Impact of fronto-orbital and lateral orbital wall advancement on orbital volume and shape in non-syndromic metopic craniosynostosis

M Roy*, M Goos, E Ho, MJ Koudstaal, CR Forrest
Toronto, ON

PURPOSE: Metopic craniosynostosis occurs in approximately 25% of non-syndromic craniosynostosis cases. Periorbital dysmorphism includes hypotelorism, lateral orbital wall recession and trapezoidal shape to the orbital perimeter. This study’s objectives were to quantify orbital volumetric and shape changes perioperatively after performing fronto-orbital advancement (FOA) with lateral orbital wall advancement, and compare differences between the orbital morphology of children with non-syndromic metopic craniosynostosis and healthy age-matched controls. METHOD: This retrospective case series included non-syndromic metopic craniosynostosis patients who underwent FOA with lateral orbital wall advancement over a 10-year period by a single surgeon. Pre and post-operative orbital volume and morphology were measured via CT scans using a three-dimensional (3D) segmentation software. Pre-operative orbital measures were compared to a cohort of healthy controls (ages 8-12 months). Descriptive statistics were performed. RESULTS: A total of 39 children were included with an average age at surgical time of 1.02 (±0.49) years. Statistically significant increase in bilateral orbital volume were obtained perioperatively (right 14,111±2,206 to 16,857±2,126 mm3, p<0.001 and left 13,927±2,167 to 16,603±2,184 mm3, p<0.001). Similarly, increases were obtained in peri-operative interzygomaticofrontal suture distances (p<0.001), lateral wall length (p<0.001), and angle between the lateral wall to the Frankfort horizontal plane (p<0.001). When comparing pre-operative metopic craniosynostosis (n=34) orbital measurements with a cohort of healthy controls (n=31), orbital volumes were not statistically different, but the lateral wall length (p<0.001) and interzygomaticofrontal suture distances (p<0.001) were significantly smaller in the craniosynostosis cohort. CONCLUSIONS: Beyond cranial vault reshaping and expansion with FOA in non-syndromic metopic synostosis, the surgical correction of the orbital dysmorphology showed improvements in morphometric outcomes, as assessed by orbital volume and perimeter shape. Further volumetric and morphological analyses are needed to assess long-term outcomes. LEARNING OBJECTIVE: To understand key orbital measurement changes peri-operatively in non-syndromic metopic craniosynostosis children after FOA with lateral orbital wall advancement.
undertaken using a computerized search. Eligible articles assessed adult patients undergoing secondary rhinoplasty with ACCGs. Interventions to reduce warping were examined. Publication descriptors were extracted, heterogeneity was examined, and methodological quality of articles was assessed. **RESULTS:** Eighteen studies were included. Most studies were published after 2010 (83.3 percent), assessed a single intervention (83.3 percent), and were of levels of evidence III and IV. Mean patient age was 30 (range 5 to 95 years) and studies included a mean of 64 cases (range 9 to 357). Nine of the 15 non-comparative studies were considered of high methodological quality, while all three comparative studies were considered high quality. Secondary rhinoplasties which did not describe a method to address warping showed increased rates of warping compared to counter balancing techniques, chimeric grafts, titanium microplating, Kirschner wire and suture usage, irradiation, and various carving techniques. Rates of warping remained low with no major complications with the use of a variety of approaches. **CONCLUSIONS:** ACCG warping during secondary rhinoplasty can be alleviated with a variety of techniques with no clear difference in outcomes between approaches. Plastic surgeons may consider adopting one of the various techniques described in order to reduce warping, maximize aesthetic outcomes, and patient satisfaction. **LEARNING OBJECTIVES:** 1) Understand the various techniques to reduce cartilage warping during secondary rhinoplasty. 2) Learn how to improve cosmetic outcomes during secondary rhinoplasty with ACCGs.

23

**Introduction of a novel type of surgical simulation: 3D-printed step-specific simulation (S2Sim) for rhinoplasty**

D Zammit*, T Safran, G Noel, M Gilardino
Montréal, QC

**PURPOSE:** Surgical simulation traditionally comprises complete modelling of an anatomical site. The purpose of the present research was to develop the ability to simulate isolated anatomical components of a rhinoplasty operation to maximize simulation efficiency and cost-effectiveness. The authors present the technical development of step-specific simulation (S2Sim) for rhinoplasty utilizing 3D printing technology. **METHOD:** A CT scan of the nasal area was used to develop the platform and modeling for 3D printing of the nasal bones, upper lateral cartilages, lower lateral cartilages and septum. Various materials compatible with 3D printing were tested for optimal simulation. The individual components of the simulator were evaluated for feel/realism/handling of the materials, and ability to accurately perform five rhinoplasty procedures. **RESULTS:** Rigur 450 and Tango Plus resin mix selected for optimal realism of nasal cartilage was successfully 3D printed to create the cartilage complex. Realism of the various rhinoplasty components (upper/lateral cartilages, septum, facial bone and skin) was rated 4/5. The ability to perform a nasal osteotomy (4/5), cephalic trim (3.7/5), mark a caudal septum excision (3.7/5), perform domal sutures (3.7/5) and perform analar base modification (4/5) were also scored. **CONCLUSIONS:** Optimal materials to simulate nasal components were identified and a technique successfully developed to allow their accurate modeling and 3D printer production. Realism and ability to carry out surgical maneuvers was found to be very good and amenable to surgical simulation for rhinoplasty. The novel concept of S2Sim produced by 3D printing has significant potential to be more efficient and cost-effective for simulation needs. **LEARNING OBJECTIVES:** 1) Understand the novel concept of step-specific simulation (S2Sim) and how this may improve efficiency and cost-effectiveness of surgical simulation.

24

**A randomized control trial comparing surgical and patient-reported outcomes between AlloDerm and Dermacell in immediate alloplastic breast reconstruction**

MJ Stein*, A Arnaout, G Pond, M Clemons, D Fergusson, J Zhang
Ottawa, ON

**PURPOSE:** AlloDerm and Dermacell are the two leading human acellular dermal matrices (ADM) in immediate breast reconstruction. Despite differences in physical properties including sterility, there are no comparative trials to date comparing surgical and patient-reported outcome measures (PROM) between the two products. A randomized clinical trial was designed in order to determine if there was a clinical difference between the two products. **METHODS:** A single center, open-label, RCT of patients undergoing ADM-assisted immediate breast reconstruction with an implant for breast cancer was performed. Patients were randomized to receiving either AlloDerm or Dermacell. Primary outcomes were postoperative seroma (measured by duration of postoperative drain placement) and PROM’s (measured by BREASTQ). **RESULTS:** Sixty-two patients were randomized, 31(50%) AlloDerm and 31(50%) Dermacell. PROM data was available for 74% of AlloDerm 87% of the Dermacell patients. Baseline patient and surgical characteristics were similar. Median duration of drains was 10 days for AlloDerm and 8 days for Dermacell (p=0.20). At 6 months, a significantly higher number of patients with AlloDerm required revisional surgery (30.3% vs 8.6%;p=0.031). The incidence of other secondary outcomes were similar and non-significant between groups (seromas requiring aspiration(3.0% vs 11.4%), implant loss (6.1% vs 2.9%), infection (9.1% vs 2.9%), red breast syndrome(3.0% vs 2.0%), p>0.05) At 3 months, the AlloDerm group had a significant improvement in breast satisfaction (67 vs 53, p=0.03), overall satisfaction (85 vs 61, p=0.003) and satisfaction with surgeon(89 vs 67, p=0.01). At 12 months, there were no significant difference in PROM’s between groups(p>0.05). **CONCLUSION:** We report the first randomized controlled trial to date
comparing surgical and patient reported outcomes of the two most commonly used ADMs in immediate breast reconstruction in Canada. Although long term patient reported outcomes were not different between the two groups, patients who received AlloDerm had high short term satisfaction rates, despite the increased risk of revisional surgeries. **LEARNING OBJECTIVES:** Compare the surgical and patient reported outcomes between AlloDerm and Dermacell in immediate breast reconstruction.

---

**Developing a 3D bio-artificial tissue model for breast capsular contracture**

K Wu*, AMP Dias, D O’Gorman, E Turley, T DeLyzer

London, ON

**PURPOSE:** Breast capsular contracture is an unpredictable and difficult complication in implant-based breast reconstruction. There is a paucity of human pre-clinical models for capsular contracture. The objective of this study is to develop a 3D bio-artificial tissue (BAT) model of capsular contracture and test the efficacy of an anti-fibrotic RHAMM function blocking peptide (NP1-110). **METHODS:** Capsular tissue samples from seven patients undergoing capsulectomy or implant exchange were collected and classified according to Baker grade. Capsular tissue was sectioned and incubated in DMEM media to allow outgrowth of primary fibroblasts. The FlexCell TissueTrain system was used to create bio-artificial collagen-1 tissue cords. 3 x 105 primary fibroblasts from grade 1 and grade 4 cells were embedded into each cord and contraction measured over 14 days. Contracture was then measured over 14 days with the application of 20uM of peptide NP1-110 on day 0 and then 5uM on days 4 and 8 in grade 1 and grade 3 primary fibroblast-embedded cords. **RESULTS:** The BAT model reproduces the increased contractility of grade 4 fibroblasts, which demonstrate ongoing cord contractility over 14 days. Grade 1 and 4 cells contract to 50% of control cords by day 2. Grade 4 cells demonstrate ongoing contraction until day 14, whereas Grade 1 cells plateau after day 9. Peptide testing did not demonstrate any statistically significant difference between Grade 1 and Grade 3 cells, with or without treatment. **CONCLUSIONS:** The bio-artificial tissue model accurately replicates enhanced contractility of grade 4 capsular fibroblasts and presents a robust pre-clinical model with applications in future anti-fibrotic peptide testing and personalized medicine. **LEARNING OBJECTIVES:** 1. Understand the clinical utility of a bio-artificial tissue model for capsular contracture.

---

**Predictive value of 3D imaging to guide implant selection in immediate breast reconstruction**

M Yu*, MH Mahoney, G Soon, R Somogyi

Toronto, ON

**PURPOSE:** Pre-operative estimation of breast mound volume for immediate breast reconstruction is necessary for operative planning, especially in direct to implant reconstruction. Our purpose was to investigate the relationship between pre-operative predictions of breast mound weight from 3D imaging and actual mastectomy weight and implant size. **METHOD:** All patients who had previously undergone nipple sparing mastectomy by a single surgeon were included. Pre-operative 3D images were reviewed and calculations of breast mound weight were performed by three independent reviewers. Intra-operative mastectomy weight and final implant weight were collected from patient charts. A regression analysis between calculated and actual values was performed. **RESULTS:** A total of 59 reconstructed breasts were included in the study population. Pre-operative 3D imaging-guided breast weight calculations were similar across reviewers (R=0.96). Pre-operative calculations of breast weight were 49.3 ± 131 g smaller than actual mastectomy specimens. Mastectomy specimens were 34.8 ± 138 g smaller than final implant sizes. Mastectomy weight and final implant size had linear relationships with pre-operative calculations of breast weight. Formulas for predicting mastectomy weight (mastectomy weight = 0.95 (calculated weight) + 63.2) and implant size (Implant weight = 0.56 (calculated weight) + 209.7) from pre-operative calculations of breast weight were generated. **CONCLUSIONS:** Pre-operative 3D imaging can be used to guide implant selection in immediate breast reconstruction. Final implant size was heavier than intra-operative mastectomy weight and predicted breast mound weight. **LEARNING OBJECTIVES:** 1. Listeners will be able to describe a method of implant size prediction in direct-to-implant breast reconstruction patients. 2. Listeners will be able to describe the relationship between pre-operative breast mound weight, mastectomy weight, and final implant size.

---

**The first Canadian general surgery consensus on BIA-ALCL: Impact on Plastic Surgery and future direction**

Y Chocron*, A Azzi, N Ponnudurai, S Meterissian, P Davison

Montréal, QC

**PURPOSE:** Breast-implant associated anaplastic large cell lymphoma (BIA-ALCL) awareness has increased, resulting in concerns regarding the safety of implant-based reconstruction. Breast cancer patients are first seen by surgical oncologists and are
Outcomes of immediate alloplastic breast reconstruction in patients receiving post-mastectomy radiotherapy
S Fan, H Chen, J Cape*, A Grant, T DeLyzer,
London, ON

PURPOSE: Immediate alloplastic breast reconstruction is typically avoided in patients who require post-mastectomy radiation therapy (PMRT). However, a subset of patients undergoing alloplastic reconstruction may unpredictably require adjuvant radiation. The purpose of this study was to compare outcomes and complications in patients at our institution who have undergone immediate alloplastic breast reconstruction and received PMRT to either a permanent implant or tissue expander.

METHODS: A retrospective cohort study was performed looking at patients who underwent immediate alloplastic breast reconstruction over a 10-year period (2009 to 2019) at our regional breast centre. All patients who underwent immediate alloplastic breast reconstruction and received PMRT were included in the study. Major (wound dehiscence with device exposure, or reconstructive failure) and minor (infection, capsular contracture, revision surgery) complication rates between those patients receiving radiation to a tissue expander versus implant were compared using Fisher’s exact test (p<0.05). RESULTS: Six-hundred ninety-two patients were identified, and 45 patients met inclusion criteria. Of this group, 29 received PMRT to implants and 15 received PMRT to tissue expanders. Complication rates were similar between groups for infection (6.9% vs. 14.3%), capsular contracture (41.4% vs. 21.4%), revision surgery (41.4% vs. 53.3%), wound dehiscence with device exposure (3.4% vs. 14.3%), and reconstructive failure (10.3% vs. 6.7%). Total complication rates were similar between groups (51.7% vs. 40%). CONCLUSIONS: Overall 6.5% of patients who underwent immediate alloplastic breast reconstruction required PMRT over a ten-year period. Complication rates for infection, capsular contracture, revision surgery, wound dehiscence, and reconstructive failure were similar between groups. Total complication rates were similar between groups. This information will help to inform patients during decision-making regarding immediate alloplastic reconstruction and expected complications when PMRT is needed. LEARNING OBJECTIVES: 1. To understand how complication rates differ in patients who received PMRT to permanent implants vs. tissue expanders to guide patient counselling.

A prospective review of postoperative prophylactic antibiotic use in breast reduction mammoplasty: are they actually necessary?
V Doucet*, G McLeod, J Weirathmueller, K Murray
Winnipeg, MB

PURPOSE: Breast reduction mammoplasty (BRM) is a common procedure performed by plastic surgeons treating patients with hypermastia. Postoperative prophylactic antibiotics are usually prescribed in addition to preoperative prophylactic antibiotics following this procedure, despite the lack of evidence of their effectiveness in preventing surgical site infections (SSIs). This study’s purpose is to determine if the addition of prophylactic postoperative antibiotics is more effective in preventing SSIs in comparison to preoperative prophylactic antibiotics alone in BRM. METHODS: A prospective analysis of 124 elective BRM cases by a single senior plastic surgeon was completed. Two study groups of 62 patients were formed based on location of surgery at one of two surgical centers and each group followed one of two antibiotic regimens. The first regimen consisted of a single preoperative intravenous dose of antibiotics (group 1), while the second regimen consisted of a preoperative intravenous dose followed by a 5-day course of oral antibiotics (group 2). Primary outcome was incidence of SSIs. Secondary outcome measures included incidence of complications such as delayed wound healing and dehiscence, cellulitis, and antibiotic-related
Pain medication prescribing patterns in augmentation mammoplasty
J Winter*, A Islur, B Peters
Winnipeg, MB

PURPOSE: Greater scrutiny and concern toward opioid use and abuse has caused a push toward more regulation on opioid prescriptions. Standard amounts of post-operative opioid prescriptions have not been explored in the literature. This study aims to objectively obtain data to quantify the amount of opioid medication required to adequately control pain for patients undergoing bilateral breast augmentation (BBA) for both submuscular and subglandular procedures. METHODS: Cross-sectional Prospective data, using purposeful sampling was obtained through a take home patient pain tracking questionnaire. 56 patients were instructed to fill out a numeric analog scale (scale 0-10) to rate their overall pain on the day, and track the type and amount of pain medication they took for seven days. RESULTS: Both groups had adequate and comparable self-reported pain control rated 3.1/10 on average throughout the seven-day post-operative period. Within the subglandular group, the average person required 19.1 +/- 1.3 Tylenol #3 tablets per person (42.9 morphine equivalents), 17.0 +/- 2.3 Tramacets (63.75 morphine equivalents), and/or 26.2 +/- 0.9 NSAIDS tablets per person over the first seven days post op. The subpectoral group average tabs per person were 25.9 +/- 1.5 Tylenol #3's (58.2 morphine equivalents), or 23.4 +/- 0.6 Tramacets (88.1 morphine equivalents), and/or 23.2 +/- 0.3 NSAIDS. CONCLUSION: We propose a reference range of pain medication required on average for patients undergoing BBA to obtain adequate pain control in the initial postoperative period. Authors found pain can be controlled on less than 50 morphine equivalents per day, as per the most recent Canadian guidelines. LEARNING OBJECTIVES: 1. To gain objective data quantifying opioid medication prescribed for patients undergoing routine bilateral breast augmentation and the amount of opioid medication required to adequately control pain. 2. To characterize a reference range to guide plastic surgeons in regard to narcotic prescribing.

A prospective study of dynamic preoperative and postoperative anthropometric breast measurements in augmentation mammoplasty
N Cormier*, H Silverman
Ottawa, ON

PURPOSE: Breast augmentation remains one of the most common aesthetic surgeries in North America. The inherent challenge in augmentation mammoplasty is to accurately determine the tissue characteristics and laxity of the breast skin envelope. A thorough understanding of tissue factors is critical to a successful operation. The purpose of this study was to provide a clinical tool for preoperative assessment based on changes in upright and supine breast measurements to improve decision-making in primary breast augmentation. METHODS: A prospective cohort study of consecutive patients undergoing primary breast augmentation was undertaken. Linear measurements were recorded with the patient upright. Measurements were repeated by the same surgeon with the patient supine. Measurements recorded included: sternal notch to nipple (SN), nipple to inframammary fold (IMF), internipple distance (IND), and base width (BW). Postoperative measurements were completed at the one-week, four-week and three-month time points. RESULTS: Seventy-four patients underwent bilateral subpectoral breast augmentation with preoperative and postoperative measurements recorded. The mean age and BMI of participants was 34.9±5.2 years and 21.8±3.6 kg/m2, respectively. Mean implant volume and projection were 351.7±87cc and 4.9±0.7mm, respectively. Preoperatively, the mean SN distance decreased by 16.2±8.1mm when supine, while mean IND increased by 19.3±11.4mm (p<0.0001). Postoperatively, the mean difference in SN and IND was 8.8±8.3mm and 14.8±12mm (p<0.0001), respectively. IMF distance increased by a mean of 16±0.7mm postoperatively (p<0.0001). CONCLUSIONS: Dynamic measurements are a simple, accurate means of objectively assessing breast characteristics, including tissue laxity and chest asymmetry. Upright/supine SN and IND are clinically and statistically significant measurements that can guide selection of implants to fit the patient’s specific tissue requirements. LEARNING OBJECTIVES: Participants will be able to appreciate the difference in upright/supine breast measurements as a clinical tool in preoperative patient evaluation and assessment of postoperative results in augmentation mammoplasty.
Surgical ergonomics and baseline characteristics among surgery staff and trainees: A pilot study
JX Zhang*, SN Ahmed, T Sairi, K Genoway
Vancouver, BC

PURPOSE: Work-related musculoskeletal disorders are present at alarming rates among surgeons. Plastic surgeons are particularly at risk for these, especially during long microscope cases or when using loupe magnification. This pilot study seeks to establishes present baseline characteristics and perspectives among plastic surgery trainees and staff. It is part of a larger project with overarching goals of identifying and reducing the surgical trainees’ risks for the development of work-related musculoskeletal disorders. METHODS: A survey was sent to all plastic surgery attending surgeons in the lower mainland Vancouver area as well as all the plastic surgery residents nation-wide. The survey, which features elements adapted the Duke Ergonomics course, includes demographic, practice type, knowledge and behavioural questions. Descriptive statistics were used. RESULTS: Response rate was 38/120 (25.5%) from national plastic surgery residents and 27/80 (33.8%) from plastic surgery staff, half of them with over 10 years experience. Sitting positioning (34.6% vs. 40.5%), protective lead gown usage (27.5% vs. 13.1%), loupes (97.3% vs. 92.5%), and microscope (5.0 vs 5.6%) were similar among residents and staff, respectively. Despite a high rate of MSK issues already present even in the younger trainee group (86.8%), vs. staff (92.3%), the majority show reluctance to report surgery-related MSK injuries to a work safety board (76.3% vs. 80.8%). Knowledge and formal training of ergonomics was generally poor. CONCLUSIONS: This pilot elucidates characteristics and perspectives of trainees and staff on surgical ergonomics, confirming our hypothesis that MSK injuries are prevalent and that there is a lack of formal training and knowledge. It sets the stage for our future directions, as interest exists for formal teaching, as well the use of wearable haptic-feedback devices measuring postures in real time. LEARNING OBJECTIVES: To establish preliminary data on baseline characteristics and perspectives of plastic surgery trainees and staff about surgical ergonomics.

What does it take to be an academic Plastic Surgeon in Canada: Hiring trends over the last 50 years
AE Copeland*, DE Axelrod, CR Wong, JL Malone, CJ Coroneos
Hamilton, ON

PURPOSE: Canadian academic plastic surgery positions have become highly competitive secondary to delayed retirement, stagnant hospital funding, and an increasing number of plastic surgery graduates. Little information is available to help graduates navigate this challenging landscape. Our objectives were to evaluate the training backgrounds of all academic plastic surgeons in Canada, and to develop training recommendations for residents pursuing an academic career. METHODS: Training backgrounds were obtained from institutions’ websites. Surgeons were subsequently emailed to confirm this information and fill in missing details. Multivariable regression models were designed to analyze the effects of gender and FRCSC year on number of fellowships and graduate degrees and time to first academic position. RESULTS: Training information was obtained for 196 surgeons (22% female), with a 52% email response rate. 91% of surgeons completed residency in Canada. 94% completed fellowship training, while 43% held a graduate degree. 67% were hired in the same city as their residency and 18% in the same city as their fellowship. Regression analysis revealed that women took significantly longer from graduation to first academic job (p<0.01), with no gender differences in graduate or fellowship training. Additionally, younger surgeons were more likely to have graduate degrees (p<0.01). CONCLUSIONS: Nearly all plastic surgeons completed additional training, and most were employed where they previously trained. Women are disadvantaged, taking significantly longer to acquire academic positions, with no gender difference in fellowship or graduate training. Trainees should consider these patterns when planning their careers. Future research should focus on exploring gender-based discrepancies in hiring practices. LEARNING OBJECTIVES: 1) Summarize the training backgrounds of academic plastic surgeons in Canada, 2) Highlight gender disparities in hiring trends, 3) Develop recommendations for residents pursuing an academic career.

Advanced-stage chest wall sarcoma resection and microsurgical reconstruction: Indications, outcomes, and survival based on a 12-year experience
C Nguyen*, H Chapko, E Buchel
Winnipeg, MB

PURPOSE: High-grade, locally-advanced, with or without systemic metastases, primary chest wall sarcomas (AJCC III-IV) are rare neoplasms frequently associated with poor survival. The oncologic benefit of such radical surgical approach in this complex patient population remains to be defined. The objective of this study is to evaluate our clinical experience of chest wall resection and microvascular reconstruction. METHODS: A retrospective analysis of a prospectively-maintained database from 2007-2019 identified 19 patients with high-grade, advanced-stage chest wall sarcomas treated with radical resection and reconstruction.
Patient demographics, tumor and surgical characteristics, length of stay (LOS), and perioperative complications were analyzed. Overall survival was calculated by Kaplan-Meier curve. **RESULTS:** Patient population included 9 females, 10 males with a mean age of 61.6±4.8 years. Resection indications included palliative (n=10), and curative intent (n=9). The mean tumor diameter was 14±2.2cm. All cases required microvascular reconstruction with Composix Gore-tex/Prolene mesh (n=12) used for stabilization. Flap type included: single DIEP (n=10), bilateral DIEP (n=4), single ALT+TFL (n=1), bilateral ALT (n=1), bilateral ALT+TFL (n=1), and supercharged latissimus/serratus (n=2). There were no perioperative mortalities or flap losses. Complications occurred in 9 cases (Clavien-Dindo classification grade I, n=3, grade II, n= 3, grade IIIa, n=3). Median LOS was 15 days. Mean follow-up time was 30.1±1.4 months. Mean overall survival time of 34.6±8.5 months (stage III-57.8±17.2 months; stage IV-18.1±4.6 months, p<0.001). **CONCLUSION:** Microvascular reconstruction of radical composite chest wall resection for advanced-stage sarcomas can be associated with a high flap success rate and acceptable complication rate. Limited LOS and significant length of survival with mortality significantly influenced by disease stage support this aggressive approach. The option for complex reconstructions remains a viable option for high-grade, advanced-stage primary sarcomas of the chest wall. **LEARNING OBJECTIVES:** Participants will be able to learn about our experience with advanced-stage chest wall sarcoma reconstruction.

**Local FK506 (tacrolimus) drug delivery enhances nerve regeneration through unprocessed fresh nerve allografts**

K Zuo*, G Shafa, K Chan, J Zhang, T Gordon, GH Borschel
Toronto, ON

**PURPOSE:** Despite good outcomes, fresh nerve allografts are rarely used clinically due to the need for systemic immunosuppression and associated morbidity. A local drug delivery system for FK506, an FDA-approved immunosuppressant, can provide sustained release of FK506 at the site of implantation without systemic effects. The study objective was to investigate the effects of local FK506 delivery to enhance nerve regeneration in a rodent model of nerve gap reconstruction using fresh nerve allografts. **METHOD:** In male Lewis rats, a hindlimb common peroneal (CP) nerve gap (10 mm) was reconstructed with 20 mm nerve isografts from donor Lewis rats or fresh nerve allografts from genetically mismatched donor ACI rats. Rats with allografts received either systemic FK506, local FK506, or no treatment. After 4 weeks, nerve regeneration was evaluated using: (1) retrograde labeling to enumerate regeneration of motor and sensory neurons; (2) quantitative histomorphometry of the CP nerve (midgraft and distal); and (3) serum cytokine profile. **RESULTS:** Rats with isografts or fresh allografts treated with systemic FK506 demonstrated significantly greater nerve regeneration compared to untreated fresh allografts (p<0.001). Allografts treated with local FK506 demonstrated robust regeneration of myelinated axons from motor and sensory neurons, which was significantly better than untreated allografts (p<0.001) and no different than nerve isografts or allografts treated with systemic FK506 (p>0.05). Serum concentrations of the pro-inflammatory cytokine IL-12 were significantly lower in rats treated with both local FK506 and systemic FK506 (p<0.05); however, rats treated with local FK506 had undetectable serum levels of FK506 unlike rats treated with systemic FK506. **CONCLUSION:** A local FK506 drug delivery system enhances nerve regeneration through fresh nerve allografts comparable to nerve isografts or allografts with systemic immunosuppression. Local FK506 does not result in systemic FK506 toxicity. In the future, local FK506 delivery may enable clinical nerve allotransplantation without systemic FK506 toxicity. **TEACHING OBJECTIVES:** 1. State challenges of nerve gap reconstruction. 2. Describe FK506’s neuro-regenerative properties.

**Conditioning electrical stimulation improves functional recovery in a tibial to fibular nerve transfer**

J-L Senger*, K Rabey, M Morhart, A Chan, KM Chan, C Webber
Edmonton, AB

**PURPOSE:** Treatment of foot-drop using a distal nerve transfer (DNT) is often unsuccessful, with UNPREDICTABLE outcomes. We hypothesize conditioning electrical stimulation (CES) to the donor nerve prior to DNT will improve outcomes. It is imperative that CES does not injure the donor nerve to be clinically feasible; therefore, we investigated the effects of CES on the nerve. **METHODS:** One week following a common fibular nerve injury, half of the rats were treated with tibial nerve CES. Seven days later, a tibial nerve branch was coapted to the distal fibular nerve. Length of axonal regeneration of the tibial nerve into the fibular stump was quantified at two- weeks, and tibialis anterior muscle reinnervation assessed at 10 weeks. Gait kinetics and kinematics were assessed between 7-10 kinetics. The effects of CES on the nerve were compared to naive (negative-control) and crushed (positive-control) nerves. Immunohistochemistry at 7 days assessed Wallerian degeneration and infiltration of inflammatory cells. **RESULTS:** Animals treated with CES prior to DNT had longer axon extension (p<0.001). Nerve conduction studies identified greater compound muscle action potentials, increased tibialis anterior muscle mass and more reinnervated neuromuscular junctions (p<0.001). Gait analysis of CES- treated animals identified significant improvements in gait kinetics/kinematics (velocity, vertical peak, duty factor, braking/propulsion forces, dorsiflexion, dexterity) (p<0.05). The tibial nerve distal to the site of CES had no macrophage infiltration nor did it demonstrate Wallerian degeneration. Plantarfexion of the
treated limb was similarly preserved in both CES-treated and no-ES nerves. **CONCLUSIONS:** CES to the tibial nerve improved regeneration through a lower-limb DNT, with enhanced motor reinnervation and greater functional recovery. CES is non-injurious and safe for clinical use. CES may significantly improve outcomes for patients undergoing lower limb DNT.

**LEARNING OBJECTIVES:** 1) CES improves regeneration through a DNT, 2) CES improves functional outcomes, 3) CES is a clinically feasible intervention.

Comparing digital replantation versus revision amputation patient reported Outcomes for traumatic digital amputations of the hand: A systematic review and meta-analysis
N Stone*, A Shah, B Chin, V McKinnon, M McRae
Hamilton, ON

**PURPOSE:** Adults with traumatic digital amputation (TDA) of the hand may be surgically managed with replantation or revision amputation. This study aims to determine whether replantation compared to revision amputation yields superior patient reported outcomes (PROs) and other outcomes. **METHODS:** Three databases (MEDLINE, Embase, and PubMed) were systematically searched from database inception until June 13, 2019 independently and in duplicate. Data were pooled in a random-effects meta-analysis model with subgroups based on level of injury and the digit(s) involved. The certainty of evidence was evaluated using GRADE. **RESULTS:** Of 4,350 studies identified, 12 retrospective cohort studies met inclusion criteria and compared outcomes of TDA treated with replantation (n=717; 80.2% male; mean age 40.3) versus revision amputation (n=1,046; 76.1% male; mean age 41.7). Three studies reported sufficient PRO data for meta-analysis using the Michigan Hand Questionnaire (MHQ) and Disability of Arm, Shoulder and Hand (DASH) tool. Replantation of the thumb had a superior MHQ score (+12.01, 95% CI [7.96 to 16.07], I²=18%) compared to revision amputation, whether the injury was proximal or distal to the IP joint. Replantation of single non-thumb digits had a superior MHQ score (+5.32, 95% CI [3.11 to 7.53], I²=62.4%) and DASH score (-3.63, 95% CI [-7.14 to 0], I²=0%) compared to revision amputation. **CONCLUSION:** There is low-quality evidence that replantation of the thumb achieves superior PROs compared to revision amputation that may be clinically meaningful to patients based on existing estimates of the minimally important difference (MID). Although replantation also demonstrated superior PROs for single non-thumb digits, the magnitude of effect is likely not clinically important and is based on very low-quality evidence. **LEARNING OBJECTIVES:** 1) Understand how optimal treatment approach varies based on mechanism, level and type of TDA injury. 2) Appreciate how the MID of PRO tools influences whether outcomes are clinically important.

Early mandibular distraction decreases social distance and improves psychosocial acceptance and utility outcomes in craniofacial microsomia
Y Almadani*, M Gilardino, A Philip
Montréal, QC

**PURPOSE:** The utility and timing of mandibular distraction osteogenesis (MDO) in patients with craniofacial microsomia (CFM) continues to be a topic of debate, especially in the population of patients with mild or non-significant functional issues. The objective of this study was to quantitatively assess the burden of mandibular asymmetry in CFM and to accurately evaluate the outcomes of early MDO and its impact on patients’ perceived quality of life (QoL) and social acceptance. **METHODS:** A validated crowdsourcing platform was utilized to recruit participants. Psychosocial acceptance and utility outcomes were assessed for patients with CFM. Participants were presented with health-state scenarios supplemented with pre- and post-operative images. Student’s t-tests were utilized for statistical analysis, and significance was set at p < 0.01. **RESULTS:** 463 participants were included in the study. The mean visual analog scale (VAS) score for untreated mandibular hypoplasia in CFM was 0.48 ± 0.24, which improved significantly (p-value: <0.0001) to 0.63 ± 0.20 following early MDO. Time-trade off (TTO) scores for an imaginary surgery leading to perfect health with no complications were not statistically different from undergoing early MDO (p-value: 0.113). In measuring psychosocial acceptance and social distance, participants were more significantly accepting of the post-distraction state. Early mandibular distraction decreased social distance in all eight social situations assessed. **CONCLUSIONS:** Early mandibular distraction may lead to tangible positive gains in CFM patients based on utility outcome scores, psychosocial acceptance, and social distance. Therefore, although further surgery may be needed at skeletal maturity, early MDO can improve the psychological well-being of CFM patients during their crucial developmental years. **LEARNING OBJECTIVES:** 1) The participant will be able to understand the role of early MDO in CFM in the absence of functional deficits. 2) The participant will be able to appreciate the effects of early MDO on CFM patients' QoL.
Trapeziectomy is the recommended surgical treatment for trapeziometacarpal osteoarthritis: Results of a systematic review and network meta-analysis

B Chin*, C Leveille, M Phillips, A Bozzo, B Rochwerg, S Voineskos
Hamilton, ON

PURPOSE: Trapeziometacarpal osteoarthritis is a degenerative joint disease associated with progressive pain, joint instability, and loss of hand function. While many surgical options are available, previous meta-analyses have drawn uncertain conclusions on the relative effectiveness of different interventions. As traditional meta-analyses are limited to single pairwise comparisons, we performed a Bayesian network meta-analysis (NMA) of randomized controlled trials (RCTs) comparing surgical treatments for trapeziometacarpal osteoarthritis. METHODS: We searched MEDLINE, EMBASE, CENTRAL, WHO ICTRP, and ClinicalTrials.gov up to February 2019 for RCTs that examined the efficacy of surgical treatments on pain, function, and complications. Data on study characteristics, methods, outcomes, and risk of bias were abstracted by two reviewers. The GRADE approach was used to determine the certainty of evidence. RESULTS: A total of 12 RCTs (819 patients) comparing 7 different surgical treatments with a minimum follow-up period of 1 year fulfilled the inclusion criteria. Compared to previous published results with low certainty evidence, there is now moderate certainty evidence that the minor differences between trapeziectomy with and without LRTI for pain (VAS +0.07; 95%CI -5.88, 6.01) or function (DASH -1.1; 95%CI -8.78, 6.81) does not meet the minimally important difference (MID). The remaining comparisons for pain and function had low certainty evidence with significant imprecision in effect estimates. There is low certainty evidence that trapeziectomy is associated with lower complication risk compared to trapeziectomy with LRTI (OR 0.28; 95%CI 0.06-0.8) and was ranked as the treatment with the lowest complication risk by SUCRA analysis. CONCLUSIONS: This NMA allowed for a comparison between 7 surgical options for trapeziometacarpal osteoarthritis. It provides more definitive evidence that patients do not find a difference in pain or function between trapeziectomy with or without LRTI. Since trapeziectomy has the lowest complication profile we recommend this to be the treatment of choice. LEARNING OBJECTIVES: 1. Participants will be able to define a network meta-analysis and will understand when performing one is appropriate. 2. Participants will be able to describe the advantages of a network meta-analysis over a traditional meta-analysis. 3. Participants will understand the current evidence for surgical management of trapeziometacarpal osteoarthritis.

Outcomes of AIN end to side transfer for severe ulnar nerve injury: A Western Canadian multicentre cohort study

M Curran*, A Platt, MJ Morhart, JL Olson, KM Chan, Western Canada Peripheral Nerve Research Initiative Organization Edmonton, AB

PURPOSE: Severe cases of high ulnar nerve injury including cubital tunnel syndrome often have poor outcomes even after surgical decompression. The anterior interosseous end to side (ETS) nerve transfer has been proposed as a novel technique to improve outcomes. The purpose of this study was to evaluate patients in Western Canada who received the AIN ETS transfer. METHODS: Patients treated with an AIN ETS transfer were recruited from multiple sites throughout Western Canada. All patients enrolled were evaluated using an electrophysiology protocol to determine the relative contributions of AIN and ulnar nerve to reinnervate the intrinsic hand muscles. Hand function including strength and sensation was also tested. The ETS patients were compared to patients that received an end to end (ETE) AIN nerve transfer and decompression alone. All patients had a minimum of 1 year follow-up. Descriptive statistics and ANOVA was used to analyze the data. RESULTS: Forty-three patients (AIN ETS n=21; Decompression n=12; AIN ETE n=10) from four centres in Western Canada were enrolled. There was no electrophysiology evidence of axonal growth from the AIN to the hypothenar muscles in any of the AIN ETS patients, while significant axonal growth from the AIN was found in the ETE patients. CMAP significantly improved in the ETE group (p=0.004), while there was no difference in CMAP between the decompression and ETS group. CONCLUSIONS: There was no electrophysiologic evidence of axons crossing from the AIN to hypothenars following an end to side transfer. Electrophysiologic improvement was significantly improved in the ETE group. LEARNING OBJECTIVES: 1. Describe the relative contributions of the AIN and ulnar nerve after AIN ETS nerve transfer 2. Describe the outcomes of nerve transfers for severe high ulnar nerve injury

Deep learning for automated assessment of upper extremity radiographs

TJ Saun*
Toronto, ON

PURPOSE: Hand X-rays are commonly ordered in outpatient, inpatient, and emergency settings, the results of which are often initially interpreted by non-radiology trained healthcare providers. Much like the advent of automated ECG interpretation in the
1970s, there may be utility in automating aspects of upper extremity X-ray analysis to aid with rapid initial analysis and reduce false negative interpretations. Deep neural networks have been shown to be effective in several medical imaging analysis applications. The purpose of this work was to apply a deep learning framework to automatically classify the radiographic positioning of hand X-rays. **METHODOLOGY:** A 152-layer deep residual neural network was trained using the MURA (musculoskeletal radiographs) dataset from Stanford University. This dataset contains 5,933 hand X-rays. The original dataset was filtered to remove pediatric X-rays as well as bilateral and atypical views. The X-rays were all labeled as either PA, lateral, or oblique view. A subset of 851 images was set aside for model validation and testing. Dataset augmentation was performed, including horizontal and vertical flips, rotations (+/-45 degrees), as well as modifications in contrast (+2, -0.5) and brightness (+50, -50). The model was evaluated and performance was reported as a confusion matrix from which accuracy, precision, sensitivity and specificity were calculated. **RESULTS:** The augmented training dataset consisted of 80,672 images. Their distribution was 38% PA, 35% Lateral, and 27% Oblique positions. When evaluated on the test dataset, the model performed with 95.5% accuracy, 92.6% precision, 94.0% sensitivity, and 96.3% specificity. **CONCLUSIONS:** Radiographic positioning of hand X-rays can be effectively classified by a deep neural network. Further work will be performed on classification and localization of abnormalities, automated assessment of standard radiographic measures and eventually on computer-aided diagnosis and management guidance of skeletal pathology. **LEARNING OBJECTIVES:** 1. Understand how a computer algorithm can assist in analyzing hand X-rays. 2. Appreciate the workflow required to achieve AI-assisted diagnosis and management for hand pathology identified on X-ray

45

**Utilities of surgery versus splinting for carpal tunnel syndrome: A longitudinal prospective cohort study**

A Wang*, H Retrouvey, M Krahn, S McCabe, H Baltzer

Toronto, ON

**PURPOSE:** Utility is a quantitative method of expressing patient preferences for health outcomes, on a scale of 0 (death) to 1 (perfect health). This longitudinal prospective cohort study aimed to compare the change in utilities of carpal tunnel syndrome (CTS) patients following surgery or splinting. **METHOD:** We recruited adults referred to a tertiary care centre whose diagnosis of CTS was confirmed on the Katz Hand Diagram. Patient symptoms were assessed using the Boston CTS Scale. Short Form Sixth Dimension (SF-6D), Chained Standard Gamble (CSG), Visual Analogue Scale (VAS), and EuroQol 5D Questionnaire (EQ-5D) were used to measure utilities. Patients were assessed both at baseline and after surgical release or three months of night splinting. **RESULTS:** Twenty-four patients met inclusion/exclusion criteria, of which 13 (54%) had splinting and 11 (46%) underwent surgery. Following treatment, utilities for the surgical group increased by 0.01 for SF-6D (Cohen’s d=0.09), 0.03 for CSG (Cohen’s d=0.31), 0.12 for VAS (Cohen’s d=0.631), and 0.01 for EQ-5D (Cohen’s d=0.09). However, utilities for the conservative group decreased by 0.03 for SF-6D (Cohen’s d=-0.33), 0.02 for CSG (Cohen’s d=-0.25), 0.10 for VAS (Cohen’s d=-0.46), and 0.05 for EQ-5D (Cohen’s d=-0.33). Changes in utilities were found to significantly correlate with changes in the Boston CTS Scale for SF-6D (p=0.02), VAS (p<0.01), and EQ-5D (p<0.01) only. **CONCLUSIONS:** Utility in this CTS population increased between 0.01 and 0.12 for the surgical group but decreased between 0.02 and 0.10 for the splinting group. While SF-6D, VAS, and EQ-5D responds to changes in patients’ CTS symptom and functional severity, CSG did not. **TEACHING OBJECTIVES:** 1. Participants will be able to define health utility. 2. Participants will be able to appreciate the value of utility measurements in healthcare. 3. Participants will be able to describe four utility measurement methods.

46

**A comparative cost analysis of local anesthesia versus brachial plexus block for complex hand surgery**

F Meng*, A Baradaran, R Finlayson, S Thibaudeau

Montréal, QC

**PURPOSE:** Local anesthesia has shown to be safe and cost-effective for elective hand surgery procedures performed outside of the operating room. The economic benefits of local anesthesia compared to regional anesthesia for complex hand surgeries performed in the operating room involving repair of tendons, nerves, or bones are unclear. The aim of this study was to perform a comparative cost analysis of complex hand surgery performed in the main operating room using local anesthesia (LA) or brachial plexus (BP) block. **METHODS:** A cross-sectional study was performed on data from a prospective randomized controlled trial of anesthesia modality for complex hand surgery at our institution in Montreal, Canada. The first 40 consecutive patients randomized 50:50 to LA or BP were included. The primary objective was to determine the mean anesthesia-related cost, which was derived from the sum of anesthesia personnel fee, block room fee, and equipment/medication fee. Secondary objectives were to analyze block performance time, block onset time, duration of anesthesia, duration of surgery, and time in the recovery room. **RESULTS:** The mean anesthesia-related cost of performing hand surgery under LA was $241±33 (mean±SD), compared to $429±43 for BP, a difference of $188±12 per case (p<0.0001). The mean block performance time was significantly quicker for the LA (78±31 sec) versus BP (456±403 sec) patients (p<0.001). We found no difference in the total duration of surgery, duration of anesthesia, block onset time, and time in the recovery room (p>0.05). **CONCLUSIONS:** The use of LA for complex hand
surgical procedures performed in the operating room is associated with mean cost savings of $188 per case. This has significant economic implications for a publicly funded health care system. LEARNING OBJECTIVES: To understand the effects of LA or BP for complex hand surgery on OR efficiency and costs to public health care.

47

A prospective analysis of opioid prescription, consumption, and psychometric correlations in outpatient plastic surgery procedures.
J Barkho*, C Leveille, K Faragalla, N Sengupta, C Wong, M McRae
Hamilton, ON

PURPOSE: The primary purpose is to determine the factors predicting opioid prescription, and the secondary purpose is to determine the factors predicting opioid tablet consumption after outpatient Plastic Surgery procedures. METHODS: Data was collected prospectively using two surveys: (1) pre-operative on the day of surgery, and (2) post-operative on approximately day 14. The primary outcome was type of prescription given (opioid versus non-opioid). The secondary outcome was the number of opioid tablets consumed at the second survey. Information on demographics, the pain catastrophizing scale (PCS) and patient health questionnaire-4 (PHQ-4) for depression and anxiety were gathered. Statistics included Chi-Square, student’s t-test, univariable, and multivariate regression analyses. RESULTS: Four hundred and forty patients were recruited, of which 49% (214) received an opioid prescription. The following factors were independently associated with receiving an opioid prescription: upper limb surgery (OR 4.0 [1.7-9.3]), breast and abdomen (OR 11.1 [1.2-101.1]), dermatologic (OR 0.2 [0.1-0.5]), and surgery in the main operating room (OR 23.6 [10.0-55.2]). Patients consumed a mean of 8 opioid tablets post-operatively. More tablets were consumed if patients were younger than 60 years old (p<0.05), taking pain medications pre-operatively (p=0.03), and if they scored higher on the PHQ-4 (p=0.002) but not the PCS (p=0.732). Surgeons prescribed less opioids over time in minor procedures (p=0.001), without an increase in pain crises. CONCLUSION: The patterns of opioid prescription and consumption after outpatient Plastic Surgery are elucidated. Plastic surgeons globally over-estimate patients’ opioid requirements. Potentially less opioids could be prescribed in the minor procedure room without an increase in pain crises. LEARNING OBJECTIVES: (1) Recognize the factors associated with prescribing opioids. (2) Identify patients at risk of increased opioid tablet consumption. (3) Familiarize oneself with the mean number of tablets consumed for common outpatient procedures.

48

Opioid medication disposal among patients following hand surgery
C Yeung*, C Novak, D Antflek, H Baltzer
Toronto, ON

PURPOSE: Despite efforts at increasing public awareness to dispose unused narcotics, prescribed narcotics are retained post-operatively, which may lead to drug diversion and abuse. This study assessed retention of unused opioids among hand surgery patients and describes disposal methods and barriers. METHODS: Participants undergoing hand surgery were given an opioid disposal information sheet pre-operatively (n = 103), and surveyed post-operatively to assess unused opioids retained, disposal methods, and barriers to disposal. A binomial logistic regression was conducted to determine if age, gender, visual analog pain score, and/or type of procedure could predict opioid disposal. RESULTS: Eighty-eight patients were included in the analysis (15 were excluded; finished prescription or continued opioid use for pain control). Unused opioids were retained by 70 patients (79.3%) and disposal was reported by 18 patients (20.5%). Common disposal methods included returning opioids to a pharmacy (61.1%) or mixing them with an unwanted substance (16.7%). Reasons for retention included potential future use (61.4%), inconvenient disposal methods (22.9%), or keeping an unfilled prescription (11.4%). Patients undergoing soft tissue only procedures were more likely to dispose unused opioids compared to those undergoing bony-related procedures (OR = 2.2, CI = 0.53 - 9.29). Females were more likely to dispose compared to males (OR = 1.1, CI = 0.38 - 3.32). Despite these observed trends, however, there were no significant predictors associated with narcotic disposal. CONCLUSIONS: Most patients undergoing hand surgery retain prescribed opioids for future use or due to impractical disposal methods. The most used disposal methods include returning narcotics to a pharmacy or mixing opioids with unwanted substances. Identifying predictors of disposal may provide important information when developing strategies to increase opioid disposal. LEARNING OBJECTIVES: 1. Describe opioid disposal methods and reasons for retention among patients undergoing hand surgery. 2. Consider patient factors that may contribute to disposal.