF ZYGOMATICO-ORBITAL-MAXILLARY COMPLEX FRACTURES

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[1]Department of Plastic and Reconstructive Surgery, Shanghai Ninth People's Hospital, Shanghai JiaoTong University School of Medicine, People's Republic of China, Shanghai, China

Introduction & Objectives: Craniomaxillofacial fractures occur in humongous population worldwide in combination with other severe injuries including airway, spinal, and upper and lower body injuries leading to increasing morbidity and mortality. Of these, ZOM complex fracture is one of the common facial injuries causing severe aesthetic and functional deformities and so forth leads to influence the quality of life.This pilot prospective randomized controlled study was to evaluate the clinical outcomes of the 3D printing guides combine with navigation guided technique and compare with traditional navigation technique in the reduction of ZOM complex fractures.

Material & Methods: 20 patients diagnosed with unilateral ZOM complex fractures, admitted to our department were randomly divided into Group A and Group B with the use of 3D printing guides combine with navigation aided techniques and with the use of traditional navigation aided technique respectively. All of the patients underwent 1mm thickness preoperative CT scans. Virtual surgical plan and the postoperative 5 days CT data were imported in Mimic software to measure the outcomes. Primary outcomes measures were unoverlapped volumes percentage of the ZOM fracture and secondary measures were intraoperative time, patients' satisfaction rate, mean discrepancy of each 6 points determined by the fracture ends, diplopia severity score, amount of mouth opening and postoperative complications rate .Grouped t test and fisher exact probability test were used for the statistical analysis..

Results: All cases achieved good results without serious complications in both group A (3D printing guides+navigation) and Group B (navigation) which included 10 cases of unilateral ZOM fractures in each group. Group A resulted with the better accuracy ($P < 0.001$) with reduce operation time with high patients' satisfaction rate and no statistical significance in diplopia outcome and mouth opening outcomes.

Conclusion: The combination of the 3D printing guides with navigation techniques provided a more rapid, convenient and intuitive three-dimensional surface reduction compared with the navigation aided technique in the treatment of ZOM fractures.

Disclosure of Interest: None Declared

19-5-250

BLACK BONE MRI IS AS ACCURATE AS CT SCANS IN VIRTUAL SURGICAL PLANNING FOR FIBULA FLAP MANDIBULAR RECONSTRUCTION: A MEANS TO REDUCE RADIATION EXPOSURE

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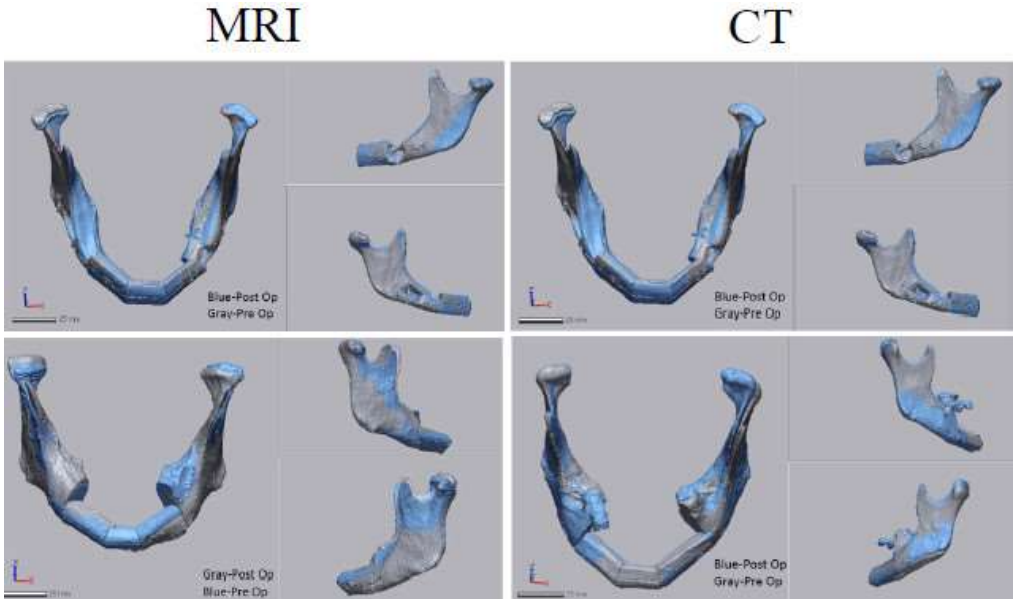
[1]Plastic and Reconstructive Surgery, Mayo Clinic, Rochester, United States

Introduction & Objectives: From 1990 to 2007, the number of CT scans in the United States rose from 13 million to 72 million. Accurate bone imaging enables advances in reconstructive surgery, including the ability to design 3-D printed surgical guides enabling accurate surgical planning and success in complex surgical cases. However, CT radiation exposure also increases carcinogenesis risk. The purpose of this project is to develop a MRI scanning technique that demonstrates bone clearly and to prove that this technique can be used instead of CT for surgical planning and 3D surgical guide creation.

Material & Methods: This study included ten cadaver heads. A mock fibula free flap for mandible reconstruction was performed. Five of these surgeries were planned and guides were created utilizing BlackBone MRI, whereas the other five were planned and performed using CT scans. All specimens underwent a pre-operative CT scan with guides affixed. After mock surgeries were performed utilizing the guides, all specimens underwent a post-operative CT scan. Three-dimensional reconstruction of scans was performed and surgical accuracy to the planned surgery was assessed using GeoMagic Wrap, assessing guide positioning accuracy, average post-operative deviation from plan, and differences in planned and post-operative volume.

Results: Ten mock fibula free flap mandible reconstructions were successfully performed. Guides created from BlackBone MRI demonstrated high accuracy to surgical plan. The pre-op Blackbone MRI scan had an average deviation from the pre-op CT scan of less than 2mm ($p < 0.05$). Cutting guide placement in both surgeries had an average deviation from planned placement of 0.75mm ($p < 0.05$). The average deviation of post-operative anatomy from pre-operative plan was 1.5mm ($p < 0.05$). Post-operative volume deviated less than 5% from the planned volume. These values were comparable to those assessed from the surgeries performed with guides created from CT scans. Figure 1

Conclusion: This study demonstrates that virtual surgical planning and 3D surgical guide creation can be performed using Blackbone MRI with comparable accuracy to CT scans. This could dramatically reduce radiation exposure for patients. The successful segmentation, virtual planning, and 3D printing of accurate guides from Blackbone MRI therefore demonstrates potential to change the pre-operative planning standard of care.



Disclosure of Interest: None Declared

19-5-251

COMPARISON OF 3D RECONSTRUCTED MR IMAGES WITH CT: PROOF OF CONCEPT

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Introduction & Objectives: Due to its magnetic resonance (MR) related properties, bone has much lower signal in MR imaging than other tissues, making it possible to delineate bone for imaging. Eley et al. developed a "Black Bone" (BB) MR protocol as an alternative to computed tomography (CT); however, challenges in obtaining reproducible 3D reconstructions have prevented clinical application. In this study, we revisit the BB approach using a high-resolution 3D Golden-Angle (GA) stack-of-stars radial MR sequence (which we name as "BB-GA") that is intrinsically robust to motion and has enhanced bone vs. soft-tissue contrast. Our objective is to use MR in place of CT for diagnosis, pre-operative planning and cranial suture visualization.

Material & Methods: Table 1 lists the 3 patients that were scanned following IRB approval. The scan time for MR was 5:04 (min:sec). The semi-automated post-processing consisted of: inhomogeneity correction, inversion to make the black skull bone appear white, thresholding to remove soft tissue, and interpolation to the corresponding CT resolution. Each child's MR images were registered onto their CT images and both sets were volume-rendered for displaying with multiple views/rotations. A craniofacial surgeon, radiologist and neurosurgeon reviewed the MR and CT images independently. They scored the images for diagnostic use and pre-surgical planning on a 5-point scale, while scoring the patent sutures on a 3-point scale.

Results:

Patient	Age	Disease	CT resolution (mm)	MR resolution (mm)
1	9 months	Meningocele	0.43x0.43x1.00	0.63x0.63x0.80
2	5 years	Epilepsy	0.37x0.37x0.75	0.60x0.60x0.80
3	8 years	Arachnoid cyst	0.31x0.31x0.60	0.60x0.60x0.80

Table 1. Patients scanned for this study

Figure 1 shows the representative 3D-reconstructed cranial images. All 3 raters either 'agreed' or 'strongly agreed' that all 3 BB-GA images were clinically acceptable for diagnosis (except one rater being 'equivocal' for Child 3) and for pre-surgical planning (except another rater being 'equivocal' again for Child 3), while all 3 CT images were 'strongly agreed' upon (except a rater marked 'agree' for the pre-surgical planning of Child 3). Considering 5 sutures per child, 42 out of the 45 responses from the 3 raters were "fully visible" for BB-GA whereas all were "fully visible" for CT (except one rater did not review CT images for child 2). Overall Cronbach's α=0.87.

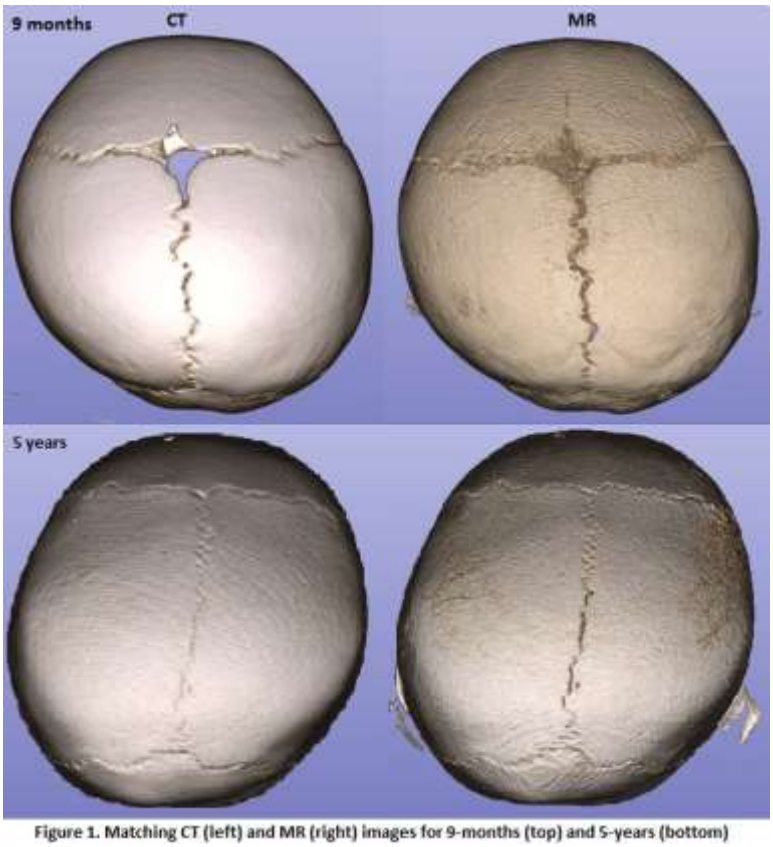

Figure 1. Matching CT (left) and MR (right) images for 9-months (top) and 5-years (bottom)

Conclusion: The BB-GA was shown to be capable of providing clinically acceptable 3D-reconstructed cranial images. Future directions include reducing the scan time (and, in some cases, the concomitant sedation), applying motion correction, and automation of post processing for clinical utility.

Disclosure of Interest: K. Patel Conflict with: Mallinckrodt Institute of Radiology, Conflict with: Stryker CMF, Conflict with: Hanger, P. Commean : None Declared, C. Eldeniz : None Declared, G. Skolnick: None Declared, M. Goyal: None Declared, M. Smyth: None Declared, U. Jammalamadaka : None Declared, H. An: None Declared

19-5-252

A 3D MORPHABLE HEAD MODEL FOR APERT AND CROUZON SYNDROME

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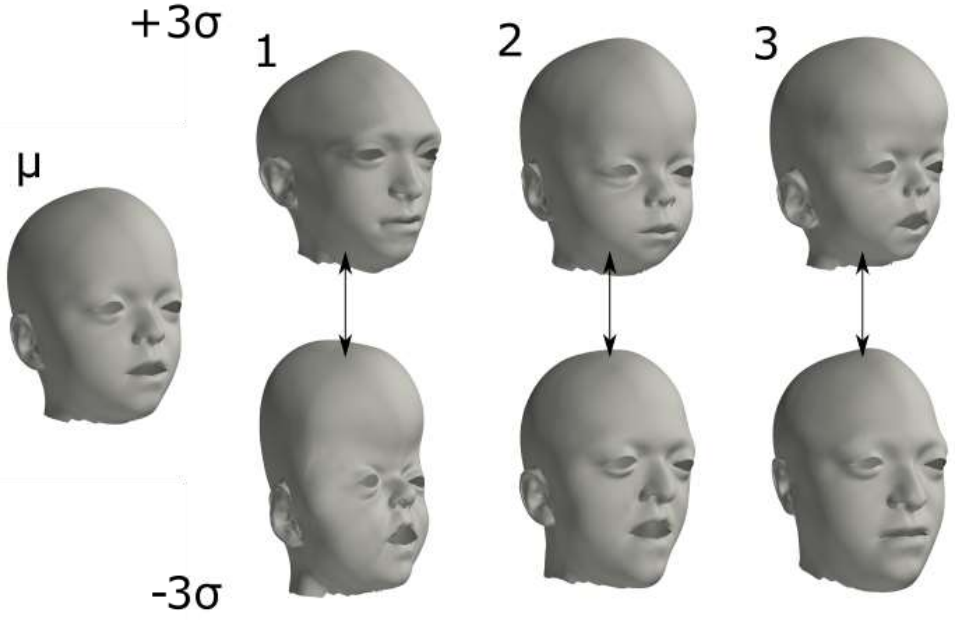
Introduction & Objectives: Morphable models of 3D shape have been applied in diverse disciplines including creative media, medical image analysis and biometrics. Even though they have been used extensively for the face case, limited work has been done for the case of the full head. Recently, a 3D Morphable Model of Craniofacial Shape was built using a large-scale head dataset. Inspired by this work, we have built and propose a 3DMM of the head for people with craniosynostosis, namely Apert and Crouzon Syndrome. We show that the proposed 3DMM can describe syndromic cases.

Material & Methods: The construction of our Syndromic 3DMM consists of four main stages:

- **Data preprocessing:** We collected CT scans of 49 Apert and 63 Crouzon patients. We cleared the meshes and manually added a set of 68 3-D sparse annotations for the face and a set of 55 3-D sparse annotations for each of the ears.
- **Similarity alignment:** The collection of meshes are subjected to Procrustes Analysis to remove similarity effects, leaving only shape information**.**
- **Dense correspondence:** Using elaborate machine learning techniques like Gaussian Processes, 3D meshes are reparametrised into a form where each mesh has the same number of vertices joined into a triangulation that is shared across all meshes.
- **Statistical modelling:** The morphable model is then derived by applying Principal Component Analysis to the registered meshes.

Results: The first three components of the syndromic model are shown in Figure 1 at plus/minus 3 standard deviations, σ, from the mean, μ. The first component has captured the shape variation of the frontal and parietal bones, and indicates a transition between Crouzon and Apert syndrome. Other components capture attributes such as the length and width of the face, and retraction of the cheekbones.

Conclusion: We have presented a Syndomic 3DMM of head for people with craniofacial anomalies, the first statistically descriptive 3DMM ever constructed for those with craniosynostosis. We have shown that the new model can be used to describe people with deformities and that it can generate novel instances of the head for both Apert and Crouzon syndrome.



Disclosure of Interest: None Declared

19-5-253

VIRTUAL 3D PLANNING OF OSTEOTOMIES FOR CRANIOFACIAL SURGERIES

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Introduction & Objectives: Computer-assisted surgery has been more and more involved in craniofacial surgery these past years. It is useful in many situations among which stereolithographic models, surgical simulations of osteotomies and bone moving, and cutting guides and customised implants. The present paper argues that computer-assisted surgery is particularly useful in complex cases such as rare malformations, or to address the sequelae of previous surgeries. The various advantages of the technique are emphasized from a surgical standpoint as well as from a teaching one.
Material & Methods: Forty cases of various computer-assisted surgeries are scanned, allowing for a comprehensive review of outcomes in cases such as craniosynostoses, complex craniosynostoses, hypertelorisms, craniosynostoses sequelae and cranio-facial and orbital traumas.
Results: Outcomes prove promising in all of the cases reviewed, excepting in some few cases for which computer-assisted surgery with cutting guides may not be necessary. In these specific cases, the pedagogical input is however interesting for residents and students.
Conclusion: Computer-assisted surgery is revolutionising the surgical approach to complex craniofacial malformations, as well as easing the less complex ones. It is likely that in the years to come, this technique will supersede the previous ones. However, using this technique implies the acceptation of relying on a device that is not human. We need to consider computer-assisted surgery as a tool that can change surgical practices. The surgeon can rely on it, yet nothing will replace his/her eye and experience. It is the combination of both this experience and the appropriate use of computer-assisted surgery that, ultimately, leads to a successful surgery.

Disclosure of Interest: None Declared

19-5-254

PREOPERATIVE PLANNING USING THREE-DIMENSIONAL SIMULATION FOR CRANIO-MAXILLOFACIAL SURGERY

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Introduction & Objectives: Surgical planning is the most important part as well as the accuracy of the operation in cranio-maxillofacial surgery. The conventional cephalogram is useful for a two-dimensional surgical planning. Recently, a three-dimensional CT image is available easily, making it possible to comprehend the deformity intuitively. But on planning the treatment for the asymmetric cases mainly composed of three-dimensional distortions, the three-dimensional CT images output on films or a monitor are useless for the simulation as with the cephalogram, because they are essentially two-dimensional. In such cases, a three-dimensional simulation is extremely useful, so it should be promoted more in clinical use.

Material & Methods: We use an image processing software for 3D design and modeling, Mimics® (Materialise NV, Belgium) for simulation. CT image data output by DICOM format are imported into the software, and 3D skeletal images are calculated excluding the unnecessary data such as artifacts after extracting only bone images. Furthermore, these 3D images can be cut like a real surgery using optional planes on three-dimensional space or cutting templates for osteotomy set in advance such as Le Fort I osteotomy, SSRO etc. Each cut image is recognized as a different 3D object and we are able to move it freely on a three-dimensional space. Both the direction and the distance in the movement of the objects should be assessed in reference to the measurement results of a cephalogram or the dental cast model.

Results: We have applied this method to over 350 cases since 2006. This method was particularly useful in treatment planning of the asymmetric cases, and could give us more information such as the contact or interference condition between each bone fragment after movement.

Conclusion: Three-dimensional simulations enable us to make the reasonable plan, and it is thought that safety and certainty in the real surgery rise drastically.

Disclosure of Interest: None Declared

19-5-255

THE ROLE OF 3D-PRINTING CRANIOFACIAL MODEL SIMULATION IN CONGENITAL CRANIOFACIAL SURGERY

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Introduction & Objectives: Surgical correction of congenital craniofacial anomaly is always challenging, especially in cases with syndromic craniosynostosis. Aside from skull deformity, these patients also had midface retrusion and need to be corrected. Due to the limited operation field, after osteotomy, it is difficult to put the midface bone piece in ideal position.

Regarding skull operation, for achieving better aesthetic outcome, we not only advanced but also reshaped the cranial vault, so more complicated designs were always required.

With the advance of medical imaging and 3D-printing technique, now fabricate a 3D craniofacial model from the patient is rather convenient, and is ready for every kinds of surgical manipulations.

Here we present our experience of using these models for pre-surgical planning and simulations for congenital craniofacial surgeries.

Material & Methods: From 2017 to 2018, before corrective procedures, surgical simulations were performed on six children with syndromic craniosynostosis. This was achieved by using true surgical instruments on 3D-printing skull models. The surgical procedures include three midface advancement, two fronto-orbital advancement/reshaping and one posterior vault expansion. After the “osteotomy” of the model bones, hard cardboard was cut to desire size and shape to simulate the bone plate as well as bone graft in the cases of midface surgeries. The fixation was achieved by gluing these “plates” to the model bones.

During the period of study, three generation of 3D-models were developed using different materials and machining, so that they may be easier to be cut and burred by true surgical instruments.

Results: The pre-op planning made by 3D-printing model simulation prove to be useful in achieving good surgical results. In midface cases, these procedures help us optimize the final position of the midface. The area for calvaria bone graft donor site could also be estimate precisely in advance.

As for cases underwent fronto-orbital reshaping, the pre-surgical design and planning significantly decrease the time for intra-op decision-making, therefore effectively reduced the total operation time.

At post-operation follow-up, image studies shown all the bone pieces were positioned as planned by pre-surgical simulations.

Conclusion: We think the pre-op 3D-model simulation enable us to foresee the anatomical difficulties before operations, and make the surgical results more predictable. By decrease the time of intra-op decision making, it could also effectively shorten the total surgical time.

Disclosure of Interest: None Declared

19-5-256

3D PRINTED MODELS VS. VIRTUAL SURGERY SIMULATION IN CRANIOFACIAL SURGERY EDUCATION

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Introduction & Objectives: Craniofacial Remodeling Surgery involves complex translocation of osseous segments, osseous segment bending and remodeling, and contouring of edges and interferences. This complex set of skills often justifies additional fellowship training for mastery. 3D printed models (3DM) and Virtual Simulation Surgery (VSS) are emerging technologies in Craniofacial Surgery planning. Their role as an education facilitator and ability to "shorten the learning curve" have not been formally explored in Craniofacial Surgery.

Material & Methods: Three surgical techniques: "Fronto-Orbital Remodeling" (FOR) (In-situ remodeling and Neoforehead techniques) and "Craniomegaly Reduction" (CR) were selected for the study. Plastic Surgery fellows were asked to perform "Model Surgery" on 3D-printed Models of upcoming surgeries and participate in Virtual Surgery Planning Sessions.

The time committment required for each method (3DM vs VSS) was measured. Learner comfort and familiarity with the specific skills detailed above was measured on a 5 point Likert scale before and after intervention. Finally, during the actual surgery, extent of participation of the Resident in the actual surgery and comfort of the supervising attending surgeon delegating tasks to the resident were measured similarly.

Results: Nine patient planning sessions were included: 4 Craniomegaly Reduction, 1 secondary FOR for Unicoronal Synostosis and 4 primary FOR for metopic Synostosis. Virtual Simulation Surgery took an average of 72 minutes to complete while 3D Model Surgery required 27 minutes only. For in-situ remodeling, familiarity with Segment Translocation improved 1.7 points (3.0 to 4.7), and familiarity with osteotomy design improved 1.4 points (3.3 to 4.7). For Neo-forehead planning cases, those increased 1.4 and 0.7 points respectively. Comfort with contouring and interferences was 4.3 before and 4.7 after. Non-measured comments generated from the survey yielded additional information on bendability of different 3D printer material (ABS vs Resin). Learner satisfaction was equivalent for both methods, however learners noted the versatility of VSS in having "do-overs" and planning contingencies. Learners felt 3D Models gave more information about interferences and bony edges. ABS was more pliable than resin, thus more suitable for modeling infant "primary" surgery.

Conclusion: : These results support a role for 3D Models and Virtual Simulation Surgery for Craniofacial Education. VSS and 3DM offer complementary information.ABS is somewhat bendable, and more suitable for infant surgery modeling.

Disclosure of Interest: None Declared

DAY19 - STATION 6 - CRANIOPLASTY

19-6-257-N / 19-12-305

USE OF NOVEL TECHNOLOGIES IN THE ANALYSIS, PLANNING AND SURGERY FOR CRANIOPAGUS TWINS. PAST, PRESENT AND FUTURE

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Introduction & Objectives: Advances in 3D visualisation, surgical planning and rapid prototyping have enabled a greater understanding of patients with unique anatomy. These new innovative technologies are collectively described at 3D technology and enable complex treatment strategies to be performed with less risk and a greater degree of certainty of outcome. In depth 3D analysis was retrospectively performed on 2 sets of craniopagus twins and prospectively in 1 set of twins.

Material & Methods: Imaging data was analysed using 3D software (Mimics, Materialise) and segmentation of skin, bone, brain, dura and vasculature were performed on 3 sets of craniopagus twins. The morphology of the brains, vasculature and the rotational and angular relationships between each set of twins was defined and classified according to O'Connell. Any areas of arterial cross perfusion and the venous anatomy was characterised. The quantity of dura and areas of brain fusion were also defined.

Results: The rotational relationship of the 1st 2 sets of twins was very similar (49 and 51 degrees) with the current set having a 114 degree rotational relationship. All twin pairs would be classified as O'Connell type III (40-140 degree) total vertical craniopagus twins. The brain morphology was also more compact and separated in the 1st 2 sets of twins. The most recent set have a significant elongated parieto-occipital lobe extending into the opposing twins hemi-cranium. This final set also had a more complex vascular pattern with areas of cross perfusion identified at the apices of these elongated portions by the opposing twin.

Conclusion: 3D technologies are an important tool in the understanding of complex craniofacial conditions. Although these 3 sets of twins can be grouped together as type 3 total vertical craniopagus twins, significant differences can be identified using detailed 3D analysis. The pair with an increased rotational relationship appear to have more complex brain malformation, increased cross perfusion and larger areas of brain fusion. These are all significant contributors to clinical risk and the succesful separation of craniopagus twins.

The development of 3D technology continues to provide greater insights in the understanding, and planning of all patients with complex craniofacial conditions and enables the development of trully individualised treatment strategies.

Disclosure of Interest: None Declared

19-6-258

SPLIT CALVARIAL GRAFT FOR RECONSTRUCTION OF FULL THICKNESS CALVARIAL DEFECTS

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Introduction & Objectives: Full thickness calvarial defects present formidable problems both for the patient as well as the surgeon. Larger defects pose greater challenge for reconstruction. The main objectives of cranioplasty are to achieve wound healing, obliterate dead space in the bony vault and to protect the brain from external injuries. Many options exist for the reconstruction of these defects which include both autogenous and alloplastic materials. Many alloplastic materials have been used for reconstruction including hydroxyapatite but all these have significant disadvantages and can lead to chronic inflammation along with risk of infection. The autogenous materials are preferred as they have the least chances of rejection and infection. The common autogenous materials used for cranioplasty include the split calvarium and the rib. The best option for reconstruction is a split calvarial bone as it matches the contour and the density of the lost bone. This study describes our experience in treating a variety of full thickness calvarial defects using split calvarial graft.

Material & Methods: 22 patients with various types of full thickness calvarial defects were reconstructed using split calvarial graft during the period from 2103 to 2018. The age ranged from 6 years to 62 years with male female ratio of 1.5:1. There were 10 cases of frontal, 9 cases of parietal and 3 cases of occipital defects. The aetiology of defects included post-traumatic, post-oncologic, post-inflammatory and after craniotomy for acute subdural haemorrhage. All patients underwent reconstruction using split calvarial graft.

The harvesting of the split calvarial graft was done after performing a craniectomy as the defect sizes ranged from 6 cm to 18 cm in maximum diameter. The outer part was used to cover the donor defect whereas the inner part was used to cover the recipient defect. The fixation material included mainly absorbable sutures and titanium plates.

Results: Satisfactory aesthetic and functional results have been obtained in the series using the technique of split calvarial bone grafting. All the patients healed well in terms of bony and soft tissue healing. Radiologically the gap in the bones healed in 7-8 weeks. The reconstruction of the parietal defects was easier than reconstruction of the fronto-parietal defects due to contour differences. There was 1 patient who developed a sinus after closure. The sinus healed after a course of dressings and antibiotics.

Conclusion: Autogenous bone grafts hold the key for full thickness reconstruction of calvarial defects. The acceptance of the graft coupled with low risk of infection make it the ideal material for cranioplasty. Split cranial grafts give an aesthetically pleasing contour and it is easier to harvest them from a craniectomized bone rather than in vivo harvest.

Disclosure of Interest: None Declared

19-6-260

THE UTILITY OF PARTICULATE BONE GRAFT CRANIOPLASTY FOR PRIMARY CRANIAL VAULT EXPANSION

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Introduction & Objectives: The purpose of this study is to evaluate the efficacy of particulate bone cranioplasty, harvested from the inner table of the calvarium, to minimize calvarial defects that may arise in cranial vault remodeling/expansion (CVR) for craniosynostosis.
Material & Methods: A retrospective review of was performed for all patients who underwent CVR with particulate cranial bone cranioplasty between 2010-2018. Statistical comparisons were made of demographic information, type of surgery, perioperative complications, bone gaps on CT >1 year post-op, and bone gaps present on physical exam at a minimum of 1 year follow-up.
Results: 421 patients were identified and 323 met inclusion criteria. 10-15cc of particulate cranial bone was harvested without clinically detectable detriment to the cranium, and there were no complications related to bone graft harvest. Bony gaps were identified on 4.9% of patients (N=14), with only one requiring revision cranioplasty for a critical-sized calvarial defect (0.3%). Risk factors for clinically detectable bone gaps were age, post-operative wound infection, presence of a VP shunt, and history of previous surgery (all $p < 0.01$).
Conclusion: Particulate cranial bone cranioplasty results in a low incidence of cranial bone defects in the setting of CVR. Risk factors for bone gaps include age, wound infection, presence of a VP shunt, and history of previous surgery. Additional follow-up is needed to determine the long-term safety profile of particulate bone cranioplasty.

Disclosure of Interest: None Declared

19-6-261

ADULT CRANIOPLASTY RECONSTRUCTION WITH CUSTOMIZED CRANIAL IMPLANTS: DOES RADIATION THERAPY AFFECT OUTCOMES?

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Introduction & Objectives: Reconstruction of complex cranial defects presents numerous challenges especially when combined with radiation therapy (RT). As such, we chose to investigate whether pre- or postoperative RT increases the risk of complications in the setting of cranioplasty (CP) with customized cranial implants.

Material & Methods: A retrospective review was performed on our IRB-approved database spanning January 2012 to March 2018. All CPs performed by the senior author (CG) were included. Further analyses were performed on "primary" CPs (defined as no prior CP attempts to correct their index cranial defects). "Revision" CPs (defined as having prior CP reconstruction performed by either the senior author/different surgeon) were excluded. The primary outcome was complication incidence in patients who underwent pre- or post-op RT. Complications were categorized as major or minor. "Major" required reoperation, while "minor" were self-limiting. Recurrences of the indication for index craniotomy/craniectomy were not considered CP-related complications. Complication rates were further assessed by implant material. Standard descriptive analyses were performed. Chi-squared tests were used to examine for significant differences across categorical variables, with significance set at $p<0.05$.

Results: 227 primary CPs were performed between January 2012 and March 2018. 18 patients underwent pre-RT and 11 underwent post-RT. Mean age was 50 years (SD±16.3, range 17-92 years). Of the 199 patients who did not undergo radiation, 23 (12%) had major complications. Of the 18 pre-RT patients, 3 (17%) had major complications. Two patients had tumor recurrence requiring further surgery. None of the 10 post-RT patients had complication; 2 had tumor recurrence requiring additional surgery. There was no statistically significant difference among the groups ($p > 0.05$). Of the 199 with no radiation, the most common CP implant chosen was solid, pre-fabricated PMMA (i.e. no liquid mixing intra-op). The use of autologous bone compared to synthetic implants did not result in statistically significant differences in complications in any of the groups.

Conclusion: In this study, neither pre-RT nor post-RT significantly increase the risk of major complications in primary CP. We hypothesize that our patient-specific algorithm for choosing solid implants over titanium mesh, combined with various neuroplastic surgery techniques like scalp augmentation with fascia, contribute to these findings. Further studies are needed to determine whether this holds true in revision surgeries.

	No Radiation	Pre-operative Radiation	Post-operative Radiation
No complication	173	15	10
Minor Complication	3 (1.5%)	0	0
Major complication	23 (11.6%)	3 (16.7%)	0
Total	199	18	10

Disclosure of Interest: None Declared

19-6-262

REPAIR OF CRANIAL BONE DEFECTS IN CHILDREN USING SYNTHETIC HYDROXYAPATITE CRANIOPLASTY (CUSTOMBONE®)

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Introduction & Objectives: In pediatric cases, the use of autologous bone tissue to repair large cranial bone defects might be very complex. Aim of this study is to review our experience with the synthetic hydroxyapatite bone substitute (CUSTOMBONE®) in children.

Material & Methods: Patients file of children undergoing a cranioplasty with a CUSTOMBONE® implant were reviewed. CUSTOMBONE® were implanted in 30 children from 2006 to 2017 in children aged from 8 months to 16 years, with a mean age of 7 years and 8 months). The most common indication for cranioplasty was post-traumatic decompressive craniectomy. Mean patient follow-up was 6,7 years.

Results: Cosmetic results were satisfactory in every patient. No complications were reported but in one case the implant had to be changed after a severe head trauma due to an epileptic seizure in the early postoperative period. In all patients, cerebral blood flow improved during the postoperative phase. Control CT scans showed that implant osteointegration started around 13 months post-opertively (range: 3–22 months).

Conclusion: CUSTOMBONE® implant seem to meet all necessary conditions for good clinical outcome: protective properties, restoration of normal intracranial physiology, satisfactory cosmetic results, a good integration in the autologous bone.

The minimum thickness of the implant (4 mm) might represent a challenge in young children but we used it successully in our series. High costs represent another limitation for its use.

Disclosure of Interest: None Declared

19-6-263

USE OF CUSTOM-MADE TITANIUM THREE-DIMENSIONAL IMPLANTS FOR A FRONTO-ORBITO-ZYGOMATIC RECONSTRUCTION IN RARE FACIAL CLEFTS: THE FIRST CASE REPORT

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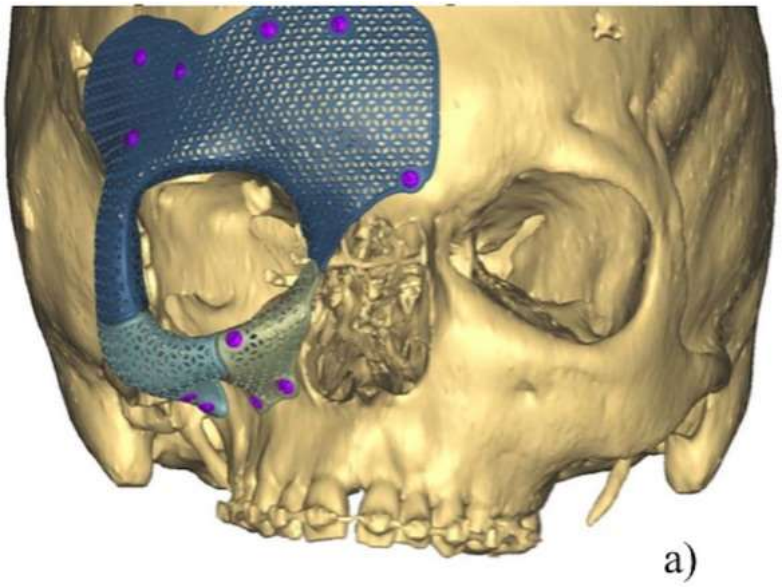
Introduction & Objectives: The reconstruction of the complex anatomy of the orbit is a real challenge. Many pathologies can modify the anatomy of the orbital region, such as fractures, tumors or congenital malformations like rare facial clefts. Currently, there is an increase in the use of allogenic or alloplastic implants like three-dimensional (3D) manufactured of customized implants in craniofacial reconstructions. Many articles reported the use of these implants in post-traumatic facial reconstruction. No case report in the world literature deals with reconstruction of the bone orbit with customized implants in congenital malformations such as rare facial Tessier's clefts. We report the first world case of fronto-orbito-zygomatic reconstruction using custom-made titanium 3-Dimensional printed implants in a teenage girl with rare facial Tessier's clefts.

Material & Methods: A 16-year-old girl, followed since birth in our department in the Woman-Mother-Child University Hospital in Lyon, had a major right fronto-orbito-zygomatic hypotrophy due to a combination of multiple facial clefts: Tessier number 2-12 (paramedian cranio-naso-labial cleft) and number 10 clefts (superior median orbital cleft).

A high-resolution computed tomography scan (CT scan) of the patient's craniofacial skeleton was realized before the surgery. By mirroring, the contralateral bone defect was calculated. The frontal bone defect was evaluated at 11,8 millimeters and the zygomatic bone defect at 16,7 millimeters compared to the left side. Titanium implants were then designed virtually based on the mirrored fronto-orbito-zygomatic surface and manufactured using the computer-assisted design computed-assisted manufacturing (CAD-CAM) method.

Results: Three titanium implants were printed: a frontal implant, a zygomatic implant and an orbital floor implant. We chose to perform three implants to facilitate the surgery and avoid too large and too much facial incisions. Furthermore, a hypocorrection was decided to avoid skin necrosis after surgery. Under general anesthesia, a coronal and inferior sub ciliar incisions were performed. There was no intra and post-operative complication. A follow-up of 12 months of the patient revealed a good aesthetic result with an improvement of the fronto-orbito-zygomatic depression.

Conclusion: We expose a first world case of fronto-orbito-zygomatic reconstruction in a context of congenital facial malformation. The use of custom-made titanium 3D implants in craniofacial reconstructions is a valuable help that is being increasingly practiced. Unlike post traumatic orbital defect, a congenital malformation associates bone deformities with soft tissues abnormalities. Thus, bone reconstruction appears to be only the first step in a long complex reconstruction procedure.



Disclosure of Interest: None Declared

19-6-264

CRANIOPLASTY CRIPPLES & MICROSURGICAL RECONSTRUCTION

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Introduction & Objectives: Multiple cranioplasties after trauma, craniectomies and hematoma damage lead to repeated interventions due to inflammation and implant exposure. The purpose of this study is to present our experience of multiple cranioplasties, the complications with implant exposure as well as the treatment with microsurgical reconstruction with free tissue transfer.

Material & Methods: A retrospective research underwent on all treatments performed for exposed implant coverage after cranioplasty between January 2016 and Dicember 2018

Results: 5 male patients underwent calvarian reconstruction during the study period after trauma and long-term hospitalization in intensive care unit due to epidural hematoma and more then 5 craniotomies and cranioplasties. After laboratory and imaging testing as well as careful preoperative preparation along with the neurosurgery team the implants was removed and replaced. Three scalp flaps performed to cover the calvarian defect. Two free anterolateral thigh flaps in combination with custom made Porous polyethylene alloplastic material were performed after the failure of previous locoregional flaps reconstruction. The facial artery and the external jugular vein were used as recipient vessels. Primary closure of the donor-site was possible in one case; with skin grafting performed for the second patient. The flap survival rate was 100%. Complications were minor of wound healing in the donor site and scarring where it was treated with local wound care and antibiotics. The locoregional flaps are an option treatment but the ALT flap offers the advantage of customizable size, option of fascia lata as vascularized dural replacement, and minimal flap atrophy typical of muscle flaps. Indications include very large defects with exposed prosthesis, or defects with bone or dural loss. Our experience support the use of customized free ALT flaps to achieve functional and cosmetically superior result for the reconstruction of large scalp defects, with remarkably improve of neurological and cognitive outcomes supported by imaging.

Conclusion: The combination of cranioplasty with or without alloplastic material mesh and the microsurgical reconstruction with free tissue transfer should be considered as the preferred reconstructive option for postcranioplasty exposed implant.

Disclosure of Interest: None Declared

DAY19 - STATION 7 - CRANIOFACIAL AESTHETICS

19-7-265

AESTHETIC GENIOPLASTY BASED ON STRATEGIC CATEGORIZATION

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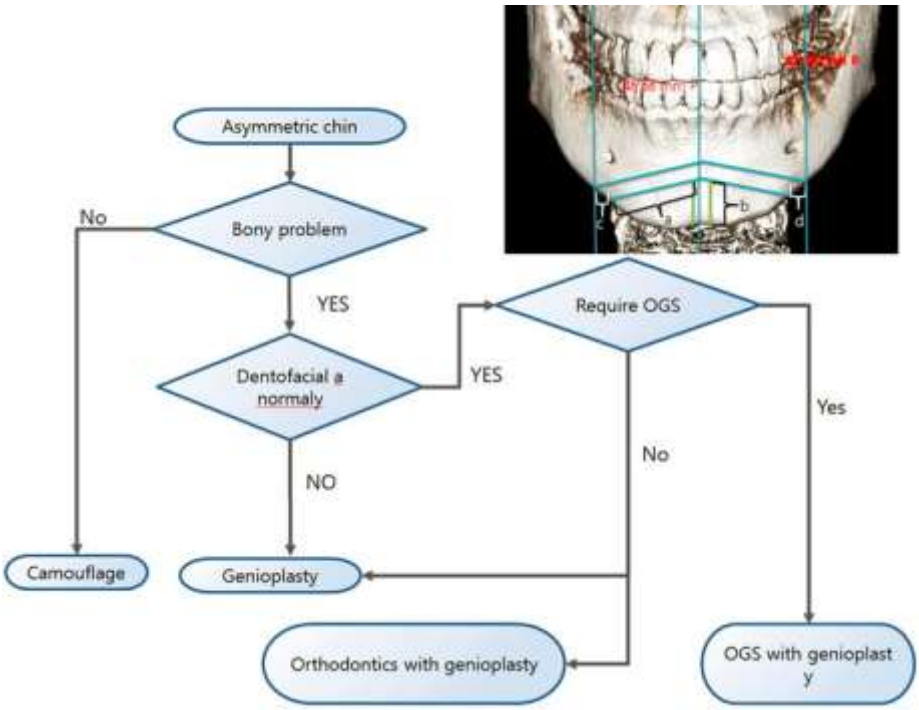
Introduction & Objectives: Genioplasty is a popular procedure for the correction of lower facial contour. In aesthetic surgery, various T-narrowing osteotomies have been widely introduced and performed. Using the procedures, advancement, reduction, narrowing or widening and lengthening are possible. Computerized tomography (CT) images facilitate preoperative planning in detail. Authors have applied novel planning methods based on strategic categorization for genioplasty and analytic results are described.

Material & Methods: This retrospective study reviewed 200 patients who underwent genioplasty procedures for facial contouring from October 2015 to April 2018. With regard to the preoperative evaluation of mandible, operative procedures were classified to three types: 1) Vertical segment osteotomy, 2) Horizontal segment osteotomy and 3) Bone graft. Adequate osteotomies were followed by rigid fixation using titanium plate and screws. The follow up period ranged from 6 to 24 months (average, 17 months). The results were assessed based on medical records, photographs, and facial bone computerized tomography (CT) images.

Results: Overall Patients were satisfied, and rated excellent in terms of the lower facial contour and balance. There was no major complication, such as mental nerve neurotemesis or facial palsy. Minor wound infection was observed in 3 cases, and controlled well with antibiotics. Temporary partial sensory loss was reported in 3 cases, however resolved in 6 months.

Conclusion: The patients' chief complaint and bony structures should be carefully evaluated before genioplasty procedures. During the operation, meticulous osteotomies and rigid fixation are necessary. Authors' strategies for genioplasty resulted in aesthetic balance and allowed predictable outcomes.



Disclosure of Interest: None Declared

19-7-270-N /S6A-03

BIFRONTOORBITAL REMODELING REVISITED: LONG TERM FOLLOW-UP OF OPERATED PATIENTS FOR SYNOSTOTIC PLAGIOCEPHALY

Jordi Puente Espel [1,*], Jeremy Chang [1], Giovanna Paternoster [2], Roman Hossein Khonsari [2], Jenny Chen [2], Syril James [2], Dominique Renier [2], Eric Arnaud [2]

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Introduction & Objectives: Synostotic plagiocephaly represents a surgical puzzle, for which multiple surgical methods have been developed. The objectives were:

1.Demonstrate the facial features presented by pts over a long period of time, the persistent abnormalities showed and its treatment.

2. analyze pts operated by the same surgeons at a single center.

Material & Methods: A retrospective chart review. Inclusion criteria for patients were as follows: (1) unicoronal synostosis treated with BFOA, (2) previously unoperated skull, (3) follow-up period of at least 10 years, (4) informed consent, (5) treated at a single medical institution. The demographic info, clinical-morphologic data, postoperative-surgical complications and reoperation rate were analyzed according to age at surgery (BFOA), based on three groups: 0-6, 6-12, >12 months. Complications were analyzed in consonance with the surgical aspects (i.e. dural tears, etc.), the Whitaker, Sloan and Clavien-Dindo classifications. Reoperation was reported based on functional or morphological aspects.

Results: 27 pts included; 21 female, 6 male; 3 had a family member affected. Age at operation was 6—28 mo(average 10). The advancement distance was 10—25 mm (average 18.7). Groups according to age at surgery were: 0-6 (n=7), 6- 12 (n=11), >12 mo (n=9). The complication rate or reoperation rate was not associated with the distance advanced. 4 pts had dural tears but none had a persistent CSF leak; 1 patient had a hematoma (not related to surgery) and 1 patient had a conspicuous scar. According to the Whitaker classification, 12 pts were class II (7 were reoperated); and three patients were class III, requiring additional procedures. All pts were considered to have an adequate morphological result on the surgical table; deficient morphology was encountered: between 2-5 yrs of age in 11 pts (40.7%), 1 required reoperation (lesser bone contouring revisions); between 5-10 yrs of age in 8 pts, 5 required reoperation; and 10-15 years of age in 2 patients, the two required reoperation.

Conclusion: Several factors affect patients with synostotic plagiocephaly, some can be modified in surgery and others will prevail as the individual grows. Immediate postoperative results might be satisfactory for variables that can be altered surgically, following a detailed and meticulous surgical technique. Yet, the craniofacial region will show progressive changes related to the condition, that may affect the outcome in a period that may last up to 15 years from the initial surgery. The use of adjuvant procedures (i.e. fat grafting, bone grafts and implants) are helpful tools to achieve an adequate final result.

Disclosure of Interest: None Declared

19-7-267-N / 18-5-150

A 3D STATISTICAL FACE MODEL FOR SYNDROMIC CRANIOFACIAL PATIENTS

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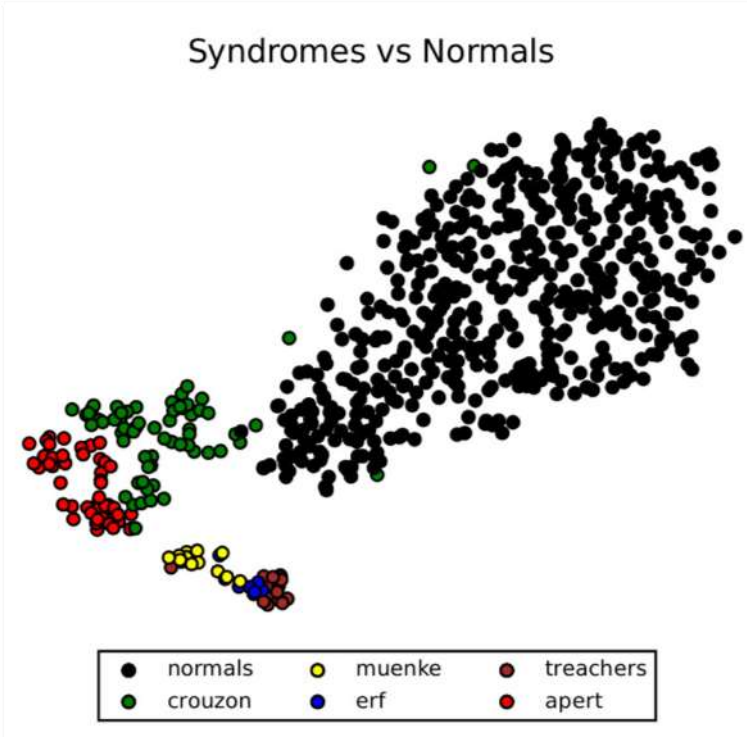
Introduction & Objectives: 3D Morphable Models (3DMMs) are powerful statistical models of 3D facial shape. Even though powerful 3D facial shape models can be learnt, it has not been examined how they can describe people with facial deformities. In this paper, we propose a "syndromic" 3DMM by combining a powerful statistical model of facial shape for normal people, with a new statistical model of facial people with Apert, Crouzon, Treacher-Collins, Muenke, and ERF syndromes. We show that the proposed 3DMM not only can described syndromic cases but also separate aforementioned syndromes into different clusters.

Material & Methods: CT scans of patients diagnosed with Apert, Crouzon, Treacher Collins, Muenke and ERF were included in this study.The construction of the Syndromic 3DMM consisted of 4 stages: 1) data pre-processing: CT-scans were collected, meshes were cleared and manually annotated; 2) Similarity alignment and statistical modelling:the meshes were subjected to Procrustes Analysis to remove similarity effects, leaving only shape information; 3)dense correspondence: using elaborate machine learning techniques like Gaussian Processes, 3D meshes were reparametrised into a form where each mesh has the same number of vertices joined into a triangulation that is shared across all meshes; 4)Principle Component Analysis (PCA): the registered meshes were statistically analysed with PCA, generating a 3D deformable model.

Results: A total of 148 patients could be included: 49 Apert, 63 Crouzon, 16 Treacher-Collins, 14 Muenke, and 6 ERF patients for the construction of the model.In order to visualise the shape space, we applied t-Distributed Stochastic Neighbour Embedding (t-SNE) to the shape vectors from all syndromic samples in addition to some normal samples. The clusters are clearly separated from the main manifold of normal people.

Conclusion: We present the first statistical descriptive Syndromic 3DMM ever constructed. This model can be used to recognise craniofacial syndromic patients. This is the first demonstration of the distribution of 3D shapes of the face of normal people versus syndromic patients. This model raises the possibility for the future applications such as an automated diagnostic tool for patients with suspected craniofacial syndromes.



Disclosure of Interest: None Declared

19-7-268-N / 19-11-304

AUTOLOGOUS FAT: CORRECTION OF SECONDARY DEFORMITIES DUE TO CRANIOSYNOSTOSIS

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Introduction & Objectives: Children who have undergone craniectomy and frontocranial remodeling for craniosynostosis frequently outgrow their initial repair. When there are signs of elevated intracranial pressure the only solution is to redo the intracranial procedure and expand the calvarial vault. In most of our patients though the indication for secondary surgery is more of a cosmetic one due to asymmetry, cranial irregularity, and most commonly due to a predictable absence of growth of the skull and forehead in specific areas predicated on the suture that was involved.

Material & Methods: Over the past eight years a total of 100 consecutive patients underwent autologous fat transfer to the forehead, midface, and skull region to correct a secondary craniofacial deformity. We have carefully looked at the charts of all patients done at one facility by a single surgeon with regards to secondary surgery. Since this procedure is one for appearance only to eliminate the stigmata of craniosynostosis, not all families desired surgery. The study base is only those patients that have returned to our institution for follow-up.

Results: A total of 450 facial areas were addressed in this series and the total amount of fat injected ranged from 7cc's to 90cc's depending on the diagnosis, the location, and the deformity. 90% of the patients were done as an outpatient with overnight stay required for large volume lipofilling and those that had midface augmentation with concerns about airway.

Growth-related facial deformity secondary to craniosynostosis surgery is extremely predictable. Patients that have had an open sagittal suture procedure frequently are left with bifrontotemporal pinching with facial growth. Unicoronal synostosis patients commonly have persistent frontal and orbital asymmetry that was either impossible to correct at the time of initial surgery or developed later in life secondary to facial growth. Metopic synostosis patients frequently outgrow their initially satisfactory correction and develop not only bitemporoparietal pinching, but frontal bone flattening and overall irregularity. Midface hypoplasia with frontal bone flattening and overall asymmetry is even more common in children with bicoronal suture synostosis particularly in those that are syndromic.

Conclusion: Autologous fat transfer to the face is an excellent technique for correction of secondary craniofacial deformities when open cranial surgery is not indicated. The need for lipofilling as a planned secondary procedure in the future is frequently discussed at the time of the original procedure because certain deformities are predictable with growth and age. It has become our procedure of choice for craniofacial correction when intracranial pressure is absent.

Disclosure of Interest: None Declared

19-7-269-N / 18-5-152

QUANTIFICATION OF BONE AND SOFT TISSUE DEFORMATIONS IN CRANIOFACIAL PATIENTS

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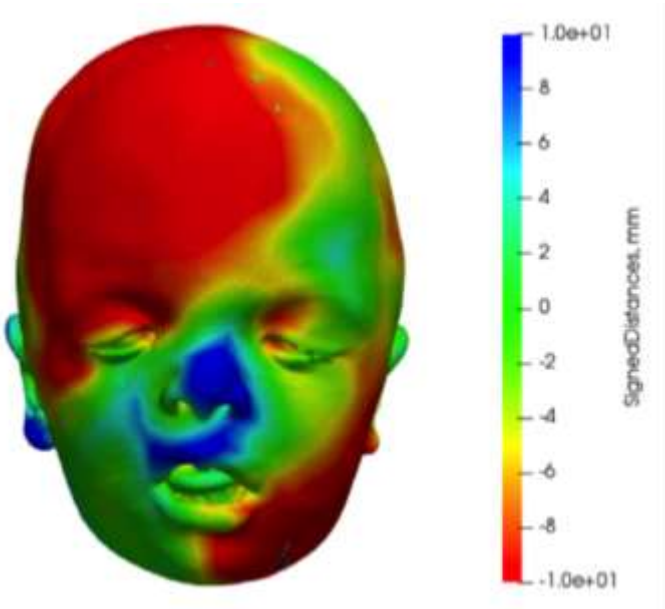
Introduction & Objectives: Children with faciocraniosynostosis suffer from facial deformities and may require reconstructive surgery with external distraction via RED-frame. Various RED-frame distractive surgical techniques exist including Monobloc distraction, midfacial bipartition, Le Fort III (with fronto-orbital remodelling), and Le Fort II (with zygomatic repositioning (ZR)). The choice is based on surgeon's experience and Centre preferences as well as on subjective outcomes. In literature, quantitative studies focus on the advancements (rigid displacements and rotations) post RED-frame distraction, but the intrinsic shape changes (deformations) of bone and soft tissue remain unknown. This study aims to quantify 3D bone and soft tissue changes post RED-frame distraction in craniofacial patients, comparing the available surgical techniques.

Material & Methods: Pre and postoperative (during and post RED-frame removal) CT-scans of patients who had RED-frame distraction were included. A pipeline was created for the quantification of facial shape changes post-surgery. All CT-scan bone and soft tissues surfaces were reconstructed. All bone and face meshes were semi-automatically registered using an iterative closest point (ICP) algorithm on the operated region. Distances between the surfaces were calculated and visualised as colourmaps to highlight the regions of local deformations and bending.

Results: A total of 16 consecutive patients (F:M 8:8) could be included (average age: 11.9 years old). Colourmaps showed the different surgery features in terms of shape changes without the overall rigid advancement/rotation confounding factor. Figure 1. demonstrates soft tissue changes following midfacial bipartition distraction and nasal bone graft in a patient with Apert syndrome. It shows a negative value of the right frontal bone and orbit. This suggests bending of the bone inward from the reference *i.e.* pre-operative mesh. Moreover, it shows a positive soft tissue shape change of the nose and peri-orally.

Conclusion: Using this quantitative method, it is possible to analyse the surgical results in terms of local facial shape changes and compare the various RED-frame distraction techniques. This method could be used for patient specific surgical planning, but also to monitor in real-time the results of the distraction protocol and adjust by extending the face image acquisition to 3D photography.

Figure 1. Colourmap of facial deformations 355 days following midfacial bipartition and nasal bone graft in an Apert patient. Positive values correspond with positive changes from pre-operative CT-scan, negative values correspond with those negative from the reference.



Disclosure of Interest: None Declared

19-7-266-N / 19-12-312

THE USE OF A TENDON PULLEY TO ACHIEVE A MULTI-VECTOR LINE OF PULL IN LENGTHENING TEMPORALIS MYOPLASTY: A NEW TECHNIQUE TO OPTIMIZE THE SMILE

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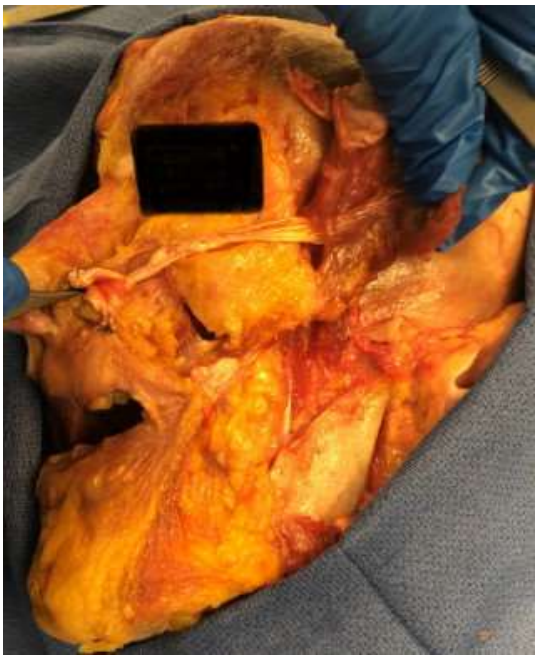
Introduction & Objectives: Lengthening temporalis myoplasty (Labbe procedure) is a single-stage, dynamic procedure used to reanimate the middle third of the paralyzed face and restore a symmetric, natural smile. The currently described technique includes the temporalis muscle tendon inset to the orbicularis oris muscle at the oral commissure. This creates the line of pull produced by the zygomaticus major and zygomaticus minor muscles, which averages about 40 degrees to the horizontal plane. The nearly vertical line pull produced by the levator labii oris and levator labii oris alaeque nasi (average of 80 degrees) is not reproduced by the Labbe procedure's inset. The resulting smile thus has a transverse line of pull and lacks the vertical line of pull inherent in a natural smile. We introduce a modification to the temporalis muscle tendon inset that allows reproduction of both the transverse and vertical lines of pull.

Material & Methods: Lengthening temporalis myoplasty was performed on two sides of a fresh cadaver head. The temporalis muscles were mobilized and the tendons were released from the coronoid insertion. To reproduce the actions of zygomaticus major and zygomaticus minor muscles, the tendon was sutured to the orbicularis oris muscle at the commissure and the most lateral aspect of the upper lip orbicularis oris. An additional tendon slip was then separated from the main tendon and was sutured to the upper lip orbicularis oris muscle medially to reproduce the actions of levator labii superioris and levator labii superioris alaeque nasi. The tendon slip was wrapped in a tendon sling (2 x 1 cm tendon graft harvested form the most anterior portion of the temporalis muscle tendon) and anchored (using a bone anchor) to the nasal process of the maxilla. This tendon sling acted as a pulley to redirect the line of pull to a more vertical trajectory. (Figure 1).

Results: The average line of pull (calculated in degrees to the horizontal plane) of the zygomaticus major, zygomaticus minor, levator labii superiorosis, and levator labii superiorosis aleque nasi was 50, 30, 76, and 81 respectively. The standard inset of the temporalis tendon reproduced the actions of zygomaticus major and zygomaticus minor muscles only (average of 40 degrees). The modified method of inset resulted in reproduction of both transverse (average of 40 degrees) and vertical lines of pull (average of 78.5), which simulates the actions produced by the zygomaticus major, zygomaticus minor, levator labii superiorosis, and levator labii superiorosis aleque nasi

Conclusion: Using a tendon sling to create a pulley system permits production of a multi-vector temporalis muscle pull that leads to a more dynamic, natural smile.



Disclosure of Interest: None Declared

19-7-272

AUTOLOGOUS FAT GRAFT FOR CORRECTION OF FACIAL ASYMMETRY IN PEDIATRIC PATIENTS WITH PARRY-ROMBERG SYNDROME

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[1]Plastic, Reconstructive and Aesthetic Surgery, Tokyo Metropolitan Police Hospital, Tokyo, Japan

Introduction & Objectives: Autologous fat grafting is an established valuable tool in the correction of facial soft tissue asymmetry and volume deficits in adult patients with progressive hemifacial atrophy; Parry-Romberg syndrome. However, few studies about autologous fat transfer in the pediatric patients to offer aesthetic and psychosocial improvements before maturation of craniofacial skeleton exist describing the outcomes of pediatric facial fat grafting. The objective of this case study is to identify the pediatric outcomes after autologous fat grafting for the correction of facial asymmetry and objectively evaluate the outcomes by using 3-dimensional (3-D) volumetric analysis.

Material & Methods: Retrospective chart review during past three years was performed identifying pediatric patients 15 years old or younger, having undergone autologous fat grafting to the face for correction of facial volume deficits or asymmetry. Intraoperative variables were analyzed including graft volume transferred, donor fat processing technique, and donor site. Outcomes were evaluated based on photographs, number of revisions or corrections, and complications. Especially patient and surgeon satisfactions were evaluated by comparing the preoperative and postoperative 2-dimensional(2-D) standardized photographs. The 3-D images were also analyzed using 3-D analysis software to calculate the volume changes between them.

Results: Three patients were identified. 2 patients were classified in Guerrerosantos type 3; involvement in soft tissue, bone and cartilage. One patient was classified in type 4; most severe type, the skin is close to the bone and there is bone involvement. The median age at the time of first fat graft was 12.6 years. The average time from primary procedure to most recent follow up was 2.5 years. The average volume of single graft transferred to the face was 27.2 ml (13.6-53). Medial thigh was the most common donor site utilized. According to the 2-D photographs evaluated by both patients and the surgeon, satisfaction with the cosmetic results were achieved with an average of 3.3 graftings. There were no complications. The preoperative and postoperative volume differences of each time was statistically significant ($p<0.01$).

Conclusion: Autologous fat transfer is a safe and viable treatment in the pediatric patients with Parry-Romberg syndrome. Although repeat fat grafting procedures may be required to achieve adequate correction, it could be useful to maintain facial balance until the optimal period for cranio-maxillo-facial surgery.

Disclosure of Interest: None Declared

DAY19 - STATION 8 - CRANIOSYNOSTOSIS/MISCELLEANOUS

19-8-273

INTRACRANIAL VOLUME IN PATIENTS WITH SHUNT-RELATED CRANIOSYNOSTOSIS

E. Mantilla-Rivas [1,*], L. Tu [2], A. R. Porras [2], H. Alexander [3], M. Manrique [1], J. R. Bryant [1], R. Keating [3], S. N. Magge [3], J. S. Myseros [3], C. Oluigbo [3], A. K. Oh [1], M. G. Linguraru [2], G. F. Rogers [1]

[1]Plastic and Reconstructive Surgery, [2]Sheikh Zayed Institute for Pediatric Surgical Innovation, [3]Neurosurgery, Children's National Health System, Washington DC, United States

Introduction & Objectives: Shunt-related craniosynotosis (SRC) occurs well after birth when loss of suture patency has less impact on cranial shape and volume than in-utero fusions. It is unclear if this process adversely affects cranial growth and reduces ICV expansion. Thus, encountering this complication represents a treatment challenge. In this study we evaluate the association between ICV and the presence of SRC in patients requiring cerebrospinal fluid shunting.

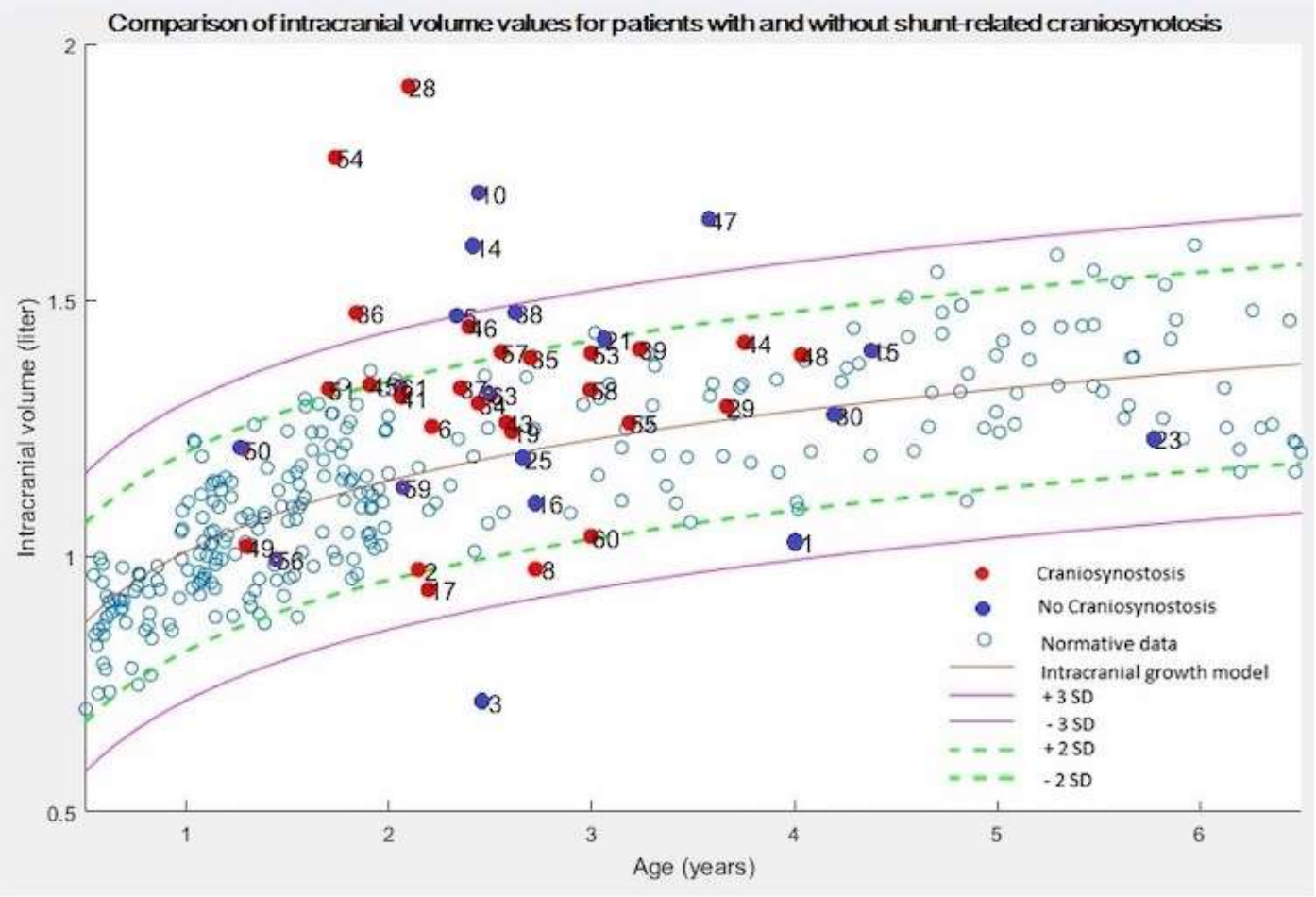
Material & Methods: We identified 44 patients from 2006 to 2012 who underwent ventricular shunt placement secondary to increased intracranial pressure for congenital conditions including: Dandy Walker, Spina bifida, Chiari malformation and congenital hydrocephalus. The patients were classified into two groups: Patients with SRC (Group 1, N=26) and without SRC (Group 2, N=18). Post-operative computed tomography (CT) scan was done at a mean of 2.18 ± 0.63 years and 2.67 ± 1.16 years (p-value=0.13) for Group 1 and 2, respectively, after surgery. Cranial suture fusion and ICV measurement were evaluated. ICV was compared to an established normative database from over 550 healthy individuals. Given that ICV values did not show a normal distribution [Figure 1], we divided each group of patients into three categories: ICV within ± 2 standard deviations (SD); ICV between ± 2SD and ± 3SD; and ICV over ± 3 SD of the mean. Fisher's exact test and t-tests were carried out to measure categorical variables and the association between continuous variables, respectively.

Results: Significant difference for the age of shunt placement was found. Nonetheless, postoperative CT scan age and ICV measurements had no significant difference between the two groups [Table 1]. Fisher's exact test revealed no difference between the ICV of patients with and without SRC for each category.

Variables	**SRC (n= 26)**	**No SRC (n= 18)**	***p-value***
Age at shunt placement (days)	121 ± 83.75	65.33 ± 81.78	**0.04**
Postoperative CT (years)	2.52 ± 0.65	2.85 ± 1.07	0.26
Intracranial volume (cc)	1314.69 ± 216.72	1292.45 ± 244.	0.76

Conclusion: This study demonstrates no significant difference in the ICV between the two groups. In spite of this, since the onset of craniosynostosis is unknown, this single ICV measurement does not exhibit a complete picture of the impact on skull growth. Serial ICV measurements may provide better understanding of the long-term impact on skull growth in patients who developed SRC.

Picture for abstract 19-8-273:



Disclosure of Interest: None Declared

19-8-274

INCIDENTAL DIAGNOSIS OF CRANIOSYNOSTOSIS AT THE ER: SERIES OF 331 PATIENTS

M. Manrique [1,*], E. Mantilla-Rivas [1], J. Bryant [1], R. Keating [2], A. R. Porras [3], M. G. Linguraru [3], A. K. Oh [1], G. F. Rogers [1]
[1]Plastic and Reconstructive Surgery, [2]Neurosurgery, [3]Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National Health System, Washington DC, United States

Introduction & Objectives: Craniosynostosis (CS) is usually diagnosed during early childhood for the presence of skull deformities, asymmetry of the face, or increased intracranial pressure. However, some patients present a diagnostic challenge due to delayed CS, since the clinical presentation can be either mild or absent. Although the clinical consequences of this are not certain, the emergency department (ED) might present a particularly well-suited alternative for the diagnosis of these individuals. In this light, the purpose of this paper is to document the prevalence of CS in a sample of patients coming from the ED from 1 to 5 years of age, at our institution.

Material & Methods: A total of 331 computerized tomographies (CT) scans from children between 1 to 5 years old (mean age 2.4 ± 1.3 years) were retrospectively reviewed. These images were taken at the ED from June 2005 to October 2016. Reasons for the imaging included: trauma, seizures, headaches, among others. Patients with a past medical history of shunt placement and CS associated syndromes were excluded. CS was diagnosed via review of CT scans by either three plastic and reconstructive surgeons or one neurosurgeon. Suture fusion, radiology report, the reason for CT scan and past medical history were recorded as covariates.

Results: A total of fifteen patients were found to have CS [Table 1]. Of these, 20% were reported by the radiologist. The most common fused suture was sagittal (73.3%), followed by unilateral coronal synostosis (20%) and bilateral coronal synostosis (6.7%). Indications for CT in patients who were found to have CS were: Trauma (66%), followed by seizures (13%), headaches (6.7%), ataxia (6.7%), irritability (6.7%). Most of the patients had no significant medical history.

Prevalence of craniosynostosis per age group

Age group (years)	Craniosynostosis	No craniosynostosis
1 (N=104)	3 (2.9%)	101
2 (N=84)	6 (7.1%)	78
3 (N=65)	2 (3.1%)	64
4 and 5 (N=78)	4 (5.1%)	74

Conclusion: CS can be under-recognized in the ED. In this study, we highlight the relevance of performing an extensive evaluation the head CT scans on patients younger than 5 years of age. Radiologist must be aware of the possible presence of CS, regardless of the chief complaint for ED consultations.

Disclosure of Interest: None Declared

19-8-275

ASSOCIATION OF CRANIOSYNOSTOSIS WITH CHARGE SYNDROME

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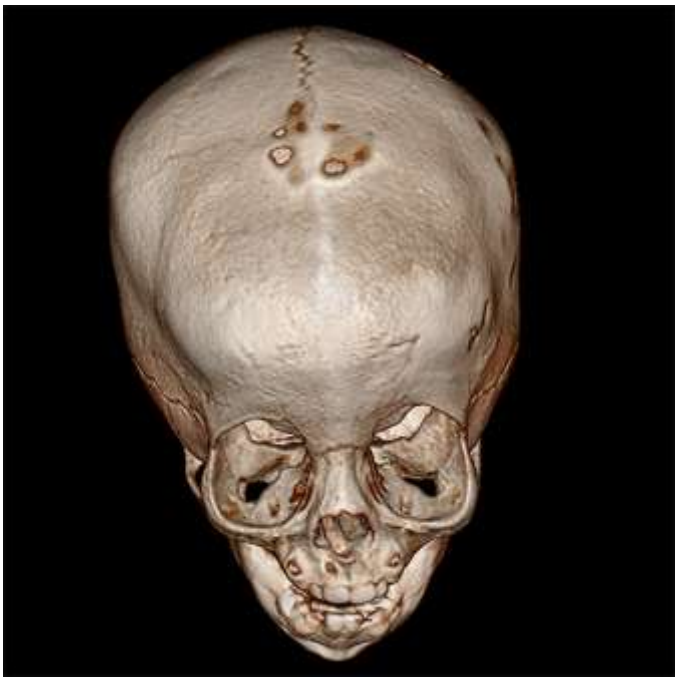
Introduction & Objectives: We present here two cases of craniosynostosis and CHARGE syndrome. CHARGE syndrome is characterized by a combination of multiple congenital anomalies including **C**olobomas, **H**eart defects, choanal **A**tresia, **R**etardation of growth or development, **G**enital hypoplasia, and **E**ar malformations. Originally thought to be an association, CHARGE syndrome was shown in 2003 to be a genetic disorder caused by a mutation in the CHD7 protein. Only one prior case report has documented the presence of craniosynostosis in CHARGE syndrome. We present here two additional cases including a case of progressive postnatal multi-suture synostosis.

Material & Methods: Patient 1 was identified as an inpatient via consultation to our services (AA + BF). At the time of diagnosis, no prior publications associating craniosynostosis with CHARGE were identified on a Pubmed search (single case report published in January 2019). Patient 2 was identified in discussions with a colleague (AT).

Results: Two patients with CHARGE syndrome and craniosynostosis were identified. Patient 1 was initially seen at day 2 of life with concerns for macrocephaly. She had a small fontanelle but otherwise normal head shape. CT at day 3 of life demonstrated patency of all cranial sutures. Due to her respiratory compromise, she remained hospitalized for a long period of time. Thus, at 3 months of age, her head shape was noted to be abnormal and a repeat CT revealed partial bicoronal synostosis, fusion of the metopic suture, and narrowing of the anterior sagittal suture. By 7 months of age, the coronal sutures were completely fused and the anterior portion of the sagittal suture was fused (Figure). Fronto-orbital advancement with sagittal strip craniectomy was performed at 8 months of age.

Patient 2 was an infant female with CHARGE syndrome and a documented mutation in CDH7. She underwent a CT scan at 4 days of age for unrelated reasons, which demonstrated partial fusion of the left lambdoid suture. Per her parents' wishes, conservative management was elected.

Conclusion: We present here a rare case of progressive postnatal multisuture craniosynostosis in a patient with CHARGE syndrome, and an additional case of isolated lamboid synostosis in another CHARGE patient. Patients with CHARGE syndrome should be evaluated for craniosynostosis. There should be a low threshold for referring these infants to a craniofacial surgery program should any head shape anomalies occur.



Disclosure of Interest: None Declared

19-8-276-N / 19-9-283

NOTHING CAN STOP THE PEDIATRIC NEUROSURGEON: HOW TO MANAGE FRONTO-ORBITAL ADVANCEMENT WITHOUT BIOABSORBABLE PLATES

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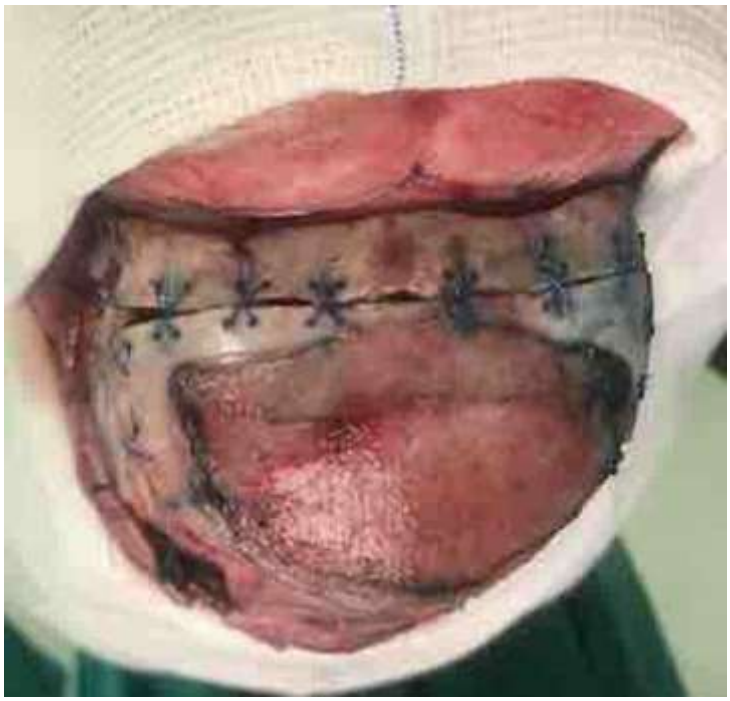
Introduction & Objectives: A variety of means has historically been used for rigid fixation in craniosynostosis surgical correction: metallic wires, metallic plates and screws, and meshes. The disadvantages of metallic plating include the possibilities of an allergic reaction; growth restriction; exposure, extrusion, or transcranial migration of the implanted device; infection; visibility; and palpability when placed under thin skin. Since the introduction of resorbable fixation devices in the early 1990s, its ability to maintain sufficient rigidity until skeletal healing is complete has made them an attractive alternative for pediatric skeletal fixation. However, the high cost of bioabsorbable plates may be a limiting factor for the surgery. Many neurosurgical units still use PDS suture for fixation, but we know that with the manipulation of the new frontal and orbital bandeau, these sutures can become loose. The objective of this study is to describe simple techniques that allow reliable and low cost fixations.

Material & Methods: Retrospective study of patients submitted to fronto-orbital advancement in pediatric neurosurgery unit from August 2014 to August 2018. We analyzed the surgical technique employed and the aesthetic results.

Results: During the study period, 55 children with simple and complex craniosynostosis were submitted to fronto-orbital advancement. Approximatly 50% of the cases consisted of syndromic patients. We describe a rigid fixation technique of the new frontal and the orbital bandeau with 4 symmetrical burr-holes in each fixation unit, promoting cross absorbable suture. For fronto-orbital advancement, in the absence of bioabsorbable plates, we used autologous bone fragment as a presumed plate, being this one of thin tickness, but long enough to surpass the anterior and posterior bone margins, and being superimposed and fixed to these margins also with 4 burr-holes and cross absorbable suture.

Conclusion: Since 1970s, pediatric neurosurgeons and craniofacial surgeons search a way to achieve rigid fixation with the best aesthetic result. Historically, we witnessed stainless steel wire fixation, titanium fixation plates, meshes and bioabsorbable plates. Although still relatively new to the scene of craniofacial reconstruction, bioabsorbable plating have worked remarkably well. However, this doesn't mean that the surgery can't be done without it. The technique of 4 points fixation achieves rigid fixation with good aesthetic results.



Disclosure of Interest: None Declared

19-8-277

DYNAMIC OSTEOTOMIES WITH EXPANDING SPRINGS FOR CRANIOESTENOSIS BY TRANSPLANTED OSTEOPETROSIS

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Introduction & Objectives: Osteopetrosis belong to a heterogeneous group of hereditary osteopathies characterized by deficiency in bone resorption that occurs due to osteoclast dysfunction. The classic form of childhood malignant osteopetrosis includes the early closure of the cranial sutures with increased intracranial pressure. We present the case of an infant with osteopetrosis who underwent bone marrow transplantation (BMT) at 4 months who developed symptoms of intracranial hypertension due to multiple cranioestenosis diagnosed after transplantation. She was submitted to 2-stage cranioplasty with the use of semicircular osteotomies and expanding springs in the first time at 11 months and Nautilus helicoidal osteotomies in the second time with 1 year and 4 months. We present the clinical results regarding remission of symptoms, cranial remodeling and low morbidity of the technique.

Material & Methods: A retrospective case study was conducted at BP Hospital of São Paulo during 2017.

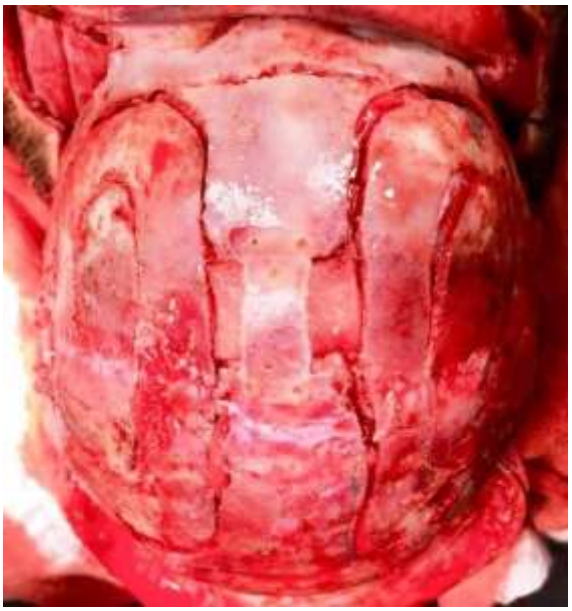
Results: Case presentation

M.A.L, female, was diagnosed with osteopetrosis at 3 months. After transplantation, she presented clinical complications. At 9 months the fontanelle closed and the child evolved with exophthalmos and severe motor and visual limitation resulting from intracranial hypertension. The skull CT evidenced multiple craniosynostosis due complete sagittal and bilateral coronal sutures closures plus partial lambdoid sutures closure and disseminated craniolacunia, presenting compression of the posterior fossa and herniation of cerebellar tonsils.

First Surgery: She was submitted at 11 months years old to parallel semicircular osteotomies with fulcrum in the anterior fontanel under the use of Midas-Rex osteotome, using 4 expanding springs in the lower semicircle and 2 in the upper semicircle, aiming the posterior fossa decompression. After the first surgery, the motor development improved with crawling, firming the trunk and presenting finer motor movements. The vision improved dramatically and progressively.

Second Surgery: It was performed at 1 year and 4 months at the moment of spring removal after complete ossification of the anterior osteotomies, aiming to complement the remodeling of the cranial framework with the most matured and recovered child. Helicoidal dynamic osteotomies were performed on Nautilus supraorbital bilaterally reaching the vertex area, aiming at the treatment of the secondary defect resulting from cranioestenosis. A metastatic bone band was discontinued and the ostectomized horizontal fragment was rotated and fixed vertically as the use of absorbable plaques for frontal remodeling with increased area.

Conclusion: The use of dynamic osteotomies with springs was effective for the treatment of cranioestenosis in this patient showing itself to be a safe solution in the therapeutic arsenal of this disease.



Disclosure of Interest: None Declared

19-8-278

OPTICAL COHERENT TOMOGRAPHY AND TRANSORBITAL ULTRASOUND IN PATIENTS WITH CRANIOSYNOSTOSIS. ARE THEY USEFUL TOOLS TO ASSESS INTRACRANEAL HIPERTENSION?

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Introduction & Objectives: For many years, patients with syndromic and non syndromic craniosynostosis have been exposed to invasive methods for detecting intracranial hypertension (ICP), nowadays multiple non invasive methods have been proposed and studied in order to avoid risks. Therefore transorbital ultrasound (TOUS) and optic coherence tomography (OCT) have acquired strength; TOUS allows to determine the optic nerve sheet diameter and OCT allows to assess the peripapillary retinal nerve fiber layer thickness, both measurments along with clinical and tomographical signs have high sensitivity and specificity for ICP.
However none of previous papers have determined values for those variables in patients under 6 years old and there is also lack of information about post surgical changes comparing with initial values.
The objective of this paper is to determine the correlation between OCT and TOUS results with clinical findings that suggest ICP in Mexican patients under 6 years old with craniosynostosis, as well as variations between the basal and postoperative values
Material & Methods: All patients with craniosynostosis scheduled for surgical treatment were documented regarding:
1. Signs of ICP in CT Scans
2. Clinical signs of ICP
3. Peripapillary retinal nerve fiber layer (RNFL) thickness measurement
4. Diameter of optic nerve sheat (ONSD) measurement with transorbital ultrasound

In the postoperative period (6 months average) same parameters were measured and corrrelated with inicial values.
Results: Ten patients with sindromic and non sindromic craniosynostosis were included. RNFL values ranged 47µm-98 µm; ONSD ranged 3.1-4.8. Values correlated positively with indirect signs of ICP. In patiens with data suggesting ICP a postoperative reduction in RNFL was observed, this could indicate improvement in the intracraneal pressure following cranial vault expansion.
Results regarding age changes in RNFL values will be discussed in presentation.
Conclusion: RNFL and ONSD are helpful guides to asess the presence of ICP, Values in neonatal and pediatric age are now provided in order to be used as reference in our population.

Disclosure of Interest: None Declared

19-8-279

THE IMPORTANCE OF CLOSE NURSE FOLLOW UP DURING TREATMENT WITH CRANIOREMOLDING ORTHOSIS FOR CRANIOSYNOSTOSIS

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Introduction & Objectives: In Norway all children with craniosynostosis are treated at the Oslo University Hospital. Since 2014 minimal invasive craniectomy followed by helmet therapy has been the preferred treatment. Strict helmet use and close follow up is mandatory to secure an optimal outcome. This technique requires a close outpatient follow up period for 6 to 18 months which is a heavy emotional burden for some parents. In this report the authors share their experience regarding the practical and organizational outpatient follow up for patients undergoing this treatment.

Material & Methods: The authors performed a retrospective analysis of 128 consecutive children who had undergone a minimally invasive procedure followed by helmet therapy. The follow up period varied from 6 to 18 months. Clinical records were reviewed for data related to their outpatient clinic visits, wellbeing regarding the helmet use, but also number of helmets, number of visits and complications related to the helmet.

Results: Their first visit with a nurse was at the preoperative initial consultation. Then at 6. and 10. postoperative day, and averaged 3 clinic visits in the first month, thereafter monthly visits. Most infants required the use of 2-3 helmets, infrequently required a fourth helmet. Two patients needed reoperation. Most patients were 2-6 months old at the time of operation. 2 were younger than 2 months, and 4 were older than 12 months. The infants accepted the helmet satisfactory in all cases but 2-3, and not in any case the helmet therapy was abandoned. A significant number of parents expressed worries regarding helmet use on the first visits. Their anxiety level /stress burden normalized during the first weeks of follow up.

Conclusion: Initial thorough information and empowering of the parents early in the process of treatment seems to help the parents coping with the helmet therapy and makes them less unsecure and stressed. When the parents are well prepared they are coping better with the treatment and we observe that the children as well adapt more easily to the helmet therapy.

Disclosure of Interest: None Declared

DAY19 - STATION 9 - CRANIOFACIAL RECONSTRUCTION

19-9-281-N / 17-12-105

REPARATIVE PROCEDURE IN LARGE LOSSES OF SCALP AND BONE OF THE SKULL AFTER RESECTION OF ADVANCED RECURRENT TUMOR ABOUT 2 CASES

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Introduction & Objectives: Scalp and Skull bone reconstruction is challenging for maxillofacial surgeons due to its proximity to important anatomical structures. This report evaluates the use of temporalis flap combined with thin skin graft for reconstruction of extended scalp and skull bone defects after skin spinocellular carcinoma resection.
Material & Methods: The proper choice of a reconstructive technique is affected by several factors—the size and location of the defect, the presence or absence of periosteum, the quality of surrounding scalp tissue, the presence or absence of hair, location of the hairline, and patient comorbidities. Successful reconstruction of these defects requires a detailed knowledge of scalp anatomy, hair physiology, skin biomechanics, and the variety of possible local tissue rearrangements. *we report* a *case* study of *2 patients*, 80 and 76 years old, both with a large losses of scalp and bone of the skull after resection of advanced skin spinocellular carcinoma.
Results: for the two patients after resction of scalp and bone skull due to epidermoide carcinoma, we repared the defect with local flap and skin graft.
the reconstruction was palliatif in one cases to recover the cerveau, and curatif in the other.
Conclusion: Successful reconstruction of the scalp requires careful preoperative planning and precise intraoperative execution. Detailed knowledge of scalp anatomy, skin biomechanics, hair physiology, and the variety of available local tissue rearrangements allows for excellent aesthetic reconstruction.

Disclosure of Interest: None Declared

19-9-282-N / 17-12-101

MANDIBULAR RECONSTRUCTION USING DOUBLE STEP DISTRACTION OSTEOGENESIS IN SEVERE BILATERAL MANDIBULAR RAMUS HYPOPLASIA

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Introduction & Objectives: Amongst the surgical techniques to correct severe ramus hypoplasia we have distraction osteogenesis (1) and microvascularized free flaps, both provide not only with bone, but also with soft tissues. Microvascular techniques present higher morbidity and cost. Therefore, in selected patients, a double step distraction osteogenesis using an internal device can provide a successful treatment providing enough bone and soft tissues (2).
The aim of this presentation is to show the results of a double step distraction osteogenesis in a patient with severe ramus hypoplasia secondary to a Bilateral Tessier's number 7 cleft. The patient underwent a Lefort I impaction of 4 mm and an advancement mentoplasty previous to the mandibular distraction.
Material & Methods: We performed photographs, TC scans and panoramic radiography to evaluate the patient's appearance and lengthening of the mandibular ramus with the newly generated bone.
Results: Both mandibular ramus were lengthened 6 cm, enabling the patient to close her lips. The new bone presents in the panoramic radiography of the same diameter as the original distracted segments.
Conclusion: Mandibular double step distraction osteogenesis is a reliable method to correct large mandibular defects in selected patients. It provides bone of good quality as well as soft tissue with low morbidity and cost.

Disclosure of Interest: None Declared

19-9-283-N / 17-10-090

USING THE SUBMENTAL FLAP FOR RECONSTRUCTION OF TRAUMATIC FACIAL DEFECTS - A CASE SERIES STUDY

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Introduction & Objectives: Soft tissue deformities may involve the skin, subcutaneous tissue, underlying muscle or a combination of any of these elements. Traumatic facial injuries may be blunt, penetrating and/or avulsive in nature. An avulsion or loss of soft tissue may create a significant deformity which requires reconstruction. The aim of this present study was to evaluate using the submental flap for reconstruction of traumatic facial defects. Various techniques can be used for defect reconstruction, including skin grafts, local or regional flaps and free vascularized tissue transfer. The location, function and size of the defect are the main factors in selecting the most appropriate reconstruction. The reconstruction flaps should be reliable, functionally and cosmetically acceptable, of suitable size and have minimal donor site morbidity.

Material & Methods: We studied subjects who had a soft tissue defect in the lower third of the face due to traumatic injuries and underwent a submental flap to repair of the defect. Defect's size before reconstruction, etiology of injuries,age and sex of subjects and complications were documented for one year after the surgery. Thirteen patients underwent a submentel flap for repairing a maxillofacial defects.

Results: The width of flaps was between 4×7 cm to 6×10 cm^2. Dehiscence occurred in one gun shot case.Infection or necrosis was not observed in all of the flaps.One case of the lower lip deformity due to flap tension was seen.Two patients had temporary the marginal mandibular paresis for 3 months.

Conclusion: The submental flap is a useful and reliable flap for repairing the maxillofacial soft tissue defects.Our study demonstrated a high success of using the submental flap for a traumatic soft tissue defect in the face .

Disclosure of Interest: None Declared

19-9-284

HISTORY RECALL, TYPICAL WORLD WAR I INJURIES IN THE EGYPTIAN REVOLUTION 2011

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Introduction & Objectives: World War I was one of the most painful moments in the human story. Its legacy was ten million victims and more than 50 million refugees. On the other hand, it was one of the most inspiring events to the revolution of plastic surgery.

After 100 years, we struggled with facial injuries similar to those in WWI in a particular event in Egyptian history – the Egyptian revolution. However, we managed them using the new concepts in plastic surgery, microsurgery and virtual model assisted surgery.

Material & Methods: Over a period of five years, we struggled with 32 cases of facial injuries resulted from firearm and blast injuries. The series contains 24 gunshot wounds, five close-range shotgun wounds, and three high-energy avulsive facial injuries. Early definitive bone and soft-tissue reconstruction have been performed in 17 patients. While 15 warranted delayed intervention. We noticed that these injuries were identical to those in World War I.

The patients ranged in age from 6 to 64 years, with a mean age of 27 years.

Results: Combining strategies of microsurgery and 3D virtual models were used to reconstruct complex facial defects. Radial forearm flap, Anterolateral thigh flap, temporoparietal fascia flap, and Fibula Flap utilized in the reconstruction. We used either vascularized bone flap or bone grafts to reconstruct cranial, facial or mandibular defects aided by 3D printing techniques. We achieved functional and aesthetic restoration of the patients with revisional surgeries in five cases.

Conclusion: In exceptional events, history recall is applicable. However, the value of innovation and usage of new technology to manage similar problems with an innovative way is the legacy of understanding history. Thanks to microsurgery and 3D printing techniques which helped us in this event.

Disclosure of Interest: None Declared

MODIFIED TECHNIQUE FOR ELEVATION OF EAR FRAME IN MICROTIA RECONSTRUCTION USING SPLIT THICKNESS COSTAL CARTILAGE GRAFT

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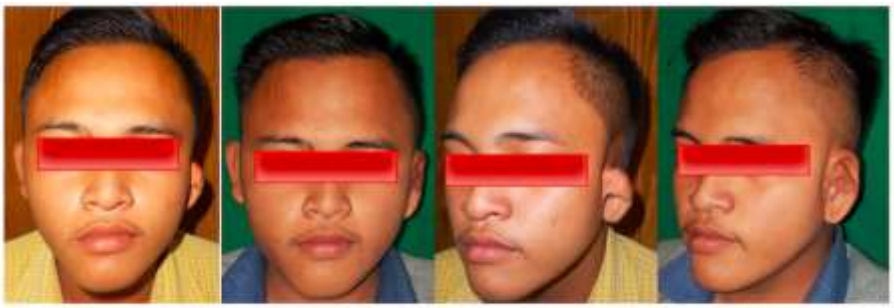
Introduction & Objectives: Elevation of ear frame in microtia reconstruction is a difficult and challenging procedure but often to be underestimated. At the stage of ear frame's insertion we already used a big amount of costal cartilages to make a well-shaped ear frame, remaining us only a small amount of costal cartilages to be used in second stage using same incision as in the first stage or using other contra lateral costal cartilages if it is not sufficient. We aim to proposed our technique, using small pieces of split thickness costal cartilage graft for elevation of ear frame in microtia reconstruction.

Material & Methods: Seven patients underwent elevation of ear frame in Microtia Reconstruction approximately 6 months after insertion of ear frame. Our modified technique is using small pieces of split thickness costal cartilage graft (1-2 mm thickness) from the unilateral fifth costal rib, using same incision as in the first stage which was located in between sixth and seventh costal cartilages. The split thickness costal cartilage was being inserted according to previous measurement, representing the distance from mastoid skin surface of the normal ear to helical rim of ear in 5 points particular markers, and covered with temporoparietal fascia flap and skin graft.

Results: Post-operative result showed an acceptable ear contour and texture. The auricular projection is well maintained, with natural appearance similar in shape, size and position to the healthy ear. All of patients were satisfied with the result.

Conclusion: Our technique using small pieces of split thickness costal cartilage graft is a simple but delicate technique that could be an option for elevation procedure in microtia reconstruction.



Courtesy of Putri, MD

Disclosure of Interest: None Declared

19-9-287

RELATIONSHIP OF MANDIBULAR MORPHOLOGY TO EXTERNAL EAR VOLUME IN TREACHER-COLLINS SYNDROME

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Introduction & Objectives: Treacher-Collins syndrome (TCS) patients are frequently affected by congenital ear deformities. The external ear in TCS patients tends to have both abnormal morphology and reduced overall volume. Previous studies considered a correlation exists between TCS mandibular skeletal features and external ear volume. The purpose of this study was to assess the external ear volume in TCS patients three dimensionally. Furthermore, this study evaluated the relationship between mandibular morphology, external ear profile and external ear volume.

Material & Methods: 36 non-operated TCS patients were compared to 39 age- and gender-matched normal controls. Morphological variables of the mandible and the external ear were compared between TCS group and controls by three-dimensional cephalometrics. The external ear volume and morphological variables were analyzed with independent sample *T*-tests and Pearson correlation coefficient analyses.

Results: The external ear volume was reduced by approximate 50% in TCS patients compared to controls (P<.001). External ear length and width were positively correlated with external ear volume (length: r=.809, P<.001 on left and r=.732, P<.001 on right; width: r=.518, P=.001 on left and r=.447, P<.010 on right). A negative correlation of right ear inclination angle and external ear volume was shown in TCS patients (r=-.396, P=.027). However, no correlation was shown for the mandibular anatomic variables.

Conclusion: Three-dimensional analysis confirmed that external ear volume is significantly reduced in TCS patients. The external ear dimensions and orientation correlated significantly with ear volume. There was no intrinsic association between the severity of mandibular deformity and external ear volume.

Disclosure of Interest: None Declared

19-9-288-N / 19-12-306

APPLICATION OF AUGMENTED REALITY FOR THE POSITIONING OF RECONSTRUCTED EAR

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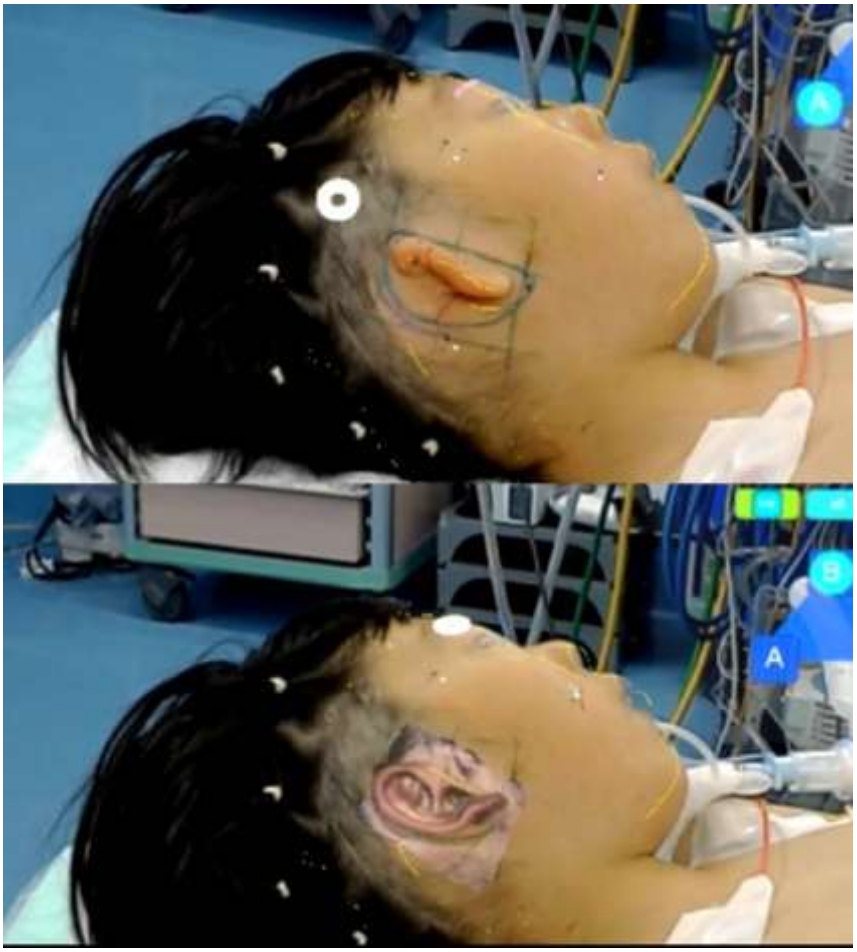
[1]Plastic and Reconstructive Surgery, Osaka Medical College, Takatsuki, Japan

Introduction & Objectives: The positioning of the auricle is a key factor in successful ear reconstruction. However, the position of the ear is usually determined by transferring the auricle image of the nonaffected side to the affected side using a transparent film. Augmented reality (AR) is becoming useful in the surgical field allowing computer-generated images to be superimposed on patients. In this report, we would like to introduce an application of AR technology in ear reconstruction.

Material & Methods: AR technology was used to determine the position of the reconstructed ear of a ten-year-old male with right microtia. Preoperative three-dimensional (3D) photographs of the non-affected side were taken using VECTRA®H1. Then the image was horizontally inverted and uperimposed on the 3D image of the affected side with reference to the anatomical landmarks of the patient's face. These images were projected onto the patient in the operation room using Microsoft's HoloLens. The design and positioning of the auricle was done in reference to the AR image. To confirm the accuracy of AR technique, we compared it to the original transparent film technique. After the insertion of the cartilage framework into the skin pocket, the position and shape of the reconstructed ear was confirmed using AR technology.

Results: The positioning of the reconstructed ear was successfully performed. The deviation between the two designated position using the AR and the transparent film were within 2mm.

Conclusion: AR technology is a promising option in the surgical treatment of microtia.



Disclosure of Interest: None Declared

DAY19 - STATION 10 - CRANIOFACIAL TRAUMA

19-10-289

SKULL AND FACIAL FRACTURES RELATED TO DOG BITES AMONG CHILDREN: A CASE-CONTROL STUDY OF 60 FRACTURES

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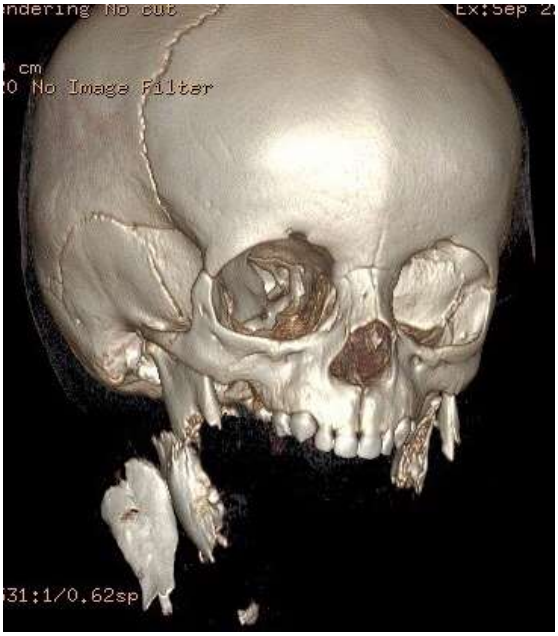
[1]Department of Plastic Surgery, University of Pittsburgh, [2]Department of Emergency Medicine, Children's Hospital of Pittsburgh, Pittsburgh, United States

Introduction & Objectives: Dog bites continue to be a worldwide pediatric public health problem. In the United States alone, ~4.5 million people suffer from a dog bite each year. For various reasons, children are the most vulnerable and suffer the greatest impact on quality-adjusted life-years. While many dog bites are relatively minor, these injuries can be devastating and, on rare occasion, can be fatal. Dog bites can be severe enough to cause skull and facial fractures. The current literature lacks detailed analysis of these injuries. **The objective of this study is** to characterize pediatric dog bite-related craniofacial fractures and factors related to the dog bite incident.

Material & Methods: A case-control study was conducted to include all pediatric dog bite victims with craniofacial fractures presenting to our quaternary care hospital from 2008-2019. Control dog bite patients without craniofacial fractures were randomly selected from the same population. We abstracted demographic and clinical details from charts, reported summary statistics, and calculated odds ratios (OR) with 95% confidence intervals.

Results: Of 3,602 dog bite encounters, we identified 38 patients with 60 craniofacial fractures (11 orbital, 10 mandibular (see Figure for patient example), 10 nasal, 8 parietal, 6 maxillary, 6 dental, 6 frontal, 4 zygomatic, 3 temporal, and 2 occipital). We obtained 38 control dog bite victims without craniofacial fractures. Relative to controls, patients with craniofacial fractures were more likely to require operative repair (16% vs. 61%, $p<0.01$) and hospital admission (18% vs. 84%, $p<0.01$). Age under five (mean age= 3.3 years), rural location, and large dogs (over 30 pounds) were significantly associated with increased risk of craniofacial fractures (OR 4.2 [1.5-12.8], OR 5.4 [1.3-32.0], and OR 6.2 [1.7-28.1], respectively). Nine patients (12%) required multiple reconstructive operations, and four patients (5%) developed post-traumatic stress disorder. The dog was the family dog in 40% of cases and an extended family member's or friend's in 36% of cases. 24% of cases involved a stranger's dog or stray dog.

Conclusion: Dog bite-related pediatric craniofacial fractures are rare but can be highly morbid injuries that lead to multiple surgeries and psychiatric sequelae. Toddlers in rural households with large dogs are at particularly high risk for sustaining craniofacial fractures from bites. These findings have important prevention implications that may guide parental decision making regarding dog ownership in a household with a child.



Disclosure of Interest: None Declared

19-10-290

ORBITAL RECONSTRUCTION IN ADULT AND PEDIATRIC CRANIOFACIAL TRAUMA AND CONSERVATIVE MANAGEMENT OF THE ORBITAL WALLS

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[1]Plastic surgery, [2]Miami Children's hospital, Miami, United States, [3]Craniofacial surgery, Sobrapar, Sao Paolo, Brazil

Introduction & Objectives: Adult and pediatric orbital trauma and the avoidance of perioperative and postoperative morbidity with respecting orbital walls and lower eyelid anatomic elements that can be challenging to repair secondarily. There appears to be one indication for immediate orbital wall repair with pediatric trap door fracture to help avoid occulocardiac reflex and extraocular muscle fibrosis. There is much controversy for the indications and timing of repair. This as well as the anatomic approaches or their avoidance when feasible to the orbital fractures, will help prevent unnecessary sequela when the orbital wall fracture is minimally displaced, no enopthalmous, and the orbital periosteum is mostly intact.

Material & Methods: A conservative approach to orbital trauma with fractures involving one or more orbital walls in adults (23 subjects) and in pediatric (5 subjects). These had various combination of fractures of the frontal, zygomatic, maxillary and orbital complex region observed over a 3 year period. Close examination and measurements clinically and radiographically of globe, orbital volume and shape, and orbital wall fracture deformity was done preoperatively and postoperatively. Lower eyelid approach and orbital floor exploration was avoided when orbital floor or wall was small or minimally involved, no enopthalmous, and orbital periosteum appeared mostly intact. Intraoperative CT not available.

Results: Of the conservatively managed orbital wall fractures where the lower eyelid approach and orbital wall exploration was avoided, 2 adults had developed enopthalmous with 1 having diplopia also, and 1 pediatric patient developed enopthalmous and mild diplopia. Both adult patients refused to have secondary surgery to correct enopthalmous and diplopia improved in the one adult. The pediatric patient required secondary bone graft reconstruction to correct enopthalmous and diplopia also improved. The orbital facial symmetry and aesthetics was maintained in the 3 to 12 months postoperatively and no globe sequela was reported in the others

Conclusion: Given the low occurrence of secondary orbital wall repair, a conservative approach appears to be safe and effective in orbital wall fractures that are minimally displaced despite surrounding injuries, no enopthalmous, and periorbita and attachments appear mostly stable and intact. Approach lower eyelid, orbital rim and orbital floor only when necessary. This avoids unnecessary lower eyelid sequela and orbital floor disruption. Careful preoperative and postoperative evaluation and planning is a necessary. Staged secondary reconstruction may be needed and acceptable. Consultation with colleagues and mentors in the more complex cases

Disclosure of Interest: None Declared

19-10-291

THE FUNCTIONAL OUTCOME OF MANDIBULAR CONDYLAR HEAD FRACTURES

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Introduction & Objectives: The management of mandiblular condylar head fracture is not yet conclusive. The aim of this study is to determine the functional outcome of different treatment strategy in unilateral or bilateral condylar head fracture.

Material & Methods: 62 patients with unilateral or bilateral condylar head fractures diagnosed by computed tomographic (CT) scan received open reduction internal fixation or close reduction were retrospectively review from March 2007 to Aug 2017. 31 patients had unilateral condylar head fracture and the other 31 patients had bilateral condylar head fracture. In these cases, 44 patients were received open reduction internal fixation and 18 patients were received close reduction with intermaxillary fixation. The patient's basic data, fracture type, associated injury, occlusion, maximum mouth opening (MMO), and complications were recorded.

Results: 93 condylar head fracture were found in 62 patients. The most frequent fracture type were type A (45 TMJs, 48%), followed by type M (20 TMJs, 22%) according to He's classification. The open reduction group had better postoperative recover of MMO in postoperative 3 months (p=0.035), 6 months (p=0.001), and 1 year (p=0.050). Trismus was defined as patient's MMO less than 35mm at postoperative 6 months follow-up. On multivariate analysis, the patients received closed reduction only had more risk to developed trismus compared with patients received open reduction internal fixation (OR: 4.757, P=0.027). There were 5 patients developed malocclusion, 1 patient developed wound infection, 1 patient developed screw mal-position, and 1 patient developed TMJ osteoarthritis. No major complication, like permanent facial nerve palsy and Frey's syndrome related to surgery.

Conclusion: ORIF for condylar head fracture provides a better functional recovery than close reduction in either unilateral or bilateral condylar head fracture. The recovery of MMO is less in Bilateral condylar head fracture than unilateral condylar head fracture but both better than closed group**.**

Disclosure of Interest: None Declared

19-10-292

AESTHETIC OUTCOME OF PRIMARY RHINOPLASTY OF SADDLE NOSE DEFORMITY IN NASO-ORBITAL ETHMOIDAL FRACTURES IN ASIAN PATIENTS

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Introduction & Objectives: Saddle nose deformity following naso- orbital ethmoidal (NOE) fractures remains a challenging problem for the reconstructive surgeon. Early reduction and internal fixation allow for fracture stabilization, but is unable to address the problem of the depressed nasal dorsum, especially after soft tissue shrinkage. Since 2008, our department has carried out immediate nasal reconstruction in patients present with depressed nasal dorsum secondary to NOE fractures, using autologous bone grafts or artificial implants. The aim of this study is to evaluate the outcome of primary rhinoplasty in patients with NOE fractures.

Material & Methods: From 2006 to 2009, 9 patients presented to our department with NOE fractures complicated by saddle nose deformity underwent primary nasal reconstruction at the time of their fracture fixation. Life size (1:1) frontal and lateral post-operative photographs were taken. Three objective measurements were made, including the nasofrontal angle, tip projection and radix projection. These measurements were compared between normal persons (group 1), preoperative patients (group 2) and postoperative patients (group 3). Nose aesthetic assessment was carried out via a panel assessment involving 10 laypersons using a visual analogue scale (VAS) of 5. Patient satisfaction was further assessed subjectively by the patient themselves using the VAS.

Results: When comparing group 3 to groups 2, a significant reduction in the nasofrontal angles was found with an accompanying increase in the radix and tip projection ($p<0.05$). Comparing group 1 and 3 revealed no statistical significance between normal persons and post primary rhinoplasty patients with regard to all three measures. Average patient satisfaction scored 3.86±1.07 compared to 3.63±0.84 by laypersons and 4±0.77 by specialists' panel.

Conclusion: Primary nasal reconstruction may be an alternative method for achieving optimum results following NOE fractures preventing the development of secondary saddle nose deformity with a shortened nose which may potentially be more difficult to correct

Disclosure of Interest: None Declared

19-10-293-N / 18-10-191

AN ANALYSIS OF PLATE FORM DISTORTION AFTER GRAFTING: CASES OF ORBITAL WALL FRACTURE

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Introduction & Objectives: Resorbable plates have been used as a reconstructive material for orbital wall fracture. Cases of reconstructed resorbable plates have increased because they are thin and easily turned into an orbital form. In addition, they can be used without a donor site. However, their materials are gradually resorbed and might be distorted as time passes. Then, resorbable plates can also cause late enophthalmos. Therefore, the present retrospective study aimed to elucidate their degree of deformation after grafting.

Material & Methods: A total of 13 patients (12 men and 1 woman; mean age, 43.3 years) who presented to Teikyo University Hospital and underwent surgical correction between April 2014 and June 2018 were retrospectively investigated. Resorbable Superfixsorb MX plates, consisting of hydroxyapatite and poly-L lactic acid, were used for reconstruction. Three-dimensional (3D) mirror image models were used to make the plates suitable for orbital defect reconstruction. Grafted plates were configured into 3D images using a computed tomography workstation (Ziostation).

The angle formed at three points (both longitudinal edge, central point) was measured immediately and 3 months the after operation. Then, the deviation angle was defined as the latter minus the former angle.

Results: The mean follow-up was 5.5 (5–7) months. No signs of plate resorption were observed during the study period. The mean deviation angle was 1.95° (−1.4–9°). All cases were not infected and did not require reoperation. No patient showed late enophthalmos.

Conclusion: The plates' form should be maintained as grafted. However, in the present study, all grafted plates changed with time. Four plate curvatures became strong and nine flattened after grafting. The plate that showed biggest curvature changes (9°) has a narrow central part. Other plates have uniform width. Therefore, making the width of resorbable plates uniform is recommended to maintain their form after grafting.

Disclosure of Interest: None Declared

19-10-294

THE ORBITAL INDEX: A NOVEL RISK STRATIFICATION SYSTEM FOR PREDICTING LATE ENOPHTHALMOS IN ORBITAL FLOOR FRACTURE MANAGEMENT

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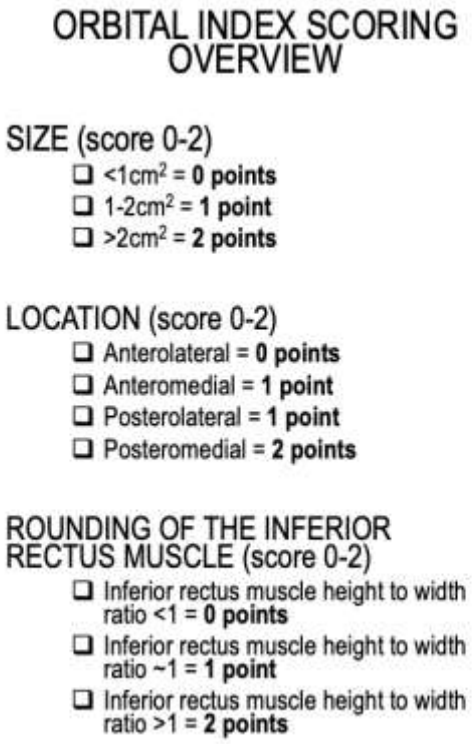
Introduction & Objectives: Early identification of surgical indication is critical to optimizing outcomes in orbital floor fracture management. Absolute indications for surgical repair of orbital floor fractures are acute muscle entrapment and globe malposition. However, identifying those at risk for delayed enophthalmos and requiring subsequent surgery remains a challenge despite multiple proposed criteria. This study aims to validate a clinical prediction tool using CT data to stratify risk for delayed enophthalmos and establish a threshold for surgical intervention.

Material & Methods: The Orbital Index stratifies fractures by size, location, and inferior rectus rounding (a surrogate for fascioligamentus sling disruption); scale of 0-6. A twenty year (1998-2018) single-center retrospective analysis of orbital floor fractures was performed, scores were assigned and verified by two investigators, and correlated with treatment course. Inter-observer reproducibility across scoring components was assessed with Weighted Cohen's Kappa statistic comparing scores of craniofacial specialists, plastic surgery trainees and medical students. Providers were surveyed pre-and post-intervention to determine whether use of this tool improved understanding and communication.

Results: The Orbital Index demonstrated high fidelity, inter-observer reproducibility, and identified a score of ≥4 as a surgical threshold. Retrospective chart review identified 201 fractures meeting inclusion criteria; 35% scored 0 (operative rate 3%), 12% scored 1 (8%), 10% scored 2 (10%), 11% scored 3 (18%), 9% scored 4 (50%), 12% scored 5 (63%), and 11% scored 6 (77%). A statistically significant difference in decision for operative intervention was found between scores of 3 vs 4 (p=0.04), but not scores 0 vs 1 (p=0.27), 1 vs 2 (p=0.82), 2 vs 3 (p=0.43), 4 vs 5 (p=0.43), or 5 vs 6 (p=0.29). Mean weighted Cohen's Kappa was 0.73 demonstrating reproducibility. Participants demonstrated increased ability to correctly identify surgical need with use of the Orbital Index (p=0.01). Pre-and post-intervention surveys demonstrated increased subject self-reported understanding (p=0.001) and communication. (p=0.0003)

Conclusion: The Orbital Index is a reproducible tool to stratify risk for enophthalmos in orbital floor fracture management.



Disclosure of Interest: None Declared

19-10-295

THE APPLICATION RESEARCH OF TREATMENT ON OLD POST-TRAUMATIC ENOPHTHALMOS WITH CUSTOMIZED MEDPOR BASED ON DIGITAL TECHNOLOGY

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Introduction & Objectives: Post-traumatic enophthalmos remains a surgical challenge due to inaccurate restoration of orbital anatomy such as overt volume deficits or suboptimal reduction. The treatment requires careful preoperative planning, sound anatomical knowledge and good intraoperative judgement. Digital technology has the potential to reduce error and subjectively in the management of these complex injuries. This study aimed to set up a database of orbital parameters based on normal Chinese subjects to provide references, and develop a simple and convenient method using Medpor implants with digital technology to achieve individual correction and improve surgical outcomes for post-traumatic enophthalmos patients.

Material & Methods: The CT data of 102 normal people were collected from 2011 to 2015. The morphologic parameters of orbit were measured on 3D models with digital technology as followed: the orbital width, the orbital height, the orbital wall length, the lateral orbital wall length, the orbital floor length, the orbital roof length, the intra-orbital distance, the extra-orbital distance, the orbital rim perimeter and the bony orbital volume. The discrepancy between men and women, left and right side were analyzed by SPSS 19.0. Then 15 patients with old post-traumatic enophthalmos received surgical correction were enrolled from 2015 to 2018, and divided into two groups: Group A and B. Patients from group A received customized Medpor implantation with digital technology, while patients from group B received Medpor implantation without digital technology. The prognostic indexes were evaluated and the discrepancy between group A and group B was analyzed by SPSS 19.0.

Results: There were significant differences between men and women in 70% of anatomic parameters. Minor differences ($<$0.5mm) between the two side orbits were found but being considered no influence on the orbital symmetry. There were significant differences between group A and group B in orbital bony volume and eye ball protrusion of affected side ($P<0.05$). The variation of orbital bony volume and eye ball protrusion of affected side in group A was higher than in group B. There was positive correlation between orbital bony volume variation and eye ball protrusion variation.

Conclusion: A database of normal Chinese morphologic parameters of orbit was established with a digital reconstruction method, which could further provide parameters for preoperative planning and prediction of postoperative outcome. The efficacy of customized Medpor implantation in group A was superior to group B with digital technology. The prognostic indexes of post-traumatic correction can be quantitative by digital techniques. A conclusion was drawn that there is a linear relation between the volume of implants and eye protrusion.

Disclosure of Interest: None Declared

DAY19 - STATION 11 - AESTHETICS

19-11-297

FINITE ELEMENTAL BIOMECHANICAL SIMULATED ANALYSIS OF THE NASOLABIAL FOLD

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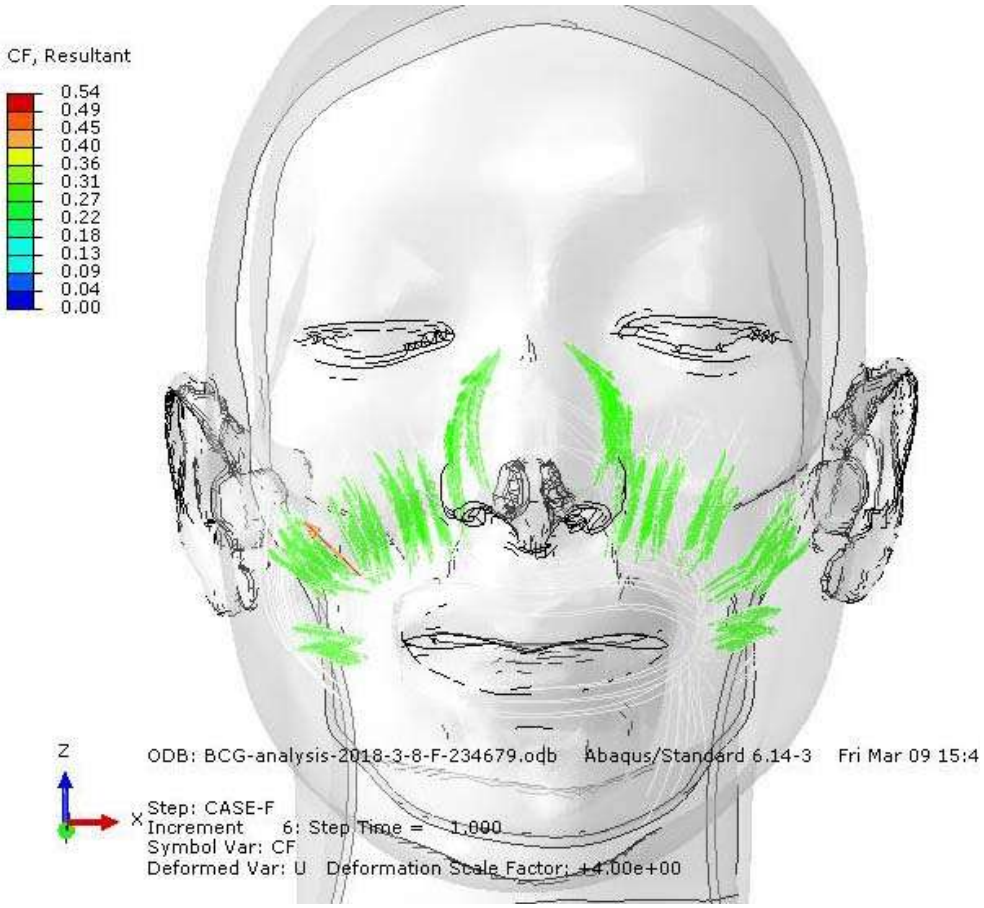
Introduction & Objectives: This study aimed to confirm the dynamic biomechanical relationships between different kinds of nasolabial folds and the facial mimetic muscles by finite element analysis.

Material & Methods: Based on the existing general anatomical data, the 3D CAD model of the skin-muscle-maxillofacial bone in the nasolabial fold region was established by using the engineering design module of the Catia software. After establishing the CAD model of the nasolabial fold with the Catia software, the CAD model was then imported into the Hypermesh software. The unit type was set up. The grid division was performed. And the material properties were then assigned. Finally, the 3D FEA model of the skin-muscle-maxillofacial bone in the nasolabial fold region was generated, and then introduced into the Abaqus software with HM format for mechanical force loading and biomechanical analysis.

Results: Based on the existing general anatomical data, a FEA model of the skin-muscle-maxillofacial bone in the nasolabial fold area was established successfully, combined with the softwares of Mimics, Geomagic Studio, Catia, Hypermesh and Abaqus together. This FEA model had a good geometric similarity and good biomechanical properties, which provided an ideal biomechanical model for the deformation and biomechanical study of the nasolabial fold.

Conclusion: The dynamic biomechanical relationships between different kinds of the nasolabial folds and the facial mimetic muscles were roughly confirmed by FEA.



Disclosure of Interest: G. C. Chen Conflict with: This study was supported by the Union Scholars and Innovation Team Development Program of Peking Union Medical College. X. Lu: None Declared

19-11-298

A NOVEL METHOD OF CORRECTING LOWER FACIAL SYMMETRY: COMPUTER-ASSISTED SURGERY WITH MANDIBULAR OUTER CORTEX "SANDWICH" GRAFTING

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Introduction & Objectives: The mandible plays a crucial role in facial symmetry due to its key position. Bilateral lower facial asymmetry is usually due to unbalanced development of the mandible and often results in esthetically unpleasant appearance. However, in patients with mild to moderate lower facial symmetry, plastic surgeons have mainly focused on the restoration of soft tissue deficiencies. While, bone deficits are easily overlooked. This article developed a new method of surgical correction of asymmetric lower facial deformity with mandibular augmentation with sandwich memthod using autologous bone grafts from the contralateral mandibular outer cortex, and apply computer-assisted techniques to improve the surgical outcomes and accuracy.

Material & Methods: From July 2014 to November 2018, a total of 16 patients with mild to moderate lower facial symmetry were prospectively enrolled in the study. Those patients in whom the asymmetric lower facial deformities were initiated by hypertrophy of the mandible without occlusion and temporomandibular joint problem were chosen for this study. Preoperative and 7 days and 6 months postoperative computed tomography (CT) and photographs were performed. Computer-aided design was done based on preoperative CT data.The authors performed mandibular augmentation using mandibular outer cortex bone graft harvested from the contralateral normal side with a sandwich memthod and rotation genioplasty to correct asymmetric lower face to improve asymmetric lower face depending on individual asymmetric facial characteristics. The effectiveness was then evaluated through cephalometric radiographs, three-dimensional computed tomography, and presurgical and postsurgical standard facial photographs.

Results: The postoperative results of all 16 cases showed that lower facial width and length were increased on the affected side and reduced on the normal side after bone grafting. Thus, the asymmetric lower face was effectively corrected three-dimensionally without serious complications and the harmonious facial contour improved significantly. The final esthetic outcomes were quite satisfactory for both surgeons and patients.

Conclusion: The results indicate that mandibular augmentation with bone grafts harvested from the contralateral outer cortex with sandwich method could be effective to improve mandibular thickness and correct the asymmetry in lower facial width, achieving three-dimensional restoration of facial symmetry in mild to moderate lower facial symmetry, so as to acquire a symmetric and harmonious face in accordance with facial esthetics.

Disclosure of Interest: None Declared

19-11-299- N / 18-10-190

TRANSCONJUNCTIVAL INCISION FOR ORBITAL FRACTURES REPAIR. INCIDENCE OF COMPLICATIONS AND RECOMMENDATIONS TO AVOID THEM IN A MEDICAL CENTRE IN MÉXICO

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Introduction & Objectives: Transconjunctival approaches have become standard and are the first choices of most surgeons for orbital fractures and inferior orbital rim fractures in zygomaticomaxillary fractures, associated with good esthetic results, surgically ideal overviews, and avoidance of functional disturbances caused by the incision. Some complications have been associated with this approach showing it is a complex procedure, with a low rate reported. We analyze the incidence of complications and how to avoid them.
Material & Methods: Clinical files from 2009 to 2018 were revisited, all the patients that received transconjunctival incisions were included. The patients were divided by the type of fracture treated. The patients with complications regarding the incisions were identified and included in a different table, the complications and their treatments were described.
Results: 109 patients were included, 44 with pure orbital floor fracture, 22 with inferior orbital rim fracture associated with zygomaticomaxillary complex fracture, 2 with LeFort II fracture, 11 with pure orbital floor and medial wall fracture, 24 with impure orbital floor fracture, 3 associated with re fractured of the inferior orbital rim for Kawamoto's procedure, 2 with pure medial wall fracture. Out of the 109 patients, 6 presented complications related to the transconjunctival approach, 2 patients presented entropion, 2 scleral show, 1 conjunctival tear and 1 conjunctival scar retraction. The complications accounted for 5.5% of all cases.
Conclusion: All the fractures presented in this study, were repaired through the transconjunctival approach. The complications regarding this approach were solved completely without incidence. Based on our experience we identifiied some points to avoid the complications reported in the literature and in this study;1.The incision must be placed 2mm anterior to the conjunctival sac, in order to avoid lesion to the conjunctiva that leads to synechia formation. 2.The incision must include the complete length from the caruncula to the lateral conjunctival sac border, in order to have an adequate exposure and to avoid conjunctival tear. 3.The dissection must be carried out in the preseptal plane, posterior to the orbicularis muscle and directly to the orbital rim. 4.Adequate pre operative reconstructive plan in order to avoid re operations, and multple transconjunctival incisions. 5.Adequate identification of structures at the time of closure, in order to avoid different planes of suture and synechia formation. The transconjunctival approach offers a fair exposure for the orbital fractures, is safe with a low complication rate, the complications due to this approach may be avoided if the previous security steps are taken into consideration.

Disclosure of Interest: None Declared

19-11-300

INTRAOPERATIVE 3-DIMENSIONAL RECONSTRUCTIVE SCANS ARE USEFUL FOR FACIAL FRACTURE TREATMENT IN HYBRID OPERATION ROOM

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Introduction & Objectives: Treatment of facial fracture is a common technique for a plastic surgeon. However green surgeons are frequently anxious that they can undergo good reduction. 6 cases (zygomaticomaxillary fracture 4, blowout fracture 1, Le Fort Ⅰ 1) were performed in Tokyo nishi tokushukai hospital. All cases underwent an open reduction in the hybrid operating room.

Material & Methods: After the temporary reduction, 3-dimensional reconstructive scans were performed to confirm the correction of the fracture. The good correction was confirmed, accomplished reduction and finished the operation. The poor correction was recognized, retried reduction immediately and rechecked the correction by 3-dimensional reconstructive scans.

Results: All cases were performed 3-dimensional reconstructive scans in the hybrid operating room. All surgeons checked the 3-dimensional reconstructive scans and discussion the performance of correction. One case was an insufficient correction and retried reduction, other cases finished operation smoothly.

Conclusion: Intraoperative 3-dimensional reconstructive scans are useful for teaching and instructing the operative technique. Otherwise, the operation time was prolonged and patients were exposed to a little radiation to take a computerized tomography. To gain experience in this method, we will examine the method about operation time and the learning curve.

Disclosure of Interest: None Declared

19-11-302

NASAL ANTHROPOMETRY ON FACIAL COMPUTED TOMOGRAPHY SCANS FOR RHINOPLASTY IN ASIANS

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[1]Plastic and reconstructive surgery, Kangnam Sacred Heart Hospital, Seoul, Republic of Korea

Introduction & Objectives: The nose is an organ that plays a key role in performing certain anatomical and physiologic functions. Cephalometric analysis is essential for planning treatment in maxillofacial and aesthetic facial surgery. Asians are commonly found to have a flat, depressed nose that is generally characterized by a low nasal dorsum, a bulbous, thick nasal tip, a small, thin, weak alar cartilage, a short columella, and lesser prominence of the nasal tip. Although photometric analysis of the Asian nose has been attempted in the past, anthropometry of the deeper nasal structures in the same population based on computerized tomography (CT) has not been published. We therefore measured three anthropometric parameters of the nose on CT scans in our clinical series of patients.

Material & Methods: We conducted the current retrospective study of a total of 100 patients (n=100) who underwent a CT-guided radiological measurement at our institution during a period ranging from January of 2008 to August of 2010. Our clinical series of patients (n=100) consisted of 50 men and 50 women with a male-to-female ratio of 1:1. In these patients, we took three anthropometric measurements: the nasofrontal angle, the pyramidal angle, and the linear distance between the nasion and the tip of the nasal bone. We measured the nasofrontal angle and linear distance between nasion and the tip on mid-sagittal CT scans and the pyramidal angle on axial CT scans.

Results: Our results are as follows: 1) The mean nasofrontal angle was 131.14° (range, 112.93°-146.62°) in the male patients (n=50) and 140.70° (range, 113.88°-162.80°) in the female patients (n=50). 2) The mean linear distance between the nasion and the tip of the nasal bone was 21.28 mm in the male patients (n=50) and 18.02 mm in the female patients (n=50). 3) The mean nasal pyramidal angle was 112.89° (range, 70.93°- 145.52°) in the male patients and 103.25° (range, 75.59°-131.12°) in the female patients at the level of the nasal root; 117.49° (range, 99.96°-139.93°) and 115.60° (range, 97.94°-135.15°) at the middle level of the nasal bone; and 127.99° (range, 96.97°-149.80°) and 125.04° (range, 98.22°-145.28°) at the level of the tip of the nasal bone, respectively.

Conclusion: In conclusion, our data will be helpful for enhancing compatibility between silicone implants and the nasal bone and for decreasing the occurrence of postoperative complications in augmentation and/or corrective rhinoplasty in Asians

Disclosure of Interest: None Declared

19-11-303

OSSEOUS TRANSFORMATION WITH FACIAL FEMINIZATION SURGERY: IMPROVED ANATOMIC ACCURACY WITH VIRTUAL PLANNING

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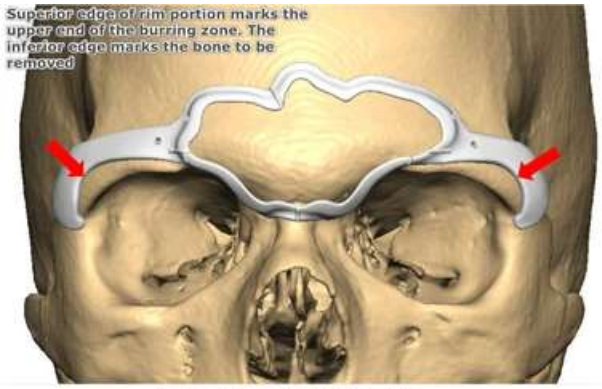
Introduction & Objectives: Facial Feminization Surgery (FFS) entails a series of surgical procedures that help trans-women pass as their affirmed gender. While virtual surgical planning (VSP) with intra-operative cutting guides and custom plates have been shown helpful for craniomaxillofacial reconstruction, they have not yet been studied for FFS. We used cadaveric analysis for morphologic typing and to demonstrate the utility of VSP in FFS procedures.

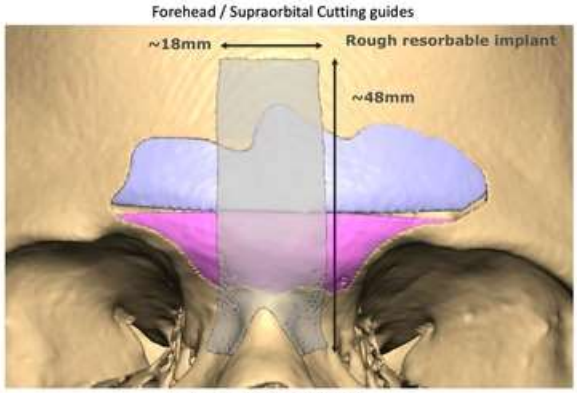
Material & Methods: Male cadaveric heads underwent morphological typing analysis of the frontal brow, lateral brow, mandibular angle, and chin regions (n=50). Subsequently, the cadavers were split into two groups: 1) VSP intra-operative cutting guides and 2) No preoperative planning. Both groups underwent a)anterior frontal sinus wall set-back, b)lateral supraorbital recontouring, c)mandibular angle reduction, and d)osseous genioplasty narrowing. Efficiency (measured as operative time), safety (determined by dural or nerve injury), and accuracy (scored with 3D CT preop plan vs postop result) were compared between groups (significance $p<0.05$).

Results: For Morphologic types per region: Frontal Brow and Lateral Lower Face Morphologic Type 3 (severe) predominated; Lateral Brow and Chin Type 2 (moderate) predominated. The VSP study group showed Frontal Sinus wall setback improved efficiency (19 vs 44min*), safety (100% vs 88%*; less intracranial entry), and accuracy (97% vs 79%*) compared to 'No preoperative planning'. The VSP study group also showed mandibular angle reduction improved safety (100% vs 88%*; less inferior alveolar nerve injury) and accuracy (95% vs 58%).

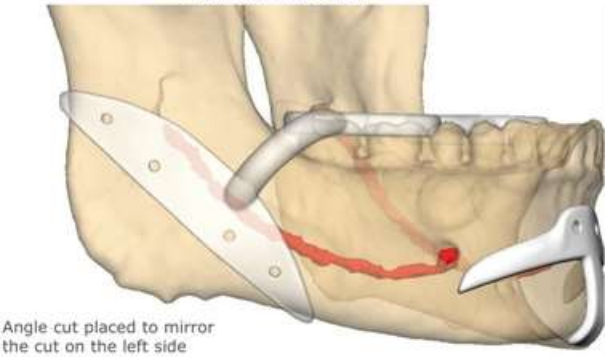
Conclusion: Preoperative planning for FFS is helpful to determine morphologic typing; VSP with the use of cutting guides/custom plates improved efficiency, safety, and accuracy when performing at least 2 of the 4 key craniofacial techniques for FFS.



Forehead / Supraorbital Cutting guides



Split-Frontal bone set back



Mandibular angle reduction ostectomy

Disclosure of Interest: None Declared

DAY19 - STATION 12 - CRANIOSYNOSTOSIS/MISCELLEANOUS

19-12-304-N / S12-05

FRONTO-FACIAL MONOBLOC ADVANCEMENT WITH INTERNAL DISTRACTION IN CROUZON SYNDROME: LONG-TERM EFFECTS OF MOLAR DEVELOPMENT AND GROWTH

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Introduction & Objectives: Crouzon syndrome is a syndromic faciocraniosynostosis that can be associated with severe fronto-facial retrusion leading to major functional impairments such as ocular proptosis and obstructive sleep apnea. The procedure of choice for the primary correction of this retrusion is fronto-facial monobloc advancement (FFMBA) with internal or external distraction. FFMBA involves pterygomaxillary dysjunction (PMD), using either a superior or an intra-oral approach. This step is at risk of damaging the germs of the decidual and permanent molars.

Material & Methods: Here we considered a series of 15 patients with Crouzon syndrome who benefited from FFMBA performed by the same surgeon, using a superior approach through the infra-temporal fossa for PMD. Based on pre-operative, early post-operative and late post-operative CT-scans, we recorded missing teeth, morphological dental anomalies and the Nolla stage for the first and second permanent maxillary molars.

Results: We showed that early FFMBA has significant dental consequences, and that the extent of these dental effects is correlated with an early age at surgery. The use of transfacial pins was also correlated with the extent of dental damage.

Conclusion: The indications of early FFMBA in Crouzon syndrome with severe functional repercussions are not questionable, but dental outcome should be taken into account when discussing early indications without severe functional impairment. Furthermore, our results still need be compared to dental outcomes of FFMBA performed with an intra-oral PMD.

Disclosure of Interest: None Declared

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NEURAL CORRELATES OF CHILDHOOD LANGUAGE DISORDER IN CHILDREN WITH CRANIOSYNOSTOSIS: A SYSTEMATIC REVIEW

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Introduction & Objectives: Craniosynostosis has been associated with increased rates of language disorder. However, the aetiology of this association is poorly understood. Changes in cerebral perfusion and differences in leftward asymmetry have both been proposed as specific neural correlates. An emerging body of literature describes the use of both structural and functional magnetic resonance imaging (fMRI) to investigate the specific changes in brain anatomy and activity that are associated language development in children with craniosynostosis. The purpose of the current study was to systematically review the available literature in this area to determine if there are consistent differences in lateralization of language or cerebral perfusion that are associated with language disorder in children with craniosynostosis.

Material & Methods: A systematic review of the MEDLINE, Embase, Central, and Pubmed databases was conducted using MeSH terms related to childhood language disorder, craniosynostosis and brain MRI methods. This initial search identified 109 articles. These were reviewed by two authors, and 30 were selected for inclusion based on predetermined criteria. PROSPERO: CRD42018109443.

Results: The included articles have heterogenous outcome measures, which precludes a metanalysis. The changes in brain structure and function associated with craniosynostosis are most commonly described in relation to broader developmental outcomes, rather than language specifically. Few studies identified associated changes in leftward asymmetry with developmental outcomes or language specifically in craniosynostosis. Furthermore, standardized language assessments were not used in the reviewed studies, and so language disorder was inconsistently defined.

Conclusion: Our current understanding regarding the structural and functional neural correlates of language disorder in children with non-syndromic single suture craniosynostosis is rudimentary. This review highlights that available research is limited by inconsistent definitions of language disorder and heterogeneous outcomes. We propose a large-scale study using magnetic resonance imaging to examine the changes to brain structure and function correlated with language disorder in non-syndromic single-suture craniosynostosis.

Disclosure of Interest: None Declared

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SING AND SAY: AN INTERACTIVE WEB-BASED RESOURCE OF LANGUAGE STIMULATION RESOURCES FOR CHILDREN WITH CRANIOSYNOSTOSIS

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Introduction & Objectives: The Four NHS-Designated Craniofacial Units in the UK regularly conduct assessments of children's speech, language and feeding skills in accordance with an agreed national assessment protocol. During these assessments children with communication delay are identified and referred to local services for therapy. However, recent reports have identified that local Speech and Language Therapy services are fractured and variable, most recently described as a postcode lottery by ICAN (2018). A 2017 quality commission and Ofsted report also highlighted the difficulties that parents report in accessing SLT services.

Material & Methods: To support children (0 – 24 months of age) who are unable to access local speech and language therapy, the Oxford Craniofacial Unit Speech and Language Therapy team created an online suite of language stimulation resources called 'Sing and Say'. Sing and Say features videos, animations, songs, information leaflets and an i-book. To measure the efficacy of the Sing and Say intervention, children's language outcomes at their pre-operative and post-operative appointment are being compared. Here, we present data from the project pilot and the language results from the non-intervention group. Parent satisfaction was measured using an online questionnaire.

Results: Results of the comprehensive baseline language assessment in the non-intervention group (n=58) indicate that 17% of children (n=10/58) presented with delayed early social skills; 22% presented with delayed speech development; 26% presented with delayed symbolic play development. Responses from the parent questionnaire indicated a 92.31% satisfaction rate (mean = 4.69, SD = 0.46) with the ease of use of the videos.

Conclusion: Results of assessment reinforce the need for speech and language therapy intervention for children less than two years of age. Initial parental feedback indicated a high satisfaction rate with the Sing and Say resource. Data collection in the intervention group has now commenced.

Disclosure of Interest: S. Kilcoyne Conflict with: Health Foundation, Conflict with: Oxford University Hospitals NHS Foundation Trust

19-12-309

COMPARISON OF BLACK-BONE MRI AND 3D-CT IN THE PREOPERATIVE EVALUATION OF PATIENTS WITH CRANIOSYNOSTOSIS

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Introduction & Objectives: Black-Bone (BB) magnetic resonance imaging (MRI) is non-ionizing imaging method and a recent alternative to computed tomography (CT) in the examination of cranial deformities. The purpose of this study was to compare BB-MRI and routine 3D-CT in the preoperative evaluation of patients with craniosynostosis.
Material & Methods: We previously routinely performed preoperative CT of the skull and brain MRI in our center for patients with clinical suspicion of craniosynostosis. We recently changed our MRI protocol into one that includes sequences for evaluation of both brain anatomy and skull bone and sutures by BB-MRI. A semi-automatic skull segmentation algorithm was developed to facilitate the visualization. In nine patients with clinical craniosynostosis both BB-MRI and 3D-CT were performed and the images were evaluated by two craniofacial surgeons, one pediatric neurosurgeon and two neuroradiologists.
Results: We obtained informative 3D images using BB-MRI. Six (6/9, 66%) patients had scaphocephaly, 1 (1/9, 11%) patient had unicoronal synostosis and 2 (2/9, 22%) patients had lambdoid synostosis. Affected synostotic sutures could be identified both by BB-MRI and 3D-CT in all patients. Intrarater and interrater reliability for rating the calvarial sutures was high. On the other hand, the reliability for rating the intracranial impressions was low by the both imaging methods.
Conclusion: BB-MRI is an alternative to 3D-CT in preoperative evaluation of patients with craniosynosytosis. BB-MRI not only provides information on cranial sutures and intracranial impressions but also on brain structure in one imaging session. This method can replace ionizing radiation-based methods in analyzing skull deformities.

Disclosure of Interest: None Declared

19-12-311

IMPROVEMENT OF PERIORBITAL APPEARANCE IN APERT SYNDROME AFTER SUBCRANIAL LE FORT III WITH BIPARTITION AND DISTRACTION

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Introduction & Objectives: Apert children have a characteristic inversion of the orientation of the palpebral fissures, an increase of the orbital distance, telecanthus and exorbitism. Le Fort III osteotomy with subcranial bipartition and distraction osteogenesis was evaluated as a tool to improve the position of the palpebral fissures in children with Apert syndrome.

Material & Methods: All patients with Apert syndrome who underwent Le Fort 3 osteotomy with subcranial bipartition and distraction osteogenesis using an external device with canthopexy between 2009 and 2014, with available pre-operative and post-operative frontal photographs were included into the study. Palpebral fissure inclination was measured. Ratios of (1) the intercanthal distance (ICD) to the outer canthal distance (OCD) and (2) the interpupillary distance (IPD) to the outer canthal distance (OCD) were computed. Pre-operative and postoperative values were compared using Wilcoxon's signed-ranks test.

Demographic Data: Fifteen patients with Apert syndrome were included. The mean age at surgery was 9.96 years of age and the average follow-up was 2.5 years.

Results: There was a significant normalization of the palpebral fissure negative inclination (right eye: 10.7 ± 2.4 degrees preoperatively vs 7.0 ± 3.1 degrees postoperatively, $p<0.001$; left eye: 12.4 ± 3.9 degrees preoperatively vs 8.7 ± 4.1 degrees postoperatively, $p=0.01$) and a statistically significant reduction of the IPD : OCD ratio (0.717 ± 0.027 preoperatively vs 0.699 ± 0.030 postoperatively, $p=0.03$). These modifications were stable on the long term.There was no significant change of the ICD : OCD ratio.

Conclusion: Le Fort III facial advancement with subcranial bipartition and distraction improves the position and orientation of the orbital region in children with Apert syndrome.

Disclosure of Interest: None Declared

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