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**W Bryan Callaghan:** President/Président
**Edward Tredget:** Vice President/Vice-président, Scientific Program Chair
**Gilles Beauregard:** Chair, Local Organizing Committee/Président, Interdance générale

## EYE-OPENER SESSION

### 00
### UPDATE ON FAT GRAFTING

**Dan Del Vecchio**
**Boston, Massachusetts, USA**

**At the end of this workshop:**

1) *The learner should be able to understand the essential principles behind large volume fat transplantation;*
2) *The learner should be able to understand the role of volumetric planning in large via fat transplantation;*
3) *The learner should be able to understand the differences between fat processing and the advantages and disadvantages of each.*

### 01
### EPIDEMIOLOGY AND CAUSES OF UPPER EXTREMITY AMPUTATIONS IN THE PROVINCE OF QUÉBEC

**E Karam, M Guez, L Paek, P Harris, MA Danino, J Bou Merhi**
**Montréal, QC**

**BACKGROUND AND PURPOSE:** The injury mechanism is the most important factor determining survival rate and functional outcome in replantation surgery of the upper extremities. However, injury causes are underreported in the literature. Thus, we sought to study the epidemiology of upper extremity injuries referred to our provincial replantation hand center.
**METHODS:** We conducted a retrospective analysis of all records of patients referred to our center for digital amputation or devascularization from January 2008 to January 2013. Further data were obtained through a validated questionnaire mailed to those patients. The gathered information included demographics and a narrative of the mechanism of injury including factors involved.
**RESULTS:** A total of 529 patients were referred during the period of 2008-2013. The referral rate was 1.175/100 000 person/year. 131 patients completed the questionnaire. The majority were male (89.31%), mostly in the 40-60 years-old age category (47.32%). 66.4% of the injuries occurred in the non-dominant hand, 40.62% involved one finger, with the thumb and index comprising 48.42% of the cases. They mostly worked an average of 30 hours/week (64.12%), though most injuries (61.24%) occurred at home. Power handtools or fixed powered machines accounted for 69.12% of the injuries. Most patients reported that guards were absent at the time of injury. Work on small pieces and lack of dexterity were most cited as reasons for guard retrieval.
**CONCLUSIONS:** A closer examination of amputation causes shows a clear pattern. Unexpectedly, most events occurred at home. Further development in safeguards and a better population awareness is required to prevent further injuries.

**Learning Objectives:**

- *Participant will be able to understand the epidemiology of upper extremity injuries*
- *Participant will be able to understand the mechanism of injury associated with the most commonly used handtools causing digital amputations*
- *Participant will be able to understand the preventive measures needed and raise awareness in his own community.*

### 02
### HEALTH CARE DELIVERY FOR PATIENTS WITH ACUTE FLEXOR TENDON LACERATIONS BEFORE AND AFTER IMPLEMENTATION OF THE ACUTE CARE PLASTIC SURGERY SERVICE IN THE SASKATOON HEALTH REGION

**C Wilgenbusch, P Dust, I Sunderland**
**Saskatoon, SK**

**PURPOSE:** Flexor tendon lacerations represent common traumatic hand injuries. In 2011, the Acute Care Surgery (ACS) practice model was introduced to facilitate efficient management of trauma patients. We hypothesize that ACS has resulted in more timely intervention, improved outcomes, and decreased 'after-hours' surgeries for flexor tendon lacerations.
**METHOD:** A retrospective review was performed of patients treated for Zones 1-5 flexor tendon lacerations from September 2007-June 2013. Patients were divided into two groups, before (Group A) and after (Group B) ACS implementation. Variables included dates of referral, consultation and tendon repair, post-operative complications, time of surgery (after 1700hrs = 'after-hours'), and hospital admission. A surgeon survey assessing work satisfaction was administered.
**RESULTS:** There were 62 Group A patients and 71 Group B patients. Group A were much more likely to have surgery performed after-hours (P=0.0019), and be admitted to hospital (P=0.0211). Time from referral to consultation and the injury-to-surgery interval were slightly increased in Group B, but this was not clinically significant. Surgeons surveyed favored the new ACS service, citing improved work-life balance.
**CONCLUSIONS:** The ACS model was designed to improve patient flow and standardize care for patients with traumatic injuries. Surprisingly, injury-to-surgery interval was slightly increased in this model. However, this was clinically insignificant and likely due to the fact that pre-ACS patients were seen in the ER, admitted to hospital, and 'added on' to the OR slate to be done overnight or the following day. The ACS model has resulted in fewer hospital admissions and decreased after-hours surgery for flexor tendon injuries, decreasing surgeon fatigue, improving work satisfaction, and likely reducing cost of care.

**Learning Objectives:**

- *To learn about a new practice model for trauma care*
- *To understand how this model has affected health care delivery for patients with acute flexor tendon injuries*

### 03
### CAN VOLAR PLATE HEAL TO FLEXOR TENDON

**MM AlQattan, WI Al Dhubaiban**
**Riyadh, Saudi Arabia**

The ability of flexor tendon to heal to the volar plate has not been previously investigated. If able to do so, flexor digitorum profundus (FDP) avulsion injuries in Zone I may be repaired to a distally based flap of the volar plate at the distal interphalangeal joint (without drilling into bone). The FDP tendon of the hind limb of the sheep was cut at the level of the ankle and then repaired to a distally-based flap of the underlying volar plate. The repair was studied histologically and tested biomechanically at seven intervals (1, 2, 3, 4, 5, 6, 8, and 12 weeks) following repair. The mean breaking strength of the tendon-to-volar plate repair was 62 N at 1 week; dropped

slightly to 52 N at 2 weeks; and then progressively increased to reach a mean of 312 N at 12 weeks. Histologically, thin randomly arranged collagen fibers were seen at the repair site at 3 weeks; while healing with thick parallel collagen bundles were seen at 6 weeks. It was concluded that the flexor tendon can heal into the volar plate.

## 04
## HEALTH-RELATED QUALITY OF LIFE IN PATIENTS UNDERGOING PALMAR FASCIECTOMY FOR DUPUYTREN'S DISEASE

**A Thoma, MN Kaur, T Ignacy, C Levis, S Martin, E Duku**
**Hamilton, ON**

**BACKGROUND:** Traditional measurements of outcome for Dupuytren's contracture treatments have been ROM gain, Grip strength and recurrence. The outcome research movement in the last 3 decades has advocated measuring outcomes from the patient's perspective. The present study was undertaken to assess the Health Related Quality of Life (HRQoL) in patients with Dupuytren's disease who undergo palmar fasciectomy.

**METHODS:** A prospective cohort of patients with Dupuytren's Disease undergoing palmar and/or digital fasciectomy was recruited from the practice of three plastic surgeons in Hamilton, Ontario, Canada. After written informed consent was obtained, participants were asked to complete three HRQoL questionnaires i.e. Short form-36 (SF-36), Michigan Hand Questionnaire (MHQ) and Health Utility Index Mark-3 (HUI3) at five time points: at 1 week and 1 day pre-operatively, and at 1, 3, 6 and 12 month postoperatively. Ranges of motion and grip strength measurement were also recorded.

**RESULTS:** For the 26 patients in the study, the multi-attribute score of HUI3 improved from 0.80 before surgery to 0.83 at 12 month postoperatively ($p>0.05$). There was no difference in the SF-36 scores, but the MHQ improved from 74 at 1 week preoperatively to 90 at 12 month postoperative visit ($p<0.001$).

**CONCLUSIONS:** Patients who undergo palmar fasciectomy for Dupuytren's Disease experience a substantial improvement in their HRQoL 12 months after surgery. In our study population, a benefit of 0.85 Quality Adjusted Life Years (QALYs) within 12 months was observed. This can be translated as: the average patient who undergoes palmar fasciectomy gains the equivalent of approx. 14.4 days (0.48 months) in perfect health by undergoing palmar fasciectomy.

**Learning Objectives:**

- *Appreciate the difference of measuring Dupuytren's contracture treatments with Patient Reported Outcomes (PRO) versus physiological measures.*
- *Familiarization of appropriate HRQL of scales to use in Dupuytren's studies*
- *Appreciate the importance of using Utilities in measuring surgical outcomes*

## 05
## WRIST GANGLION TREATMENT: SYSTEMATIC REVIEW AND META-ANALYSIS

**L Head, M Allen, KU Boyd**
**Ottawa, ON**

**PURPOSE:** There are many treatments for wrist ganglia. The objective of this study was to review the clinical outcomes of all ganglia treatment modalities and to generate a meta-analysis comparing the two most common options: open surgical excision and aspiration.

**METHOD:** Review methodology was registered with PROSPERO. A systematic search of Medline and Embase was performed for articles published between 1990 and 2013. Studies were included that reported wrist ganglia treatment outcomes; screening was performed independently by two reviewers. Risk of bias was evaluated with Cochrane's tool for randomized controlled trials (RCT) and the Newcastle-Ottawa Scale for cohort studies; GRADE methodology was used to evaluate quality of evidence.

**RESULTS:** A total of 753 abstracts were identified and screened, 112 full-text articles were reviewed and 38 studies met inclusion criteria for data extraction and qualitative synthesis; 6 studies met criteria for meta-analysis, including 2 RCTs and 4 cohort studies. In RCTs surgical excision was associated with a 76% reduction in recurrence compared with aspiration [RR=0.24; 95% CI=0.08-0.71; P=0.01; $I^2$=0%]; RCT quality was 'moderate' (GRADE). In cohort studies surgical excision was associated with a 58% reduction in recurrence compared with aspiration [RR=0.42; 95% CI=0.21–0.85; P=0.02; $I^2$=87%]; cohort study quality was 'very low' (GRADE). Mean recurrence across all 38 studies was 21.2% (SE=3.7%) with open surgical excision (studies=14, ganglia=809), 58.7% (SE=5.1%) with aspiration (studies=12, ganglia=489), and 5.6% (SE=1.8%) with arthroscopic excision (studies=11, ganglia=512); mean persistence was 52.5% (SE=5.5%) with observation (studies = 2, ganglia = 93).

**CONCLUSIONS:** Open surgical excision offers lower risk of recurrence compared with aspiration in the treatment of wrist ganglia. Further RCTs are needed to increase confidence in the estimate of effect and to compare complications and recovery between treatments.

**Learning Objectives:**

- *To summarize the difference in outcomes between surgical excision and aspiration of wrist ganglia.*

## 06
## RETURN TO WORK AND MORBIDITY IN CONSERVATIVE IMMOBILIZATION VS PERCUTANEOUS SCAPHOID FIXATION: A SYSTEMATIC REVIEW AND META-ANALYSIS

**H AlNaeem, S Aldekhayel, O Fouda Neel**
**Montréal, QC**

**PURPOSE:** Management of minimally displaced scaphoid fractures remains controversial. Multiple studies summarized the outcomes of different management options including immobilization and percutaneous fixation. The current study aims at assessing the impact of different management options on patient's return to work.

**METHODS:** PubMed MEDLINE, Ovid MEDLINE, EMBASE and SCOPUS electronic databases were searched over the period 1974 to 2014. Medical subject headings and key words were "Scaphoid fracture" OR "Carpal fracture" AND (percutaneous OR screw fixation OR immobilization OR conservative OR cast). A two-step review process was done by two independent reviewers against a set inclusion criteria. Patients' demographics, time since injury, classification of fracture, duration of immobilization, time to return to work, time to union and complications were extracted. Meta analysis was done of comparative studies looking at return to work and complication rate.

**RESULTS:** Twelve studies met the inclusion criteria and divided in 2 groups; immobilization (group 1) and percutaneous fixation (group 2). A total of 619 patients were included; 257 in group 1 and 362 in group 2. Patients' demographics and time lag from injury to treatment were similar in both groups. Average duration of immobilization was 9.95 weeks in group 1 vs. 1.3 weeks in group 2. There was a statistically significant difference in the return to work in favor of group 2 (mean difference 42.2 [30.04–54.50]; $P<0.00001$). However, no difference was found in the complication rate between both groups (RR 0.74 [0.42–1.32]; P=0.3).

**CONCLUSION:** Percutaneous fixation of acute minimally or undisplaced scaphoid fractures is shown to be superior to cast immobilization in terms of faster return to work with no increased morbidity.

**Learning Objectives:**

- *Participants will recognize advantages and disadvantages of two commonly used treatment approaches to acute scaphoid fractures.*

## 07
## THE EFFECT OF ISOLATED FINGER STIFFNESS ON THE MOTION OF ADJACENT DIGITS

**R Baaqeel, D Ross, S Chinchalkar**
**London, ON**

**PURPOSE:** Finger stiffness is known to affect adjacent digits and overall hand function, mainly due to Quadriga[1]. There are no published studies that objectively quantify or compare the dysfunctional impact of each stiff finger. We hypothesize that the degree of dysfunction may vary depending on the involved digit.

**METHODS:** Healthy volunteers (n=25) between the ages of 18-58 years were recruited. Measurements were taken in a standardized setting by a single observer. Wooden splints were used to simulate stiffness by holding one finger, out of four, in extension. Function of adjacent, non-splinted,

digits was assessed before and after splinting using a finger goniometer and a linear scale to measure Total Active range of Motion (TAM) and fingertip distance to distal palmar crease (FTP), respectively. FTP measurement was categorized using Medsger severity scale[2]. Pre-splinting and post-splinting TAM for each finger was compared using paired Student t-test. Correlation between mean percentage reduction in TAM and FTP severity was calculated using Spearman rank correlation coefficient.

**RESULTS:** Post splinting TAM was significantly reduced in all fingers regardless of the splinted finger, P values <0.001. Mean percentage reduction in TAM was highest with splinting of the ring finger (25.6–46.5%). A splinted digit exerts the highest percentage in TAM reduction on adjacent finger(s) versus non-adjacent. There was a positive correlation between TAM reduction and FTP severity, Median rho= 0.514 (0.3–0.8).

**CONCLUSION:** Isolated finger stiffness causes significant reduction in the uninjured digits' range of motion. Ring finger involvement and proximity to the stiff finger accounted for a higher degree of reduction. This may suggest a need for more proactive approach in dealing with certain finger injuries.

**Learning Objectives:**

- *At the end of this lecture, the learner will understand the variable impact of isolated finger stiffness on hand function.*

## CANADIAN EXPERT PANEL

### 07A
### LIGAMENTOUS INJURIES IN THE HAND AND WRIST

**D Ross**
**London, ON**

### 07B
### SCAPHOID FRACTURES AND COMPLICATIONS

**M Morhart**
**Edmonton, AB**

## GUEST SPEAKER

### 07C
### BASIC SCIENCES IN PLASTIC SURGERY: INSIGHTS INTO THE MECHANISM AND TREATMENT OF SURGICAL FIBROSIS

**Anie Philip**
**Montréal, QC**

**Learning Objectives:**

- *Participants will be able to describe the basic mechanisms involved in normal wound healing and scarring;*
- *Participants will be able to identify some of the important molecular pathways that are dysregulated during abnormal scarring;*
- *Participants will be able to attain an understanding of how targeting key molecules involved in the fibrotic process may lead to the development of anti-scarring agents.*

### 08
### CD109 REGULATES TNF-α SIGNALING IN HUMAN KERATINOCYTES

**C Nguyen, K Finnson, A Philip**
**Montréal, QC**

**BACKGROUND:** CD109 is a GPI-anchored protein that we have identified as a TGF-β co-receptor that inhibits TGF-β signaling in human keratinocytes. Previous work involving CD109 investigated its in vivo effects in transgenic mice that overexpress CD109 in the epidermis and showed that these mice display enhanced wound healing and reduced scarring as compared to the wild-type. Furthermore, CD109's molecular activity was further characterized in keratinocytes isolated from CD109 transgenic and wild-type mice by genome-wide expression profiling. This gene expression analysis revealed that CD109 overexpression plays an important role in the regulation of NF-κB transcription activity. In addition, gene ontological analysis revealed that several genes differentially regulated in CD109 transgenic keratinocytes are components of the NF-κB signaling pathway including ligands (IL1-α and TNF-α), receptors (TLR2 and TNFRSF18) and intracellular regulators (NFKBIZ and IKBKE). Since these results suggested that CD109 regulates NF-κB signaling and TNF-α expression, we proceeded to investigate whether CD109 regulates TNF-α signaling via the NF-κB pathway in human keratinocytes.

**METHODS:** HaCaT, an immortalized human keratinocyte cell line, was grown in vitro. Characterization of CD109 activity in these keratinocytes were observed through knockdown using CD109 siRNA transfection. Upon transfection, cells were exposed to TNF-α (0, 15, 30 minutes). Analysis of various proteins (IκBα, pJNK, pERK) expressed in knockdown and control conditions were compared through western blotting.

**RESULTS:** Our study shows that blocking CD109 expression resulted in a small increase in NF-κB expression. Although CD109 siRNA had only modest effects on NF-κB expression, it drastically abrogated the TNF-α-induced extracellular signal-regulated kinase (ERK) signaling.

**CONCLUSION:** As TNF-α is known to signal through MAPK/ERK pathway in addition to NF-κB, these findings suggest that CD109 may potentiate TNF-α signaling via the ERK pathway in human keratinocytes. Future studies on the role of CD109 in regulating TNF-α on NF-κB and MAP kinase signaling are warranted.

**Learning Objectives:**

- *At the end of this lecture, participants will be able to understand the regulation of TNF-α pathway by CD109 in human keratinocytes*

### 09
### OPTIMIZING INJECTABILITY OF TRIAMCINOLONE ACETONIDE FOR KELOID MANAGEMENT

**A Vo, M Doumit, G Rockwell**
**Ottawa, ON**

**PURPOSE:** Injecting triamcinolone acetonide (TA) into a keloid is often challenging due To the density of keloids. The purpose of this study was to investigate the effects of various syringe and needle combinations on the injection force of TA, in order to determine the most ergonomic combination.

**METHODS:** A load cell was used to generate and measure the force of injection.

**PHASE 1:** The injection force of 5 common syringes with a 25G, 16 mm needle was measured at various injection speed (1,3,5mm/sec) by injecting water into air. The best syringe was then evaluated with various needle lengths (13-36mm) and gauges (25-30G) by injecting TA into air. Each experiment was repeated at least twice.

**PHASE 2:** The syringe-needle combination that required the lowest injection force (CLIF), 1 mL syringe with a 25G, 16 mm needle, was compared to a standard combination(SC), 3 mL syringe with a 25G, 16 mm needle, by injecting water into an excised keloid specimen. Each experiment was repeated at least 4 times.

Intraclass correlation coefficient (ICC) and independent t-test were used to determine reliability and significance respectively.

**RESULTS:** Increasing the needle gauge, syringe calibre, injection speed and needle length proportionally increased the injection force (P<0.001). CLIF required a mean of 17.0N±6.3 to inject water into the keloid, compared to 33.5 N±8.7 for SC. With TA, CLIF required 41.5 N to inject into the keloid (43.58% and 64.81% of the maximum force male and female thumbs can exert respectively), compared to 66.23N(69.20% and 103.49% of the maximum force male and female thumbs can exert respectively) for SC. ICC for all tests were greater than 0.4.

**CONCLUSIONS:** Syringe and needle calibre significantly affect the injection forces. The 1 mL polycarbonate syringe with a 25G, 16 mm needle (CLIF) is the best combination for injecting keloids. The standard combination (SC) overloads the female thumb.

**Learning Objectives:**

- *Participants will appreciate and quantify the effects of syringe calibre, injection speed needle gauge and length on injection force.*

## 10

## ALTERNATIVELY ACTIVATED M2 MACROPHAGES IMPROVE AUTOLOGOUS FAT GRAFT SURVIVAL VIA INDUCTION OF ANGIOGENESIS IN A PRECLINICAL MODEL

**S Gebremeskel, K Phipps, J Gillis, P Hong, B Johnston, M Bezuhly**
**Halifax, NS**

**BACKGROUND:** Variability in graft retention remains a significant limitation of autologous fat grafting, with under-correction necessitating repeated procedures. The authors evaluated whether graft retention in a mouse model could be improved via graft supplementation with alternatively activated M2 macrophages, a cell type known to play a critical role in tissue repair.

**METHODS:** Fat grafts from C57BL/6 mouse inguinal fat pads were supplemented with M2 macrophages generated via intraperitoneal Brewer's thioglycollate injection and in vitro culture. Grafts with saline or M2 macrophages were injected under recipient mouse scalps and assessed by serial volumetric microCT analysis. Explanted grafts underwent immunohistochemical and flow cytometric analyses for vascular density and retained M2 numbers, respectively. M2 culture supernatants were added to stromal vascular fractions (SVF) containing adipose-derived stem cells (ASC) to assess their ability to induce adipogenic gene expression.

**RESULTS:** One month following graft injection, no significant difference was noted between M2-supplemented (105±7.0 $mm^3$) and control graft volumes (72±22 $mm^3$). By three months post-injection, M2-supplemented grafts remained stable while controls experienced further volume loss (103±8 $mm^3$ vs. 39.4±15 $mm^3$; P=0.015). Presence of M2 macrophages in the supplemented grafts was confirmed by flow cytometry. M2-supplemented grafts demonstrated a 157% increase in vascular density compared to controls (P<0.05). Induction of adipogenic C/EBPα gene expression was observed when M2 supernatants were added to SVF containing ASC.

**CONCLUSION:** M2 macrophages improve autologous fat graft volume retention by stimulating angiogenesis. These findings provide proof-of-principle for the development of fat grafting techniques that harness reparative properties of M2 macrophages.

**Learning Objectives:**

- *Participants will be able to describe the current uses of fat grafts and the major setbacks.*
- *Participants will be able to describe what alternatively activated macrophages are and how to generate them.*
- *Participants will be able to describe how macrophages improve autologous fat grafting by improving angiogenesis.*

## 11

## EFFECTS OF NITROGLYCERIN OINTMENT ON MASTECTOMY FLAP NECROSIS IN IMMEDIATE BREAST RECONSTRUCTION: A RANDOMIZED CONTROLLED-TRIAL

**P Gdalevitch, N Van Laeken, J Bahng, E Bovill, P Lennox, S Macadam**
**Vancouver, BC**

**PURPOSE:** To evaluate if the post-operative application of nitroglycerin ointment (NTG) decreases the rate of mastectomy flap necrosis (MFN) in patients undergoing skin-sparing (SSM) or nipple-sparing mastectomy (NSM) and immediate breast reconstruction compared to patients receiving placebo.

**METHODS:** This is a prospective randomized double blind controlled trial which included patients aged 21 to 69 years undergoing SSM or NSM and immediate breast reconstruction at the University of British Columbia and affiliated hospitals. Patients with a medical history that precluded the administration of NTG were excluded. NTG ointment (2% at a dose of 45mg) was applied to the mastectomy skin at the time of the surgical dressing. The primary outcome was mastectomy flap necrosis documented as full or superficial thickness.

**RESULTS:** One hundred and fifty four patients have been recruited to the study with an equal distribution of patients randomized to the treatment (n=77) and placebo groups (n=77). Interim analysis shows the overall MFN rate in this study to be 26.6% (41/154). MFN in patients receiving NTG ointment (13/77) was significantly lower than in the placebo group (16.9% vs. 36.4%; P<0.006). The severity of MFN was also significantly less in patients receiving NTG ointment. Full thickness MFN in the NTG group was 7.8% compared to 27.3% of placebo patients (P<0.006).

**CONCLUSION:** In patients undergoing SSM/NSM and immediate breast reconstruction there is a significantly lower rate of MFN in patients who received NTG ointment compared to those who received placebo. Use of NTG ointment is a simple, safe and effective way to help prevent MFN.

**Learning Objectives:**

- *The learner will be able to define mastectomy flap necrosis and its risk factors.*
- *The learner will understand the mechanism of action of nitroglycerin ointment.*
- *The learner will be able to identify a possible preventative treatment for mastectomy flap necrosis.*

## 12

## THREE-DIMENSIONAL ANATOMICAL STUDY OF VASCULAR SUPPLY TO POSTERIOR INTEROSSEOUS ARTERY PERFORATOR FLAP

**J Cox, A Maciel-Miranda, A Alkhawaji, S Morris**
**Halifax, NS**

**PURPOSE:** The posterior interosseous artery perforator (PIOAP) flap is a versatile flap that can provide thin, pliable skin for reconstruction of defects on the surfaces of the hand. The reported complication rate using this flap is from 13-36%. The purpose of this study is to clarify the three-dimensional vascular anatomy of the PIOAP flap septocutaneous perforators including calibre, location, length and course relative to surrounding anatomy.

**METHOD:** Whole body lead-oxide/gelatin injection protocol followed by computed tomography angiography and analysis of imaging in Materialise's Interactive Medical Imaging Control System (MIMICS) was carried out on two fresh cadavers. Correlation was made with physical dissection. Secondary analysis of archived data rendered specimen extremities n=8. Descriptive statistics were calculated. Cluster analysis in SPSS assessed conservation of vascular anatomy. Hand held doppler assessed clinical correlation in n=12 in vivo participant extremities.

**RESULTS:** Analysis in MIMICS revealed mean perforators per specimen 4±1, mean calibre 2±1 mm, and mean length 24±14 mm coursing through the septum between extensor carpi ulnaris and extensor digiti minimi. A single cluster of perforators was conserved across specimens at X: 38±7.0% distance; Y: −15±11% distance. Hand held doppler validated the digital analysis with clinical correlation in one hundred percent of the in vivo participant extremities.

**CONCLUSIONS:** The vascular anatomy of the PIOAP flap can be effectively reconstructed using three-dimensional technology and was documented using MIMICS. The calibre, location, course and length of the septocutaneous perforators of the flap were described. Perforating arterial anatomy is conserved in a single location and was validated clinically.

**Learning Objectives:**

- *Participants will be able to describe the vascular anatomy conserved in the forearm relevant to the PIOAP flap.*

## 13

## REDUCING SEROMA IN AESTHETIC ABDOMINOPLASTY: ARE QUILTING OR PROGRESSIVE TENSION SUTURES EFFECTIVE? A SYSTEMATIC REVIEW OF THE LITERATURE

**I Maxwell, S Smith, J Klok, H Silverman**
**Ottawa, ON**

**PURPOSE:** Seroma is a common complication of aesthetic abdominoplasty. Numerous modifications to the procedure including tissue adhesives, limited flap undermining, and dead space elimination by way of securing the abdominoplasty flap to the rectus fascia with progressive tension sutures (PTS) or quilting sutures (QS) have been attempted to reduce its incidence. This systematic review summarizes the evidence in the plastic surgery literature regarding placement of PTS or QS to prevent seroma formation.

**METHOD:** A computerized search of the literature was performed via EMBASE, Medline and the Cochrane Central Register of Controlled Trials databases. A meta-analysis of the comparative studies was performed using a fixed effect model to report a pooled effect estimate from weighted odds ratio calculations. Heterogeneity among studies was quantified using the $I^2$ method. Numerous case series using PTS or QS were also evaluated.

**RESULTS:** The initial search yielded 394 papers. Of these, 18 papers met the inclusion criteria for a total of 2764 abdominoplasties. Cases performed with QS/PTS and drains had a lower rate of seroma than those with drains and no QS/PTS (OR 0.25; 95% CI 0.15, 0.41). Those with QS/PTS and no drains had less seromas than those with drains and no QS/PTS (OR 0.20; 95% CI 0.07, 0.59). Cases with QS/PTS had no difference in rates of seroma whether drains were present or not. (OR 0.88; CI 0.29, 2.72). When all 2764 cases were divided by QS/PTS present (1870) vs. not present (894) the seroma rates were 3.96% vs 20.0% respectively (P>0.0002).
**CONCLUSIONS:** From the results of this systematic review, it would appear that sutures anchoring the abdominoplasty flap to the rectus fascia have a role in reducing the incidence of seroma in aesthetic abdominoplasty. Drains did not significantly diminish seroma incidence when QS/PTS were present.
**Learning Objectives:**

- *The participant will learn the various methods described in our literature to reduce seroma rates in cosmetic abdominoplasty.*
- *The participant will become familiar with the techniques of placing quilting or progressive tension sutures to anchor the abdominoplasty flap to the rectus fascia.*
- *The participant will appreciate the evidence in our literature for the placement of quilting or progressive tension sutures for the prevention of seroma in cosmetic abdominoplasty.*

## 14
## THE ROLE OF INTRAVELAR VELOPLASTY IN THE VON LANGENBECK PALATOPLASTY

**D Sainsbury, E Henklemann, T Dunn, S Fischbach, P Kaiman, D Fisher**
**Toronto, ON**

**PURPOSE:** To compare operative details, rates of complications and velopharyngeal insufficiency, in patients undergoing repair of clefts of the secondary palate using either a Von Langenbeck technique alone or a Von Langenbeck technique combined with an intravelar veloplasty.
**METHODS:** Retrospective review of medical records and speech and language pathology charts in consecutive patients undergoing repair of clefts of the secondary palate from 2001-2007 at The Hospital for Sick Children, Toronto by two surgeons (surgeon one: von Langenbeck technique alone; surgeon two: von Langenbeck technique with an intravelar veloplasty). Demographic details, operative duration, length of hospital admission and any complications were recorded. Speech outcomes were determined at a 5-year review.
**RESULTS:** Fifty-eight patients underwent von Langenbeck repair alone (surgeon one) and 102 patients underwent von Langenbeck repair with an intravelar veloplasty (surgeon two). There was no difference between the groups in age, gender, syndromal presence, cleft type, weight or ASA grade. Furthermore, there was no significant difference in operative time and post-operative length of stay. Complication rates were minimal and not significantly different between both groups. Each group had one fistula. Hypernasality rates were not statistically different between the two groups. 22.4% patients in the von Langenbeck alone group underwent secondary speech surgery compared to 10.8% in the von Langenbeck and intravelar veloplasty group (P=0.02).
**CONCLUSIONS:** In this study the von Langenbeck palatoplasty when combined with an intravelar veloplasty did not increase operative duration, length of stay, bleeding or fistula rates. There was no difference in hypernasality between those undergoing palatoplasty with and without an intravelar veloplasty. However, those who had an intravelar veloplasty had lower rates of secondary speech surgery.
**Learning Objectives:**

- *Participants will learn about the outcomes following repair of clefts of the secondary palate using a von Langenbeck technique alone or in combination with an intravelar veloplasty.*

## 15
## MANAGEMENT OF SELF-INFLICTED GUNSHOT WOUNDS TO THE FACE: BACK TO BASICS

**D Jewer**
**St John's, NL**

**PURPOSE:** To illustrate the predictable patterns of injury that result from non-fatal gunshot wounds to the face and describe an approach for their successful reconstruction.
**METHOD:** Four cases are selected that illustrate the varied but predictable patterns of tissue loss that results from these injuries. The early management and reconstructive measures that were undertaken are reviewed as well as the complications. A treatment plan is based on these observations.
**RESULTS:** All patients were successfully reconstructed and function in society. In all cases reconstruction was aided by three-dimensional imaging. All cases underwent tracheostomy, initial conservative debridement, bone stabilization and soft tissue repositioning followed by serial debridement and soft tissue closure. The number and type of reconstructive procedures is dictated by the extent and pattern of injury which is determined by wounding ballistics, entry point and trajectory of the projectile. All patients experienced complications.
**CONCLUSIONS:** Non-fatal self-inflicted gunshot wounds to the face result in predictable patterns of injury. An understanding of the mechanism of injury and application of sound plastic surgery principals can result in satisfactory reconstruction. Tracheostomy and multiple conservative debridements combined with immediate bone stabilization and early soft tissue closure are essential to prevent contracture which must be avoided. Tissue that remains should be repositioned and not used to cover areas of deficit. Deficiencies should be replaced with additional tissue. Adequate time for scar resolution is required between reconstructive procedures. Complications are frequent and varied but easily dealt with.
**Learning Objectives:**

- *The audience will be able to recognize the patterns of injury, and understand the mechanism of injury and how it relates to wound ballistics.*
- *The audience will understand the initial management and investigations necessary to stabilize the patients and prepare them for successful reconstruction.*
- *The audience will learn the principals necessary for successful reconstruction.*

## 16
## THE FRACTURE BIOMODEL: A NOVEL TECHNIQUE FOR TEACHING FACIAL FRACTURE REPAIR

**N DSouza, J Mainprize, G Edwards, O Antonyshyn**
**Toronto, ON**

**PURPOSE:** 1) Introduce the 'fracture biomodel' surgical teaching aid: a three-dimensional (3D), solid facial fracture simulation 2) Evaluate biomodel's effectiveness in teaching the necessary skills for facial fracture repair
**METHODS:** Using CT data from an actual patient with panfacial fractures, computer modeling and rapid prototyping were employed to generate an accurate 3D fracture model, complete with articulated temporomandibular joints, and a "soft" tissue silicon core. Senior plastic surgery residents (R3, R4, R5) across Canada were invited to participate in this workshop. A presentation detailing the clinical and radiological findings in a specific fracture patient were provided prior to the exercise. The biomodels were then unveiled, and residents were given 2.5 hours to formulate and apply a fracture repair sequence to complete the reconstruction. A quiz was administered prior to and following the practical skills. Results were then compared to objectively evaluate the biomodel as a teaching tool. Subjective evaluation was further assessed by post-exercise questionnaire.
**RESULTS:** A total of 29 residents [(R3 (15), R4 (11), R5 (3)] were enrolled in the study. Statistically significant improvements were found in: the ability to diagnose fracture patterns ($t = 8.2\times10^{-7}$); choosing exposure method ($t = 0.04$); correctly identifying repair sequence ($t=0.019$). While changes existed in comfort level with treating pan-facial fracture before and after the workshop across all levels of residency training, a statistically significant difference was observed in R3 trainees only. Subjectively, 21/29 residents found the skull biomodel to be an extremely effective teaching module.
**CONCLUSIONS:** The fracture biomodel provides effective panfacial fracture simulation and serves as an effective teaching tool. This approach significantly improved pattern-recognition type fracture repair, but did not improve binary type decision-making.

**Learning Objectives:**
- *Familiar with biomodels for surgical simulation*
- *Aware of potential applications of biomodels for surgical education*

## 16A
## TRANSPAROTID APPROACH FOR EXPOSURE OF THE CONDYLAR NECK AND VERTICAL RAMUS OF THE MANDIBLE

**O Antonyshyn, K Higgins, D Enepekides**
**Toronto, ON**

Wide exposure of the entire vertical ramus of the mandible as well as the TMJ is occasionally required in very complex mandibular reconstructions. A transparotid approach with partial parotidectomy allows isolation of the facial nerve, while providing unprecedented access. Clinical application in trauma and secondary reconstruction will be demonstrated.

## 16B
## TRANSECTION OF INFERIOR FISSURE CONTENTS FOR DEEP ORBITAL ACCESS

**J Fialkov**
**Toronto, ON**

Access to the posterior orbital floor can be technically challenging. Transection of the Inferior orbital fissure contents to facilitate access to the posterior shelf, while having been suggested has not been technically described previously. This presentation aims to describe the technique and illustrate its advantages using intra-operative photographs.

## 17
## THE EFFECTS OF SECONDARY CLEFT PROCEDURES ON ALAR BASE POSITION AND NOSTRIL MORPHOLOGY IN PATIENTS WITH UNILATERAL CLEFTS

**D Matic, S Power**
**London, ON**

**PURPOSE:** The purpose of this study is to compare the effects of secondary cleft procedures on alar base position and nostril morphology.

**METHODS:** A retrospective review identified consecutive patients with unilateral clefts. Patients were grouped according to procedure: alveolar bone graft vs. total lip takedown with anatomic muscle repair vs. single-stage total lip with cleft septorhinoplasty vs. Rhinoplasty alone. Standardized pre- and post-operative photographs were obtained. Anthropometric measurements of nostril dimensions and alar base position were recorded. Ratios of cleft to non-cleft side pre- and post-operatively were compared within and across groups. Repeat measurements were recorded to calculate intra-rater reliability.

**RESULTS:** Seventy patients were included. Within the alveolar bone graft group (n=14), no differences were seen post-operatively in alar base position (P=0.933) at 33.5 months mean follow-up. Following total lip takedown and repair (n=19), greater symmetry at the alar base (P<0.001), increased vertical lip dimension (sbal-cphi, P<0.001) and decreased nostril height (P=0.004) at 23.6 months was found. Within the group undergoing lip repair and cleft septorhinoplasty (n=22), increased vertical dimension and alar base elevation (P<0.001) were also seen at 17.7 months. No difference in alar base position was seen at 21.3 months following rhinoplasty alone (n=15). Across groups, differences in alar base position were seen on cleft to non-cleft sides (P<0.05). The single-stage nose-lip group demonstrated greatest alar base symmetry (P<0.04).

**CONCLUSIONS:** Alar base asymmetry in patients with unilateral clefts may be related to soft tissue deficiency and was not affected long term by alveolar bone grafting. Greatest symmetry at the alar base was seen following single-stage nose-lip reconstruction. This may be an effective technique for correction of the cleft lip nasal deformity.

**Learning Objectives:**
- *To understand long-term effects and variables involved in achieving alar base and nasal symmetry in patients with unilateral clefts.*

## 18
## ACCURACY OF CRANIOFACIAL MODELS PRODUCED BY CONSUMER FUSED DEPOSITIONAL MODELLING PRINTERS

**C Petropolis, D Koza, L Sigurdson**
**Winnipeg, MB**

**PURPOSE:** Consumer-grade 3D printers have become widely available with the development of low-cost fused deposition modeling (FDM) technology. Craniofacial skeleton models can be produced using this technology, with potential applications in craniofacial surgery. However, a high level of printer accuracy is required for clinical use. Our purpose is to determine the accuracy of consumer grade FDM printers in the production of craniofacial models.

**METHOD:** Computed-tomography (CT) images of a dry skull were manipulated with the Osirix and ZBrush software to create 3D mid-face and mandible models. Models were fabricated using a consumer FDM printer at 100 µm, 250 µm and 500 µm resolution. Control models were produced using an industrial selective laser sintering (SLS) printer. Seven sets of linear measurements were made on the models and compared with the corresponding dry skull measurements using an electronic caliper.

**RESULTS:** Dimensional error of 0.30% was observed for the SLS models and 0.44%, 0.52%, and 1.1% for the 100, 250 and 500 µm FDM models, respectively.

**CONCLUSION:** Consumer FDM printers can produce medical models with sufficient dimensional accuracy for use in craniofacial surgery. With this technology, low-cost production of craniofacial models can be done in an office setting by individual surgeons.

**Learning Objectives:**
- *At the end of this lecture participants will be able to describe the basic steps in production of medical models from CT data. Participants will also gain an understanding of the various applications of medical models in craniofacial surgery.*

## 19
## A TECHNIQUE FOR INTRA-OPERATIVE CREATION OF PATIENT-SPECIFIC TITANIUM MESH IMPLANTS

**I Sunderland, G Edwards, J Mainprize, O Antonyshyn**
**Toronto, ON**

**PURPOSE:** To describe a novel technique of patient-specific, alloplastic cranioplasty that allows the surgeon to modify a custom implant intra-operatively to accommodate virtually any encountered change in defect size or location.

**METHOD:** Eight patients underwent patient-specific titanium mesh cranioplasty. Cranioplasty was required for defects resulting from tumor extirpation in 6 patients and complicated frontal sinus mucoceles requiring craniectomy in 2 patients. In all cases, the ultimate size of the cranial defect was unknown pre-operatively. Our technique of custom cranioplasty involved creation of a rapid prototype mold set, with contours extending well beyond the expected defect margins, accommodating for the fact that exact defect sizes were unknown. At the time of surgery the molds/custom pressing tool were used to create a patient-specific implant of 0.6 mm titanium mesh that exactly restored normal skull contour. If needed, trimming of the mesh was performed, which could be done while maintaining perfect calvarial geometry.

**RESULTS:** The described technique of patient-specific titanium mesh cranioplasty was successfully applied in all 8 patients. Excellent restoration of bony contour was achieved and there were no surgical complications. Two case examples demonstrate the technique and its clinical application.

**CONCLUSIONS:** Current prefabricated implants are designed well in advance of surgery to fit a specific defect, and are therefore limited to patients with fixed skull defects whose size and geometry are known pre-operatively. Any intra-operative modification of the size, shape or bony margin of the defect renders the implant virtually useless. In this study we describe a method of patient-specific titanium mesh cranioplasty with the unique capacity for intra-operative modification, thereby making custom cranioplasty suitable for any patient.

**Learning Objectives:**
- *To describe a novel technique of custom cranioplasty that allows for creation of a patient-specific titanium mesh implant with the capacity for intraoperative modification.*

# A.W. FARMER LECTURE

## 19A
## HEALTH CARE IN CANADA: PUBLIC, PRIVATE, PUBLIC/PRIVATE, PRIVATE/PUBLIC, OR ALL OF THE ABOVE?

**Jeffrey Simpson**
**Globe and Mail**

Given the financial strains on the Canadian health-care system and the aging of the population, what is the likely future mix of public and private delivery and financing for Canadian health-care? Are we heading towards a parallel private system, or do we have one already, and what would be the consequences for the existing public system if private delivery and financing expanded.

# EYE-OPENER SESSION

## 19B
## UPDATE ON THERAPY OF DUPUYTREN'S DISEASE

**Steven McCabe**
**Toronto, ON**

## 20
## THE DIEP FLAP IN BREAST RECONSTRUCTION: A MORBIDITY STUDY OF BILATERAL VERSUS UNILATERAL RECONSTRUCTION

**E Boghossian, A Govshievich, M Karunanayake, N Nizard, A Danino**
**Montréal, QC**

**PURPOSE:** The DIEP flap is a popular modality in breast reconstruction. Despite its well-documented complications and benefits, a lack of evidence remains with regards to the risks of performing a bilateral versus a unilateral reconstruction. A recent meta-analysis based solely on case-series advocated a significantly higher risk of total flap failure for bilateral DIEP reconstructions. As such, we sought to directly compare the rates of acute perioperative complications in bilateral versus unilateral reconstructions in our patient population.

**METHOD:** We conducted a retrospective study of a prospectively kept database on patients undergoing unilateral vs. bilateral DIEP flap breast reconstruction at a tertiary care center in Montreal (QC), from May 2010 to November 2013. The demographics, operative time, length of hospitalization, perioperative complications and surgical re-exploration were extracted for both groups. Statistical analysis was performed with a P value <0.05 considered as statistical significance.

**RESULTS:** We identified 157 unilateral (n=157 patients) and 42 bilateral DIEP flaps (n=21 patients). Total major complications were 15.9% for unilateral vs. 14.3% for bilateral flaps (P=0.79), with surgical re-exploration accounting for 12.7% of complications in unilateral cases vs. 11.9% in bilateral cases (P=0.88). Total flap loss was similar between types of reconstruction (2.5% unilateral vs. 2.4% bilateral, P value =1). The average length of hospitalization was 5.7 days for unilateral and 6 days for bilateral reconstructions (P=0.45).

**CONCLUSIONS:** Despite the significant increase in risk expected in performing bilateral vs. unilateral DIEP, the results demonstrate that in the hands of experienced plastic surgeons, the rate of complication per flap remains similar and patients remain hospitalized for a similar period of time. This study supports a comparable risk of total flap failure for bilateral compared with unilateral DIEP breast reconstruction.

**Learning Objectives:**

- *Participants will be able to identify the risk of adverse outcomes in bilateral compared to unilateral DIEP breast reconstruction.*

## 21
## ABDOMINAL BASED PERFORATOR FLAP HARVEST WITH PRIOR ABDOMINAL SCARS. SUBSET ANALYSIS OF A PROSPECTIVE RANDOMIZED TRIAL EVALUATING DIEP VS SIEA AUTOLOGOUS FREE BREAST RECONSTRUCTION

**W Jalil, K Dalke, L Sigurdson, T Hayakawa, E Buchel**
**Winnipeg, MB**

**PURPOSE:** Abdominal perforator free breast reconstruction is commonly performed. Frequently the abdominal wall donor is excluded when prior scars exist. Varying retrospective reviews have led to opinions ranging from exclusion to cautious of scarred abdomens as donor sites. This study analyzes the scarred abdomen subset of the patients enrolled in our prospective randomized abdominal based perforator flap breast reconstruction study.

**METHODS:** This study is a subset analysis of all patients with abdominal scars within an ethic board approved, prospective randomized controlled study evaluating the DIEP vs SIEA flap for breast reconstruction. All laparoscopic scars were excluded.

**RESULTS:** Sixty-two patients having 96 flaps (28 unilateral and 34 bilateral) completed a prospective randomized controlled study designed to compare the DIEP flap versus the SIEA flap in breast reconstruction. Thirty-two patients (51%) and 51 flaps (53%) were directly affected by prior scars from open abdominal surgical procedures. Perforator flaps were transferred successfully in 100 % with only two acute returns to the operating room. In the SIEA group, 9 of 21 flaps had the pedicle transected resulting in a conversion to the DIEP group. None of the DIEP group were converted to SIEA flaps. Donor site wound healing complications in patients with and without scars were evaluated. Scars recorded included (n=47), 8 midline, 3 paramedian, 6 appendectomy scars, 21 Pfannenstiel, 4 periumbilical, 3 transverse, 1 nephrectomy, 1 paraumbilical scar.

**CONCLUSIONS:** Abdominal based perforator flap breast reconstruction is the standard of care for autologous breast reconstruction. Abdominal scars have typically excluded the use of this tissue for fear the perforators will have been damaged. This study supports the idea that perforators remain on the scarred abdomen allowing safe transfer of enough abdominal tissue for breast reconstruction.

**Learning Objectives:**

- *Scars and their effect on Free Flap Vasculature*

## 22
## PRECONSULTATION EDUCATIONAL GROUP INTERVENTION TO IMPROVE SHARED DECISION-MAKING FOR POST MASTECTOMY BREAST RECONSTRUCTION: A PILOT RANDOMIZED CONTROLLED TRIAL

**J Platt, N Causarano, N Baxter, S Hofer, A O'Neill, T Zhong**
**Toronto, ON**

**PURPOSE:** Breast cancer survivors who make preference-sensitive decisions about post mastectomy breast reconstruction can have gaps in knowledge and undergo procedures that are inconsistent with their treatment goals. We evaluated the feasibility and effect of a pre-consultation educational group intervention on the decision-making process for breast reconstruction.

**METHODOLOGY:** We conducted a pilot randomized controlled trial (RCT) with a 1:1 allocation where participants were randomly assigned to receive the intervention with routine education or routine education alone. The outcomes evaluated were decisional conflict, decision self-efficacy, satisfaction with information, perceived involvement in care (PICS) following the initial surgical consultation, and uptake of reconstruction. Trial feasibility and acceptability were evaluated, and effect sizes were calculated to determine the primary outcome for the full scale RCT.

**RESULTS:** Of the 41 patients enrolled, recruitment rate was 72%, treatment fidelity was 98%, and 98% completed the outcomes. The Cohen's d effect size in reduction of decisional conflict was moderate to high for the intervention group compared to routine education (0.69, 95% CI=0.02–1.42), while the effect sizes of increase in decision self-efficacy (0.05, 95% CI: −0.6-0.71) and satisfaction with information (0.11, 95% CI =−0.53–0.76) were small. The routine education group reported higher PICS on both the patient information subscale (0.91, 95% CI =0.17–1.72) and patient decision-making subscale (0.42, 95% CI= −0.23–1.12) compared

to the intervention group. A higher proportion of patients receiving routine education signed informed consent to undergo breast reconstruction (14/20 [70%]) compared to the intervention group (8/21 [38%]) P=0.06.
**CONCLUSIONS:** A full-scale definitive RCT is warranted based on high feasibility outcomes and the primary outcome for the main trial will be the change in decisional conflict.
**Learning Objectives:**
- *Participants will understand the purpose and importance of undertaking a pilot feasibility trial prior to undertaking a full RCT.*

## 23
## NEED FOR IMPROVEMENT: EXAMINING THE RATE OF IMMEDIATE BREAST RECONSTRUCTION FOLLOWING PROPHYLACTIC MASTECTOMY IN ALBERTA

**A Astanehe, C Temple-Oberle**
**Calgary, AB**

**PURPOSE:** BRCA mutation carriers undergoing prophylactic mastectomy (PM) in Canada have lower reconstruction rate (69%) compared to women from USA (72%), Norway (80%), Italy (83%) and France (86%). The aim of this study was to assess trends in the uptake of immediate breast reconstruction (IBR) in Alberta following PM.
**METHOD:** A web-based surgical medical record was started in Alberta in 2006. A database generated from the synoptic surgical reports from 2006 to 2013 was used to retrospectively evaluate patients who underwent PM and elected for IBR versus no reconstruction. Indications for PM included: history of contralateral breast cancer, family history of breast cancer, or BRCA mutation. The cohort of patients was arbitrarily divided into two groups: 2006-2009 and 2010-2013. Frequencies of categorical variables were compared using the Chi square test.
**RESULTS:** Between 2006 and 2013, 305 patients underwent PM in Alberta, and 180 (59%) elected for IBR. Utilization of IBR in Alberta post PM was stable, with 62% in 2006-2009 and 57% in 2010-2013 (P=0.46). However, following PM the rate of immediate implant reconstruction, compared to autologous reconstruction, increased from 46% in 2006-2009 to 70% in 2010-2013 (P=0.002). Further, use of IBR after PM was lower in women with history of contralateral breast cancer (50%) compared to those with a genetic risk factor (77%) (P<0.001).
**CONCLUSIONS:** Utilization of IBR following PM in Alberta has been stable at 59% for the past 8 years. This is lower than the national reconstruction rate of 67% after PM. These findings suggest the need to improve provincial guidelines in Alberta and bridge the gap for women undergoing PM.
**Learning Objective:**
- *Participants will gain an understanding of the trends in IBR following PM in Alberta.*

## 24
## FROM THE PATIENT PERSPECTIVE: WHAT WOMEN REALLY WANT TO KNOW ABOUT BREAST RECONSTRUCTION

**V Sharma, C Webb, C Temple-Oberle**
**Calgary, AB**

**PURPOSE:** To discover missed opportunities for providing information to women undergoing breast reconstruction in an effort to decrease regret and improve patient education, teaching modalities, and satisfaction.
**METHOD:** 30-45 minute face-to-face semi-structured interviews were conducted exploring patient experiences with information provision on breast reconstruction. Purposeful sampling was used to include women with a variety of reconstruction types at different time points along their recovery. Interviews were audio-recorded and transcribed. Using grounded theory methodology, two independent reviewers analyzed the transcripts and generated thematic codes based on patient responses. Interviewing ceased once thematic saturation was reached. BREAST-Q scores were also collected.
**RESULTS:** Eleven patient interviews were conducted to achieve thematic saturation. Mean interviewee age was 55, with 3 in-situ and 8 invasive breast cancer diagnoses. Reconstructions included expander/implant (4), direct-to-implant (5), latissimus (1) and abdominal (1) flaps. Interviews occurred between 2-36 weeks post-operatively, at a median of 14 weeks. BREAST-Q informational satisfaction scores ranged between 69-85 (median score: 77). Information delivery via interaction with medical personnel and previously reconstructed patients was most appreciated. Major themes formed 12 general categories. Patients were interested in knowing more information about the reconstruction including the pros and cons of different options, immediate breast reconstruction, secondary procedures (balancing, nipple reconstruction), and the post-operative recovery. More information was desired about oncological safety/monitoring, the impact of chemoradiotherapy, and nipple-sparing mastectomies. Patients valued multiple information resources, seeing numerous photographs, finding reliable information online, identifying frequently asked questions, and managing intimacy issues.
**CONCLUSIONS:** Women having recently undergone breast reconstruction reported key deficiencies in information provided prior to surgery. Addressing what women really want to know about breast reconstruction is important for patient education endeavours, and may be studied in the future for its impact on satisfaction.
**Learning Objective:**
- *To understand what patients would like to know about breast reconstruction before undergoing surgery.*

## 25
## POSTOPERATIVE EXPANSION TIMING IN 2-STAGED IMPLANT-BASED BREAST RECONSTRUCTION AND THE PERIPROSTHETIC CAPSULE: CLINICAL AND ULTRASTRUCTURAL EFFECTS

**LS Paek, JP Giot, JO Tétreault-Paquin, S St-Jacques, M Nelea, MA Danino**
**Montréal, QC**

**PURPOSE:** In the first stage of expander-implant breast reconstruction, postoperative expansion is classically initiated at 10 to 14 days (conventional approach). The authors hypothesized that it may be beneficial to wait 6 weeks postoperatively prior to initiating serial expansion (delayed approach). Clinical and ultrastructural periprosthetic capsule analysis is first required before determining whether a delayed approach ultimately improves capsular tissue adherence and expansion process predictability.
**METHOD:** Patients undergoing 2-staged implant-based breast reconstruction were prospectively enrolled in this study. During expander to implant exchange, clinical presence of Velcro effect, biofilm and double capsule was noted. Periprosthetic capsule samples were also sent for scanning electron microscopy (SEM) observation of 3 parameters: surface relief, cellularity and biofilm. Samples were divided into 4 groups for data analysis (G1: conventional/BIOCELL®, G2: delayed/BIOCELL®, G3: conventional/SILTEX®, G4: delayed/SILTEX®).
**RESULTS:** Fifty-six breast reconstructions were included. Each group comprised between 13 and 15 breasts. In G1, no cases exhibited the Velcro effect and there was a 53.8% incidence of both biofilm and double capsule. In G2, all cases demonstrated the Velcro effect and there were no incidences of biofilm or double capsule. G3 and G4 cases did not exhibit a Velcro effect or double capsule formation; however, biofilm was present in up to 20.0%. All G2 samples revealed more pronounced 3-dimensional relief on SEM.
**CONCLUSIONS:** Variations in expansion protocols can lead to observable modifications in periprosthetic capsular architecture. There may be real benefits to delaying expander inflation until 6 weeks postoperatively with BIOCELL® expanders.
**Learning Objectives:**
- *Participants will be able to describe the key clinical and ultrastructural features of periprosthetic breast capsules.*
- *Participants will be able to appreciate the effects that differing postoperative expansion approaches may have on periprosthetic capsule development.*
- *Participants will be able to consider the clinical applicability of different tailored postoperative expansion approaches.*

## 26
## THE MONOCLONAL ANTIBODY HERCEPTIN IMPROVES REGENERATION AFTER INJURED NERVES ARE REPAIRED IMMEDIATELY OR AFTER A PERIOD OF CHRONIC DENERVATION

**M Hendry, E Placheta, T Gordon, G Borschel**
**Toronto, ON**

**PURPOSE:** Chronic denervation profoundly inhibits functional recovery following nerve injuries. Surgical strategies that employ side-to-side nerve

'bridges' may protect against chronic denervation through the activity of the potent Schwann cell mitogen Neuregulin-1, but this remains controversial. In this study we selectively inhibit the receptor for neuregulin, ErbB2, with the high affinity monoclonal antibody Herceptin to examine its effect on nerve regeneration in a rat model.

**METHODS:** The common peroneal nerves of Sprague-Dawley rats were surgically transected and repaired. Nerve repair was performed immediately or after 3-months of chronic denervation. Nerve regeneration was permitted for 1, 2 or 4 weeks following injury. Regenerated motoneurons were retrogradely labeled distal to the repair site with fluorescent dye and counted in the ventral spinal cord. Histomorphometry uantified myelinated fiber number and structural dimensions in the regenerated nerve. ErbB2 receptor activation and cellular proliferation were examined.

**RESULTS:** Significantly greater numbers of motoneurons regenerated in rats treated with Herceptin (169±31) compared with rats receiving saline (62±15) when assessed 1 week following immediate repair ($P<0.05$). Total myelinated fiber counts were significantly increased in rats receiving Herceptin (2488±154) compared to rats that received saline (1896 251) ($P<0.05$). Following chronic denervation, significantly more motoneurons regenerated in rats that received Herceptin (282±31) compared to saline controls (210±24) at 2 weeks post-repair. Interestingly, Western blot analysis revealed no change in ErbB2 activation despite evidence of increased Schwann cell proliferation.

**CONCLUSIONS:** Manipulating the ErbB2 receptor with Herceptin enhances nerve regeneration following acute and delayed nerve repair. This raises the exciting possibility of using targeted molecular therapy to improve outcomes following surgical repair of nerve injuries.

**Learning Objectives:**

- *Listeners should be able to describe the role of Neuregulin-1 and ErbB2 receptor signaling in nerve regeneration.*

## 27

## VALIDATED MICROSURGICAL ASSESSMENT INSTRUMENTS: A SYSTEMATIC REVIEW

**D Dumestre, C Temple-Oberle, J Yeung**
**Calgary AB**

**PURPOSE:** To systematically review literature pertaining to microsurgical skill assessment tools to determine those specific to, and validated for, microsurgery training.

**METHOD:** Multiple databases were searched with preset terms. Search dates included all years up to December 2013. Eligibility criteria included the presence of statistical comparison with a control group and the presence of a measure of validation. Two assessors independently reviewed the articles and their references. Each assessment tool was evaluated for content, construct, face, and criterion validity, as well observation/expectant bias and inter-rater/intra-rater reliability. For individual studies, we screened for expectant and selection bias.

**RESULTS:** Of the 238 articles reviewed, 11 articles were included. Those excluded were predominantly assessment tools that did not evaluate microsurgical skill or papers where no assessment tool was described. The assessment tools identified in this review include a self-assessment tool where trainees rate their skill confidence from one to five, stereoscopic visual acuity as a predictor for microsurgical performance, an objective motion-tracking electronic device – the Imperial College of Surgical Assessment Device (ICSAD), a video-modified Objective Structured Assessment of Technical Skill (OSATS) for microsurgical suturing, the University of Western Ontario Microsurgical Skills Acquisition/Assessment Instrument (UWOMSA) for knot-tying and vessel anastomosis, and the Structured Assessment of Microsurgery Skills (SAMS) tool, to assess skill and errors in a real clinical environment. Content, construct and face validity were consistently demonstrated, as well as observation/expectant bias and inter-rater reliability. Criterion validity was only demonstrated for half of the instruments and intra-rater reliability for only one.

**CONCLUSIONS:** Eleven articles described validated methods. Three GRS scales (UWOMSA, SAMS, and the video-based OSATS) demonstrated reliability and validity. Motion-analysis using the ICSAD is a valid objective measure of skill.

**Learning Objective:**

- *To understand currently available validated microsurgical skill assessment tools*

## 28

## AVOIDING SKIN GRAFTS: THE KEYSTONE FLAP IN MELANOMA DEFECTS

**J Stone, G McKinnon, C Webb, C Temple-Oberle**
**Calgary, AB**

**PURPOSE:** Traditionally, skin grafts were the forefront for oncological reconstruction, especially in areas with limited tissue laxity. The purpose of the study is to examine the Keystone Flap as an alternative treatment.

**METHODS:** Consecutive patients that would classically receive skin grafting were treated with the Keystone Flap. Patient demographics, post-operative restrictions, and complications are reported. With increasing familiarity executing the flap, the design was modified to keep the incisions smaller.

**RESULTS:** A database identified 32 flaps in 30 patients since 2012. The average patient age was 64.7±15.6 years (range 17 to 89). Flaps included Type I (standard flap design and closure), Type IIA (division of deep fascia), and Type IIB (addition of split thickness skin graft when excessive tension exists). The Keystone Flap was commonly used for melanoma reconstruction (72.4%). Defect size ranged from 1.2×1.2cm on a digit to 9×25cm on a chest. There were no major complications (flap survival 100%). Minor flap complications included dehiscence in 2 (6.5%), minor edge breakdown in 3 (9.6%) and cellulitis in 1 (3.2%). No patients required secondary procedures. Minimal post-operative mobility restrictions ensued. Modifications include a trailing skin bridge whilst incising fascia in a tunneling fashion.

**CONCLUSION:** The Keystone Flap avoided skin grafting in 29 in 30 patients. Most patients treated with the Keystone Flap have no post-operative activity restrictions. There were no major complications (flap failure, reoperation) and few minor complications. The Keystone Flap is reliable, easy for patients to recover from, and eliminates donor site morbidity associated with skin grafts.

**Learning Objective:**

- *To become familiar with the Keystone Flap and understand its role in reconstruction*

## 29

## PREVALENCE OF ANTIBIOTIC RESISTANT ORGANISMS IN A TERTIARY BURN UNIT: A RETROSPECTIVE STUDY OF 340 BURN PATIENTS

**A Ho, R Chambers, A Papp**
**Vancouver, BC**

**PURPOSE:** The rate of antibiotic resistant organisms (AROs) in burn units continues to increase and contributes significantly to morbidity and mortality. Contact precautions (CP) were implemented after a multidrug resistant *Acinetobacter baumannii* outbreak in 2008. Study objectives were to 1) determine the prevalence of AROs among admitted burn patients, 2) to describe the impact of CP on AROs, and 3) to identify potential predictors of AROs acquisition.

**METHODS:** Data of burn patients admitted between 2006-2010 were retrospectively reviewed. The antibiotic susceptibility profiles of burn patients who developed ARO colonization/infection at or after admission were reviewed. The AROs of interest included MRSA, VRE, extended-spectrum beta-lactamase (ESBL)-producing *E coli*, and Carbapenem-resistant *Pseudomonas/Acinetobacter species*. The pre-CP group included patients admitted between 2006-2007 and the post-CP group included patients admitted between 2009-2010. Univariate and multivariate logistic regression analysis was employed with the p-value set at 0.05.

**RESULTS:** There were 362 admissions during the study period; 340 patients had complete data for analysis. The mean age was 41.8 years. Among the AROs cultured, the most prevalent was MRSA (75%). Prior to CP, the prevalence of all AROs was 27.9%, compared to 27.6% after policy implementation. There was a trend towards an increase in VRE and Carbapenem-resistant Pseudomonas isolates and a decrease in Carbapenem-resistant Acinetobacter isolates after CP. ICU stay, >20% TBSA burns, and surgical management were significant predictors of ARO acquisition.

**CONCLUSION:** This is the first study to describe the ARO profile of burn patients admitted to our burn unit. Our results suggest that the implementation of stringent infection control policies may not significantly

reduce the frequency of AROs among this compromised population. However, CP for patients transferred from the ICU, requiring surgery, and large burns may be of benefit.

**Learning Objectives:**

- *To learn about the effectiveness of universal contact precautions in a tertiary burn unit, with respect to antibiotic resistant organisms.*
- *To gain a better understanding of the detrimental effects of universal contact precautions among inpatients.*
- *To appreciate the potential risk factors for acquiring antibiotic resistant organisms in burn patients.*

## 30
## THE SAFETY, EFFICACY AND PATIENT OUTCOMES FOLLOWING NEW MAJOR BURN CLINICAL PRACTICE GUIDELINE IMPLEMENTATION

**K Genoway, S Gregory, M Zarbafian, M Vu, D Griesdale, A Papp**
**Vancouver, BC**

**PURPOSE:** To provide an interim review of BC clinical practice guidelines implemented in 2011 to standardize resuscitation and minimize iatrogenic complications of major burn trauma.

**METHODS:** A retrospective review of TBSA estimation, resuscitation records and clinical outcomes following implementation of provincial major burn clinical practice guidelines.

**RESULTS:** Twenty-eight patients met the study inclusion criteria. Eighteen patients were transferred to and ten patients were directly treated in our centre. Mean transfer time from the periphery to Vancouver was 9.5 hours post burn.

The patient demographics were similar between all groups. Twenty-five percent of patients in the periphery had over-estimated TBSA by greater than 10%. This compares favorably as prior to the guidelines 78% had over-estimated TBSA greater than 10%.

In the 24h post burn iv-fluids received in the peripheral transfer group was 7.9 cc/kg/%TBSA prior to the guideline and 6.75 cc/kg/% TBSA after guideline implementation. In these groups 9% percent of patents developed abdominal compartment syndrome before the guidelines and one patient (5%) developed abdominal compartment syndrome afterwards. Five-percent of patients required dialysis prior to the guidelines compared to 11% (2 patients) afterwards. The patients that required dialysis after the guidelines had above average TBSA (41%), fluid given in the first 24 hour (8 cc/kg/%TBSA) and transfer time to the burn center (11.5 hours). No patients in the study have required long term dialysis.

**CONCLUSION:** The implementation of new clinical practice guidelines to aid in fluid resuscitation following major burns has improved peripheral TBSA estimation and decreased IV fluid administration for patients initially assessed in peripheral low volume centers.

**Learning Objectives:**

- *To identify the challenges of providing major burn care delivered by single providers in low volume rural settings and by quaternary multidisciplinary teams*
- *To review the clinical outcomes following the implementation of clinical practice guidelines for major burn trauma resuscitation*

## 31
## ADHERENCE OF BURN DRESSINGS AND THE EFFECT OF INTERVENTIONS ON REDUCING THIS ADHERENCE

**M Brichacek, C Ning, S Lui, S Logsetty**
**Winnipeg, MB**

**PURPOSE:** Research on dressing adherence is lacking because of difficulty replicating clinical variability in measuring adherence due to wound characteristics. A standardized in vitro gelatin model has been described to evaluate dressing adherence. We present adherence testing results using this model with five standard dressings and control material poly (ethylene terephthalate) (PET).

**METHOD:** A gelatin mold was created using standardized protocols. Dressing materials used were: PET, Fine mesh gauze coated in Bismuth and petroleum jelly (BIS), Nanocrystalline silver (NS), wide mesh polyester coated in petroleum jelly (WM), fine mesh cellulose acetate coated in petroleum with polymyxin ointment (FM) and a soft silicone mesh (SIL). The dressing material was applied to the mold and incubated at 32°C, and 75% relative humidity, for 24 hours before adherence testing. Testing was done with an Instron 5956 machine and repeated five times. Following baseline adherence measurements, testing was repeated with exposure to various agents clinically used to reduce adherence: water, soap, oil, and lotion. Water was applied for longer durations to study the effects.

**RESULTS:** The silicone dressing showed no adherence to gelatin. Dressing adherence from least to greatest was: SIL, NS, BIS, WM, FM, PET. Dry dressings showed greatest adherence. Water reduced adherence in all dressings; this effect increased with exposure time. Soap dramatically reduced the time to effect for water. Lotion reduced adherence of BIS by over 50%. Mineral oil had minimal effect on adherence, only affecting BIS.

**CONCLUSIONS:** Using the gelatin model it is possible to measure dressing adherence and the effect of various interventions. Consequently, we are exploring the clinical effect of increasing hydration time and use of soap to reduce this time.

**Learning Objectives:**

- *Participants will be able to identify the adherence of various dressings used in burn care, and also identify dressing specific interventions to decrease adherence.*

## 32
## ANGIOTENSIN RECEPTOR BLOCKADE IS ASSOCIATED WITH DECREASED CUTANEOUS SCAR FORMATION IN A RAT MODEL: A PRECLINICAL STUDY

**A Murphy, S Al-Youha, M Bezuhly**
**Halifax, NS**

**PURPOSE:** Local production of angiotensin II (AngII) following injury has been linked to fibrosis in a variety of non-cutaneous tissues via AngII type 1 receptor (AT1R)-dependent up-regulation of TGF-β. Angiotensin receptor blockers (ARB) are widely used clinically and attenuate TGF-β overexpression and collagen deposition in numerous fibro-inflammatory conditions. Both AngII receptors and TGF-β expression are increased in hypertrophic scars; however, the effect of AT1R blockade in cutaneous scarring has not been directly examined. Our aim was to evaluate the effect of the ARB losartan on hypertrophic scar development.

**METHODS:** Hypertrophic scars were generated on the backs of 12 Sprague-Dawley rats using a mechanical distraction model. Animals received oral losartan (0.3mg/kg/d) or control vehicle over the distraction period. Scar tissue was collected at 4 weeks and evaluated histologically for scar area and scar elevation index (SEI). Immunohistochemistry was performed for the presence of inflammatory cells and myofibroblasts. Messenger RNA and protein expression of AngII, AT1R, Smads 2/3 & 7, TGF-β, α-smooth muscle actin, and collagens I and III were evaluated. The effect of losartan on human dermal fibroblast (HDF) contractile, migratory and synthetic functions was assessed in vitro.

**RESULTS:** Mechanical distraction increased scar deposition in all animals. Losartan treatment was associated with decreased scar area and SEI ($p<0.05$). Additionally, dermal appendages, characteristically absent in hypertrophic scars, were present in losartan-treated, but not control, animals. Immunohistochemical analysis revealed a decreased density of inflammatory cells and myofibroblasts in losartan-treated specimens. Losartan treatment decreased HDF migration and contractile function following scratch assay ($P<0.05$) and collagen contraction assay (mean gel contraction 79.40±14.31 vs. 19.52±8.6; $P=0.001$) respectively.

**CONCLUSIONS:** Our results suggest that AngII plays an important role in the development of hypertrophic scars. Inhibition of the AT1R with losartan resulted in decreased cutaneous scar formation and inhibited fibroblast migration and contractile function in vitro.

**Learning Objectives:**

- *Participants will be able to describe the role of angiotensin II in cutaneous scarring and the potential therapeutic benefits of angiotensin II in hypertrophic scar treatment.*

## 33

### A NOVEL BIOREACTOR FOR DYNAMIC PERFUSION SEEDING OF DECELLULARIZED ALLOGRAFTS FOR TRACHEAL TRANSPLANTATION

**S Haykal, M Salna, Y Zhou, T Machuca, S Hofer, T Waddell**
**Toronto, ON**

**BACKGROUND:** Tracheal transplantation with a long-segment circumferential recellularized allograft has previously been performed without the need for immunosuppressive therapy. Prior techniques used for recellularization have involved static seeding methods.

**OBJECTIVE:** To compare traditional cell seeding with dynamic perfusion seeding techniques using a novel bioreactor for recellularization of long-segment tracheae.

**METHODS:** Long segment circumferential porcine tracheal scaffolds were decellularized using two different protocols. Tracheae were recellularized with recipient tracheal epithelial cells on the luminal surface and bone marrow-derived mesenchymal stromal cells on the external surface in a bioreactor developed in our laboratory using conventional static methods and dynamic perfusion techniques. Intracellular dyes were used to track the fate of seeded cells. Biocompatibility and toxicity assays were performed to assess safety of our bioreactor. Recellularized tracheal allografts were orthotopically transplanted in recipients.

**RESULTS:** Our bioreactor was shown to be safe and non-toxic. Dynamic perfusion seeding of both cell types demonstrates an increase in both cellular counts and homogeneity scores compared to traditional static methods. Immunofluorescence studies show no migration of cells between cell surfaces. Orthotopic transplantation of recellularized donor scaffolds in recipients revealed no labelled cells and shows an increase in survival of recipients transplanted with perfusion-seeded recellularized grafts compared to static-seeded grafts.

**CONCLUSION:** Dynamic perfusion recellularization techniques for long segment tracheal allografts increase the cellular counts, homogeneity scores and survival of transplant recipients.

## 34

### HEPATOCYTE GROWTH FACTOR EXPRESSION IN MURINE LUMBAR MOTOR NEURONS FOLLOWING SCIATIC NERVE LACERATION AND ELECTRIC STIMULATION

**AA Roy, AM Pion, E Beaumont, A Kania, JC Lin**
**Montréal, QC**

**PURPOSE:** Hepatocyte Growth Factor (HGF) plays a role in directing the growth of motor neurons during embryonic development. This factor might also be important in directing the regeneration of adult motor neurons following laceration. We aimed to identify the expression patterns of HGF following axotomy, with or without direct or transcutaneous electrical nerve stimulation in a mouse model.

**METHODS:** Sixty adult C57BL/6 mice were divided into 5 groups: Control (n=12), Sham (n=12), Axotomy (n=12, sciatic nerve laceration and immediate repair), Direct (n=12, sciatic nerve laceration, immediate repair, and application of direct electrical stimulation on the proximal end of the nerve for one hour at 20 Hz) and Transcutaneous (n=12, nerve laceration and immediate repair followed by transcutaneous electrical stimulation for one hour at 20 Hz). Spinal cords were harvested at 1, 3, 7 and 14 days post-surgery. The expression patterns of HGF were measured using in situ hybridization.

**RESULTS:** Our results showed an upregulation of HGF expression in mouse spinal cords following sciatic nerve axotomy. This occurred more quickly following electrical stimulation in both Direct and Transcutaneous groups. The expression pattern of HGF became localized to the motor neuron pools in the Axotomy, Direct and Transcutaneous groups.

**CONCLUSIONS:** HGF, a growth factor involved in directing the outgrowth of motor axons in development, has an altered expression pattern following sciatic nerve laceration, suggesting that it may also play a role in directing motor nerve regeneration. Furthermore, electrical stimulation induced a more rapid change in the expression pattern of HGF, suggesting that it may also be involved in the upregulation of nerve regeneration following electrical stimulation.

**Learning Objective:**

- *At the end of this presentation, the participant will be able to identify HGF as a growth factor involved in peripheral nerve regeneration and understand its expression patterns in mouse spinal cords following different interventions.*

## 35

### BRIEF ELECTRICAL STIMULATION INCREASES AXON REGENERATION AND TARGET REINNERVATION AFTER DELAYED PERIPHERAL NERVE REPAIR IN A SPRAGUE DAWLEY RAT MODEL

**K Elzinga, A Ladak, B Savaryn, N Tyreman, J Olson, T Gordon**
**Edmonton, Alberta**

**PURPOSE:** Loss of regenerative capacity in rat models of delayed nerve repair account for clinical findings of poor functional recovery after nerve injuries. Brief 1 h 20 Hz electrical stimulation (ES) accelerates axon outgrowth after immediate nerve surgery in rats and accelerates reinnervation of target muscles in patients after carpal tunnel release (CTR). CTR was conducted after delayed nerve damage, raising the possibility that ES can accelerate axon regeneration after delayed nerve repair. In this study we asked whether brief ES can promote axon regeneration after delayed nerve repair in a rat model as it does after immediate repair.

**METHODS:** The common peroneal (CP) or the tibial (TIB) nerve was transected and the two nerve stumps ligated and sutured to innervated muscle to prevent regeneration for 3 months. Following cross-anastomosis, the proximal CP nerve was subjected to 1h 20Hz ES or sham ES. Two and 4 weeks later, retrograde fluororuby dye was applied to regenerating CP nerves within the distal TIB nerve 10 mm from the suture site for enumeration of motor and sensory CP neurons that regenerated axons. Five months after cross-anastomosis of freshly cut CP to the chronically denervated TIB nerve stump, numbers of motoneurons that reinnervated gastrocnemius muscle were estimated by the ratio of maximal and mean motor unit isometric twitch forces.

**RESULTS:** Significantly more chronically axotomized CP motor and sensory neurons regenerated their axons into freshly denervated TIB nerve stumps after cross-anastomosis and immediate ES than after sham ES. There were also significantly more freshly axotomized CP neurons that regenerated axons into 3 month chronically denervated TIB nerve stumps after ES. Significantly more motoneurons reinnervated gastrocnemius muscle after ES.

**CONCLUSION:** Brief ES is effective in promoting axon regeneration and muscle reinnervation after delayed nerve repair. In light of evidence of ES induced neurotrophic factor expression, these data indicate that this expression may allow for axon regeneration to proceed more rigorously than without this re-expression.

**Learning Objectives:**

- *Participants will be able to list options available to augment recovery following surgical peripheral nerve repair.*
- *Participants will be able to describe the benefits of immediate electrical stimulation treatment following nerve repair.*

## 36

### N-ACETYLCYSTEINE (NAC) IMPROVES AUTOLOGOUS FAT GRAFT SURVIVAL: A PRECLINICAL STUDY

**J Gillis, S Gebremeskel, K Phipps, P Hong, M Bezuhly**
**Halifax, NS**

**PURPOSE:** Autologous fat grafting is an increasingly popular technique for soft tissue reconstruction, but is limited by inconsistent graft take, under correction, and repeat procedures. The authors examined whether a widely available, clinically safe anti-oxidant, N-acetylcysteine (NAC), could be added to tumescent solution at time of harvest to improve fat graft survival in a mouse model.

**METHODS:** Inguinal fat grafts were harvested from C57BL/6 mice using tumescent solution with or without NAC, and injected under recipient mouse scalps. Fat graft volumes were evaluated via microCT and Materialise's Interactive Medical Imaging Control System (MIMICS) volumetric analysis at 4 days (baseline), and 1 and 3 months post-injection. Explanted grafts were weighed and evaluated histologically for vascularity and quality. Flow cytometric analysis (FACS) and MTT assays were

performed on adipose-derived stem cells (ADSCs) exposed to oxidative stress (hydrogen peroxide) with and without NAC.
**RESULTS:** N-acetylcysteine resulted in improved fat graft retention, with 46% take in NAC animals, compared to 17% in controls (P=0.027). Explanted grafts from the NAC group were significantly larger (46 vs. 8 milligrams, P<0.01) and had a 133% higher mean adipocyte density (P<0.0001) than controls. No increase in vascularity was observed. FACS analysis demonstrated that NAC protected ADSCs from oxidative stress in a dose-dependent manner. Combined exposure to both NAC and hydrogen peroxide led to a 200-fold increase in ADSC proliferation, significantly higher than with either agent alone.
**CONCLUSIONS:** Addition of NAC to tumescent fluid for harvest of fat improves graft survival and quality in a mouse model. Our in vitro findings suggest that this effect is the result of protection from oxidative stress and increased survival of ADSCs and adipocytes.
**Learning Objectives:**
- *To understand the role of N-acetylcysteine in adipocyte and stem cell survival in the context of free fat grafting.*

## 37
## PREVENTION OF RETROGRADE NEURONAL DEATH FOLLOWING NEONATAL PERIPHERAL NERVE INJURY

**J Catapano, S Kemp, C Chiang, T Gordon, G Borschel**
**Toronto, ON**

**PURPOSE:** An overlooked component of disability following neonatal peripheral nerve injury is the death of central motor and sensory neurons crucial for repair and regeneration. The novel aminopropyl carbazole, P7C3, was investigated as a neuroprotective agent capable of preventing post-injury neuronal death and improving functional recovery following neonatal peripheral nerve injury.
**METHODS:** Neonatal Lewis rats were used and a blinded observer completed all analysis. Animals were injured 3 days after birth with a crush injury of the sciatic nerve. Animals were then treated with i.p injections of P7C3 for 2 weeks at various doses, with a maximum dose of 20 mg/kg/day. One month after injury, surviving neurons were labeled proximal to the site of injury with a silicone well containing 4% Fluorogold solution for 1 hour. Animals were sacrificed 1 week after labeling. Samples distal to the site of injury were harvested for nerve histomorphometry and dorsal root ganglia and spinal cords were harvested for neuronal counts. Additionally, functional recovery was assessed weekly in a separate cohort of animals starting one month after injury for a period of 8 weeks. Metrics included skilled locomotion and walking track analysis.
**RESULTS:** P7C3 significantly enhanced motor and sensory neuron survival following sciatic nerve crush injury in a dose-dependent manner (P<0.01), approaching naïve animals at the highest dose of 20 mg/kg/d. Animals treated with P7C3 at a dose of 20 mg/kg/d performed significantly better with skilled locomotion as tested by tapered beam, sciatic-functional index and ladder rung tests.
**CONCLUSIONS:** P7C3 improved motor and sensory neuron survival following neonatal peripheral nerve injury and resulted in improved functional recovery in a rat model. Improving neuronal survival with neuroprotective pharmaceuticals may improve outcomes following neonatal peripheral nerves injuries such as obstetrical brachial plexus palsy.
**Learning Objectives:**
- *Retrograde neuronal death as a therapeutic target following neonatal nerve injury*

# ROSS TILLEY LECTURE

## 37A
## A TALE OF TWO CITIES

**M Bezuhly**
**Halifax, NS**

## 38
## NOGGIN AND CHORDIN KNOCKDOWN IN DISTRACTION OSTEOGENESIS

**P Grenier-Vallée, B Kasaai, P Moffatt, R Hamdy**
**Hamilton, ON**

**PURPOSE:** Numerous reports have shown that recombinant BMPs have positive effects in several conditions associated with poor bone formation. We hypothesize that by inhibiting BMP antagonists Noggin and Chordin using RNA interference we may upregulate endogenous BMP expression and enhance osteogenesis.
**METHODS:** MC3T3 cells were transduced with lentiviruses expressing various shRNAs targeting the mouse Noggin (5 shRNAs) and Chordin (3 shRNAs) genes and 1 negative control. At various time points after infection, levels of RNA expression for Noggin and Chordin were monitored through RT-PCR. Western blotting were performed on the cell extracts and culture media to verify the expression and secretion of Noggin and Chordin proteins. Cell extracts were also analyzed on day 2 and 4 after transduction for alkaline phosphastase activity which is a marker of osteogenic differentiation.
**RESULTS:** On non-tranduced MC3T3 cells, the levels of RNA expression of Noggin and Chordin was at its highest level on Day 7 post-confluence. At this timepoint, qRT-PCR analysis showed that the shRNAs were effective in knocking down Noggin and Chordin endogenous mRNA levels down to 10% and 17%, respectively, by the most potent of shRNAs tested compared to control. Western Blot analysis also corroborates that the respective shRNAs were effective in knocking down the Noggin and Chordin proteins. Specific activity of alkaline phosphatase was increased in MC3T3 cells stably expressing Noggin and Chordin shRNA.
**CONCLUSION:** Western blot analysis, qRT-PCR and ALP assay are consistent with a successful knockdown of Noggin and Chordin. The second step of our project was to address our hypothesis with an animal model of distraction osteogenesis.
**Learning Objectives:**
- *RNA interference can be effective in modulating expression of BMP antagonists*
- *Inhibition of BMP antagonists Noggin and Chordin can lead to enhanced osteogenesis*

## 39
## A NOVEL APPROACH TO FIXATION AND GRAFTING OF SCAPHOID NON-UNIONS

**C McInnes, J Giuffre**
**Winnipeg, MB**

**PURPOSE:** We present a novel fixation technique for non-displaced scaphoid non-unions without avascular necrosis (AVN).
**METHODS:** A retrospective review was performed on all patients with a non- displaced scaphoid non-union without AVN treated with the following technique. Two Kirchner-wires are positioned volar: one perpendicular to the scaphoid fracture and one parallel to the scaphoid axis. Access to the center of the non-union is gained through a dorsal-ulnar burr hole parallel to the fracture that allows passage of a curette/burr for debridement of the non-union site proximally and distally until healthy cancellous bone and the K-wires are visualized. The volar, radial fibrous union is left intact. Cancellous bone graft harvested from the distal radius is packed into the non- union site. A headless screw is placed perpendicular to the fracture and the k-wires are removed.
**RESULTS:** Between 2012-2014, 12 patients (10M: 2F, age 13-36 years) with clinical and radiographic evidence (10 had CT/MRI, 2 had radiographs only) of scaphoid non-union (10 transverse waist, 2 proximal pole fractures) were identified. The median interval from injury to surgery was 31 weeks (range: 9-468 weeks). Two patients failed previous interpositional iliac crest bone grafting. All patients were healthy although 3 were active smokers. All patients had pre-operative wrist pain.
All patients healed (confirmed clinically and radiographically by CT scan) although 4 had delayed union requiring a bone stimulator (2/4 of whom had proximal pole fractures, none were smokers, and none had previous surgery). All had resolution of pain. The average interval from surgery to healing was 12 weeks.
**CONCLUSION:** The technique described is an efficient method for treating non-displaced scaphoid non-unions without AVN. Maintaining

the volar fibrous union likely prevents instability. Complete debridement of the non-union and compression are not essential in achieving union.

**Learning Objectives:**

- *To evaluate a novel technique for treating non-displaced scaphoid non-unions without AVN.*

## 40
## THE OUTCOMES, OPERATIVE TIMES, AND COMPLICATIONS OF THE 1,2 ICSRA BONE GRAFT FOR SCAPHOID NON-UNION

**J Robb, M Morhart**
**Edmonton, AB**

**PURPOSE:** Recent literature advocates the use of a free vascularized medial femoral condyle graft instead of the 1,2 ICSRA pedicled bone graft for the treatment of proximal pole scaphoid non-unions. The purpose of the study is to present the largest series of patients treated with a unique version of the 1,2- ICSRA and to evaluate union rate, surgical times, and complications.

**METHODS:** A retrospective review was conducted from 2003-2013 identifying 107 patients with scaphoid nonunion treated with 1,2 ICSRA. A single surgeon performed a modified technique in which the vascularized bone graft is embedded directly into the fracture site and fixated with a headless compression screw. Union was determined by bridging trabeculae on plain radiographs. Length of nonunion, previous treatment, operative times, complications and subsequent surgical procedures were recorded.

**RESULTS:** The union rate was 98 of 107 (92%). Thirty-six were fractures of the proximal pole and 71 were of the waist. The same technique was used in the humpback deformity when present. The average length of nonunion was two and a half years, ranging from four months to fifteen years. 18 patients had prior operative intervention. In 2013, the average operative time was less than an hour. All were discharged home on the day of the surgery with oral analgesic.

**CONCLUSIONS:** The results of this investigation support the use of a simplified 1,2 ICSRA vascularized bone graft in the treatment of scaphoid nonunion as it has a successful union rate with a relatively short operative time, and negligible donor site morbidity.

**Learning Objectives:**

- *Participants will be able to evaluate the 1,2 ICSRA as a treatment option for scaphoid nonunion.*
- *Participants will be able to describe a simplified technique of the 1,2 ICSRA pedicled bone graft.*

## 41
## INCIDENCE OF VENOUS THROMBOEMBOLISM IN BURN PATIENTS RECEIVING CHEMOPROPHYLAXIS

**S Sikora, K Wade, A Papp**
**Vancouver, BC**

**PURPOSE:** Determine which burn patients are at risk of VTE despite prophylaxis and may require additional prevention measures.

**METHODS:** The Burn Registry was used to find burn patients who suffered a DVT or PE between 1980 to 2012. A chart review was completed to determine which patients were being treated with thromboprophylaxis when they acquired the complication. Data collected included patient demographics, burn etiology and severity, drug use, type of VTE, type of chemoprophylaxis, and treatment response. These patients were compared to a group of 30 control burn patients.

**RESULTS:** Fifty burn patients, out of 1549, acquired a VTE (3.2%). Of these, 26 patients had charts available for review. Twelve patients (46%) acquired the VTE while on thromboprophylaxis. The mean age, gender, ethnicity, use of alcohol/drugs, smoking, inhalation injury and ICU LOS were similar in both groups (P=0.83). Flame/Flash injury was the number one cause of burn in both groups. The patients on thromboprophylaxis had a longer hospital stay (mean 113 vs 45.6 days). Those without prophylaxis had a higher incidence of pulmonary embolism (50% vs 25%) but this was not significant (P=0.28).

The control group had a higher number of patients who smoked (p=<0.01), lower incidence of inhalational injury (p=0.02), lower TBSA burned (8.4% vs. 27.6%, P=<0.01), shorter hospital stay (13.9 vs 113 days, p=<0.01), shorter ICU stay (3 vs 19.4 days, P=<0.01) and fewer operative procedures (mean of 1 vs. 4) when compared to the VTE group.

**CONCLUSION:** No significant differences between patients who acquired a VTE with or without prophylaxis. Patients with a VTE suffered a higher TBSA, incidence of inhalation injury, total number of operations, and had a longer hospital stay. This may indicate simple thromboprophylaxis is insufficient in patients at higher risk.

**Learning Objectives:**

- *Participants will be able to determine which burn patients are at high risk for VTE despite prophylaxis and may require further preventative interventions.*

## 42
## PATIENTS' PERSPECTIVE ON XIAFLEX FOR DUPUYTREN'S DISEASE: A PROSPECTIVE STUDY

**J Lee, M Roy, S Aldekhayel, M Luc**
**Montréal, QC**

**PURPOSE:** To explore the socio-demographics, motivating factors, and satisfaction levels of patients selecting Xiaflex for treatment of their Dupuytren's disease.

**METHOD:** A patient-reported multiple choice questionnaire about demographics, disease characteristics, and motivating factors in choosing Xiaflex, as well as a baseline DASH questionnaire were completed by patients before receiving their Xiaflex injection. Thirty days after the administration of Xiaflex, post-treatment and DASH questionnaires were filled by participants in order to evaluate the level of satisfaction and quantify any improvement in hand disability.

**RESULTS:** To date, we have recruited 35 patients. The majority of patients (66%) were over 60 years old and had an annual income above $60,000 (63%). The main motivating factors in choosing Xiaflex over traditional surgery was faster recovery (79%), less pain (41%), and less risks of nerve injury (32%). Patients demonstrated a high satisfaction rate (91%). All patients (100%) indicated that they would still select Xiaflex for their treatment in the future. Hand disability assessment comparing pre and post treatment DASH scores showed improvement in 60% of patients. When improvement was noted, the average decrease in DASH score was of 68%.

**CONCLUSIONS:** This is the first Canadian study to examine patient-reported efficacy of the treatment and satisfaction level. The vast majority of patients were satisfied with Xiaflex treatment and all patients indicated that they would not change their decision to have undergone Xiaflex injections.

**Learning Objectives:**

- *Participants will be able to better recognize the technique of Xiaflex injection and patients' incentives for choosing it as treatment modality over other techniques.*
- *Participants will also be able to have a tool indicating a unique patient-reported outcome measure of change in hand disability after using Xiaflex.*

## 43
## INTERNAL DERANGEMENT OF TEMPOROMANDIBULAR JOINT: UMBRELLA PERFORATED SCREW TECHNIQUE

**K Arab, MA Danino**
**Montréal, QC**

Umbrella shaped Perforated Screws (UPS) were developed for the use of orthopedic surgery to facilitate anchoring and fixation of the tissue to bone. We here present a retrospective study of Temporomandibular joint Internal Derangement (ID) with fixation using this type of screws.

**MATERIALS & METHODS:** We conducted a retrospective study including patients treated for ID using UPS to reposition the articular disc. The study included patients treated between 1998 and 2005. Patients were selected in concordance with clinical symptoms and signs of severity. All patients had an MRI (open/closed mouth) to confirm the diagnosis. Wilkes classification of tempromandibular disease (TMD) was adopted in the selection criteria.

**RESULTS:** Hundred and five patients were included, 92 female and 13 males with average age of 37.56 years. Dentists or general physicians mainly addressed these patients to our unit. The mean time from symptoms initiating to first consultation was 3.77 years, while the mean timing of surgery after initial consultation was 9.38 months. Patients have presented with various symptoms before the surgery including pain, limitation in eating habits and clicking. 77% of the patients had no or minimal pain post surgery. One hundred one patients had good eating habits after surgery. Only

34 patients had persistent clicking despite surgery. We had neither infection nor hematoma as complication. Major complication to this technique is frontal paresis (14 patients), which was explained to all patients preoperatively. This paresis recovered in less than 2 months in all patients. We had 89.5% of the patients satisfied with their results.
**CONCLUSION:** UPS are useful in the field of plastic surgery. This novel technique has the advantage of not compromising the vascular supply of the TMJ articular surface. This technique provides a simple, fast and efficient technique for posterior aponeurosis flap fixation. Our overall satisfactory rate was comparable to other studies.
**Learning Objectives:**
- *The participant will be introduced to a novel usage of perforated screws commonly used in orthopaedics to reconstruct the temporomandibular joint.*
- *The participant will acknowledge the importance of preserving the inferior joint space during disc dissection.*
- *The participant will be introduced to different historical and current modalities of TMJ disc ID treatment.*

## 44
## CLIPS – CONSENSUS OF LEADERS IN PLASTIC SURGERY

**A Knox, M Gilardino, R Warren, B Corteau, D Anastakis**
**Vancouver, BC**

**PURPOSE:** Variations between training programs and on-going debate regarding the scope of our specialty have created challenges in standardization of training and assessment of residents. We sought to establish consensus regarding core operations that every Plastic Surgery resident should be able to perform independently at time of graduation.
**METHODS:** An item generation phase identified 449 procedures that were sorted into 13 content domains reflective of the RCPSC objectives for training. In preparation for a multi-round consensus building exercise, an item reduction and vetting phase with content experts (n=16) reduced the list to 288 procedures. Peer nominated expert panelists (program directors, division heads, national education committee members, and community plastic surgeons) were recruited. Panelists agreeing to participate (n=37) were surveyed using a modified Delphi method and asked to sort the procedures into 5 categories reflective of expectations of trainee ability. Consensus was defined a priori as >80% agreement.
**RESULTS:** After 2 rounds, 159 procedures were successfully sorted into five levels of ability. (Core Essential – 137, Core Non-Essential – 8, Non-Core Experience – 1, Non-Core Fellowship – 16, and Not In Scope – 0). The remaining 129 procedures did not reach consensus after 2 rounds indicating a third round is required.
**CONCLUSION:** The Delphi method is effective at establishing expert consensus regarding operative competencies for Plastic Surgery. In anticipation of competency based training, it will be important to identify, standardize and objectify Plastic Surgery competencies for all procedures we must teach, ensuring the continued training of competent and safe Plastic Surgeons.
**Learning Objectives:**
- *Identify core procedures for our discipline as determined by leaders in Canadian Plastic Surgery.*
- *Understand the modified Delphi methodology as a tool for establishing expert consensus.*

## 45
## QUALITY OF RECOVERY IN WOMEN UNDERGOING AUTOGENOUS BREAST RECONSTRUCTION IN AN AMBULATORY SETTING

**K Davidge, K Armstrong, M Brown, P Morgan, J Semple**
**Toronto, ON**

**PURPOSE:** In 2010, Women's College Hospital (WCH) in Toronto transitioned from an inpatient hospital to an ambulatory care hospital. In order to continue offering autogenous breast reconstruction, a multidisciplinary team developed a perioperative pain management protocol to facilitate early discharge. The purpose of this study was to evaluate quality of recovery in women undergoing pedicled TRAM or latissimus flap breast reconstruction in an ambulatory setting.
**METHODS:** A prospective cohort study was performed of all women presenting for autogenous breast reconstruction at WCH between 2011-2013. Patient-reported quality of recovery was measured on postoperative days 0, 2, 4 and 7 using the QoR-27. Self-report pain and general health were also evaluated. Linear regression assessed trends in mean postoperative QoR-27, pain, and general health scores over time. Predictors of postoperative QoR-27 and pain scores were analyzed using panel regression analysis. Secondary analyses of delayed discharge (>24 hours) and complications are also provided.
**RESULTS:** Forty women (28-69 years) were included with an average body mass index (BMI) of 26.7 kg/m$^2$. QoR-27 scores consistently improved over the postoperative period, with the greatest lag seen in the physical independence score. Lower total QoR-27 scores were associated with the extremes of BMI and higher ASA classification ($P<0.05$). Worst pain scores were associated with the extremes of BMI ($P<0.05$) and younger age ($P=0.07$). Delayed discharge (24.1-28.25 hours) occurred in 40% of patients; all ASA class III patients experienced a delay in discharge.
**CONCLUSION:** Patients undergoing expedited discharge following pedicled flap breast reconstruction demonstrated satisfactory quality of recovery and well-controlled pain over the first postoperative week. Patient selection is key to successfully performing autogenous reconstruction in an ambulatory setting, with the extremes of BMI and higher ASA class being risk factors for worse quality of recovery and delayed discharge.
**Teaching Objectives:**
- *To understand quality of recovery following expedited discharge post breast reconstruction.*

## 46
## TECHNOLOGY USE AND COMMUNICATION HABITS OF SURGICAL RESIDENTS IN CANADA AND THE UNITED STATES: A COMPARISON OF TWO LARGE TRAINING CENTRES

**M Plant, A Mull, C Novak, S Mackinnon, J Fish**
**Toronto, ON**

**PURPOSE:** Smartphones, email and the internet are becoming increasingly more prevalent in patient care. Our previous study reported extremely high technology use amongst University of Toronto residents and extremely low knowledge of policy. This study evaluated the use of technology amongst surgical residents at a large teaching center in the United States and compared these results with the Canadian cohort.
**METHODS:** 171 residents in surgical specialties at Washington University School of Medicine in St Louis were surveyed to assess their knowledge of university policies, usage of the internet, email and smartphones for clinical duties and communication preferences. Statistical analyses were used to compare these results with those of a previous survey of residents (n=294) at the University of Toronto.
**RESULTS:** 101 Washington University residents responded (59.1% response rate). Internet use was high amongst both university cohorts however awareness of the policies was significantly higher ($P<0.001$) in the US; 83.1% of US residents had complete or partial knowledge of the content vs. 44.1% Canadian residents. Email use was higher in the US (95.9% vs. 85.1%). Smartphones were highly important to both cohorts. Canadian residents communicated more by text message compared to US residents who communicated in person and by pager. Both groups rated pagers as the least preferred communication method.
**CONCLUSIONS:** Technology use was high in both cohorts; however, US residents had a better understanding of the institutional policies and were more adherent to them. US residents were more likely to use pagers, however dislike for the device appears to be an international phenomenon.
**Learning Objectives:**
- *Understand the differences in technology use between Canadian and American residents.*
- *Understand the differences in knowledge of policy between Canadian and American residents.*
- *Understand the different communication habits and preferences of Canadian and American residents.*

## 47
## ELECTRICAL STIMULATION ENHANCES SENSORY NERVE REGENERATION: A RANDOMIZED DOUBLE-BLIND PLACEBO CONTROLLED CLINICAL TRIAL

**J Wong, J Olson, M MOrhart, KM Chan**
**Edmonton, AB**

**PURPOSE:** Peripheral nerve injuries are common and result in functional debilitation. Despite surgery, functional outcomes are unsatisfactory. A promising adjuvant to augment regeneration is post-surgical electrical stimulation (ES). Pro-regenerative effects have been shown with 1 h ES in animal motor and sensory axons. As well, ES has significantly improved motor regeneration in patients with severe carpal tunnel compression. Whether ES may improve sensory recovery in humans remains unknown. With the crucial role that sensation plays on fine dexterous tasks, this represents a major missing void.

**METHOD:** Adult subjects with transected digital nerves were recruited. After surgical repair, two electrode wires were placed. Patients were randomized to the placebo group (1 h null stimulation) or ES group (1h continuous ES). Quantitative cold detection threshold (CDT) was the primary outcome. Secondary outcomes included pressure threshold (PT), two-point discrimination (TPD), quantitative warm detection threshold (WDT), and DASH scores. Assessments were performed at baseline and monthly for 6 months post-operatively.

**RESULTS:** Between July 2011 and June 2012, 36 (1:1 allocation) patients were recruited from hand clinics at the University of Alberta. Patient demographics and baseline deficits were similar in both groups ($P>0.05$). After two months, the ES group began to show significantly improved CDT compared to the placebo group (TWANOVA: $P<0.001$; Tukey: $P<0.001$). By 5/6 months, the divergent trend continued with ES patients achieving near normal function. Similar differences between the two groups were also seen with the secondary outcome measures: PT ($P=0.015$; $P<0.001$), TPD ($P=0.018$; $P<0.001$), WDT ($P=0.001$; $P<0.001$), disability ($P=0.049$; $P=0.014$) and work scores ($P=0.016$; $P=0.027$).

**CONCLUSION:** ES enhances sensory recovery in humans following digital nerve transection. ES is simple, inexpensive and only takes an hour. Combined with its benefits on motor regeneration, ES is a potential treatment in a wide variety of peripheral nerve injuries.

**Learning Objectives:**

- *Identify novel treatments to enhance nerve regeneration.*

## 48
## FROM TIME-BASED TO COMPETENCY-BASED STANDARDS: CORE TRANSITIONAL COMPETENCIES IN PLASTIC SURGERY

**K Lutz, A Yazdani, D Ross**
**London, ON**

**PURPOSE:** Competency-based medical education is becoming increasingly prevalent and is likely to be mandated by the Royal College in the near future. The purpose of this study was to define the core technical competencies that should be possessed by plastic surgery residents as they transition into their senior (PGY-3) years of training.

**METHODS:** A list of potential core competencies was generated using a modified Delphi method that included the investigators and six experienced, academic plastic surgeons from Canada and the United States. Generated items were divided into seven domains: basic surgical skills, anesthesia, hand, cutaneous, aesthetic, breast, and craniofacial surgery. Members of the Delphi group were asked to rank particular skills on a four-point scale with anchored descriptors. Item reduction resulted in a survey consisting of 48 skills grouped into the above domains. This self-administered survey was distributed to all Canadian Program Directors (n=11) via email.

**RESULTS:** The response rate was 100% (11/11). Using the average rankings of Program Directors, 26 "core" skills were identified. There was an agreement of core skills across all domains except for breast and aesthetic surgery. Seven skills were determined to be above the level of a trainee at this stage while a further 15 skills were agreed to be important-but not core-competencies.

**CONCLUSIONS:** Twenty-six competencies have been identified as "core" for plastic surgery residents to possess as they begin their senior, on-service years. The nature of these skills makes them suitable for teaching in a formal, simulated environment, which would ensure that all plastic surgery trainees possess them as they transition to their senior years of residency.

**Learning Objectives:**

- *Participants will be able to define the core competencies of a junior resident as they transition into their senior years of training.*

## 49
## CHANGES IN EYEBROW POSITION AND SHAPE WITH ACTIVE BROW ELEVATION

**T DeLyzer, A Yazdani**
**London, ON**

**PURPOSE:** To compare the height and slope of the eyebrow at rest with maximal elevation, and identify if there is a change with increasing age.

**METHOD:** From standardized facial photographs of 100 women aged 20-80 at rest and with maximal elevation of the brow, height of the eyebrow at the medial limbus (A) and the arch apex (B) was measured from a mid-pupillary horizontal. From these measurements the slope of the eyebrow was calculated. For all subjects we compared A, B, and slope at rest to elevation using the student's *t*-test. Using a non-parametric analysis we compared resting A, B, and slope with elevation across groups based on decade of age. We also used student's t-test to compare the change in A, B, and slope within groups.

**RESULTS:** For all subjects, the mean change in slope from rest to elevation was 0.01 ($P=0.21$). Both A and B significantly increased (0.81 cm and 0.84 cm respectively, $P=0.00$). Across age groups mean slope was significantly different at rest, but not with elevation. The mean change in slope significantly differed across groups reflecting this. The increase in A and B with elevation was significant within groups but across groups only the change in B was significant, with older age groups having a greater increase in apex height.

**CONCLUSIONS:** The overall shape of the eyebrow is maintained with maximal brow elevation for all age groups. The ability to increase the height of the arch apex increases with increasing age due to a lower resting point secondary to ptosis, and a greater excursion of frontalis. This has implications for brow rejuvenation techniques.

**Learning Objectives:**

- *After this presentation participants will be able to describe the changes in eyebrow position and shape with brow elevation.*

## 50
## A MIXED-METHODS ASSESSMENT OF DIRECT AND INDIRECT PATIENT COSTS FOLLOWING HAND TRAUMA

**H Baltzer, M Roy, C Novak, S McCabe, P Binhammer, H von Schroeder**
**Toronto, ON**

**PURPOSE:** It is recommended that cost utility analyses have a societal perspective, including costs to the patient, health care system and third-party payers. These analyses are becoming more common in hand surgery yet a common shortcoming is limited patient cost reporting. The objective of the current study is to conduct the preliminary steps for developing a patient-reported outcome measure to prospectively quantify these costs in the hand trauma patient population.

**METHODS:** This is a prospective, mixed-methods cost of illness study conducted at a level 1 trauma centre. Upper extremity trauma patients were recruited within the four weeks of injury. Demographic and injury data were collected and a Hand Injury Severity Score (HISS) was calculated. Patients maintained a cost diary, and completed a narrative questionnaire between 4-8 weeks post-injury. Descriptive statistics and qualitative (grounded theory) analyses were performed to disaggregate and describe patient costs, which were then organized into cost categories. Recruitment was stopped upon reaching saturation.

**RESULTS:** Fourteen participants (mean HISS = 15, range: 2-64) reported 8 cost categories and 21 cost items. Direct income and indirect caregiver income losses were reported by 42% and 50%, respectively. Direct income losses ranged from decreased work productivity to months of unemployment. The average out-of-pocket cost within 4 weeks of injury were $521. Rehabilitation costs accounted for 61% of out-of-pocket costs ($342) and were the most commonly reported (64%), followed by travel (56%).

**CONCLUSIONS:** Upper extremity trauma patients experience a wide range of costs with rehabilitation costs representing a major economic burden. Our understanding of their costs and resource use may formulate the basis for future cost assessments and practice and policy changes aimed at decreasing the economic impact of these conditions.

**Learning Objective:**

- *To discuss costs for patient following hand trauma and further economic implications for patients secondary to institutional policy changes.*

## 51
## ASSESSMENT OF BURNED SURFACE AREA WITH IMAGING TECHNOLOGY

**S Matei, I Perreault, J de Guise, D Laurendeau, G Chartrand, A Desbois**
**Montréal, QC**

**PURPOSE:** Burned surface area estimation is critical when calculating fluids and nutritional needs, establishing the criteria for transfer to a specialized burn unit and evaluating the patient vital and functional prognosis. Classical methods of estimation allow the transfer of observed burned regions on diagrams with standard body proportions. Errors of transcription, inter-observer variability and different body types may influence the calculation of total burned surface area. The objective of this study is to develop a method evaluating with greater accuracy and precision the total percentage of burned area, based on real proportions. The current project focuses on the first step: the validation of an instrument determining the total body surface.

**METHODS:** A handheld 3D scanner with LED technology (Go!Scan 3D, Creaform, Levis, Canada) was used to take measurements. Four commercial manikins with various body shapes were selected. Each manikin was scanned ten times. All images were transferred to a modeling software (Burn Injuries, LIO, 2013, Montreal, Canada) calculating the total body surface. Reference for measurements was a 3D scanner with dual camera sensor (MetraScan 3D and C-Track Dual Camera, Creaform, Levis, Canada).

**RESULTS:** To evaluate the variation of measures, a confidence interval at 95 % was calculated for each group: (0.806; 0.819), (1.572; 1.591), (1.703; 1.719), (1.904; 1.928) $m^2$. A Bland-Altman plot was used for comparison between the two scanners. Mean differences were obtained: (−21; −32; −58; −73) $cm^2$. The handheld scanner produces systematically lower values than reference ones. These results remain clinically satisfactory because the underestimation by the portable scanner is between 0.1 and 0.4% of the body surface.

**CONCLUSION:** The handheld scanner is a precise and accurate tool to determine the total body surface.

**Learning Objectives:**

- *Participants will be able to describe actual limitations of the classical methods estimating total burned surface area.*

## 52
## CLASSIFICATION OF DEFORMATIONAL PLAGIOCEPHALY: A CLINICIAN'S TOOL

**K Isaac, M Moghaddam, A Clausen, C Forrest**
**Toronto, ON**

**PURPOSE:** The incidence of Deformational Plagiocephaly (DP) is estimated to be 1 in 7. To date, there is no standardized classification system to guide treatment decisions and monitor progress. The aim of this study is to create a severity classification scale for DP and to determine if our subjective clinical impression of severity correlates with objective anthropometric measurements.

**METHODS:** All infants presenting with plagiocephaly from 2007-2012 were retrospectively reviewed. Children with craniosynostosis or brachycephaly were excluded. 3D stereophotographic images and anthropometric measurements were obtained using the 3dMD system. A survey was created with 3D photographs of 20 infants selected to represent the spectrum of severity (5 normocephalic, 15 plagiocephalic). Based on vertex, anterior and posterior coronal views, experts rated the severity of asymmetry and rated the importance of 7 diagnostic criteria for defining the severity of DP. Correlation was calculated using Pearson's coefficient.

**RESULTS:** A group of 13 experts completed the survey. The expert clinical impression of severity was significantly correlated with the degree of ear displacement ($r=0.657$, $P<0.002$), the Cranial Vault Asymmetry index (CVAi) ($r=0.919$, $P<0.00001$) and the Root Mean Square (RMS) ($r=0.920$, $P<0.00001$). Experts judged occipital flattening, ear displacement and ipsilateral forehead bossing as the three most important criteria for the diagnosis of DP severity.

**CONCLUSION:** The experts' clinical impression of DP severity strongly correlates with ear displacement, CVAi, RMS and the vertex view is most valuable for defining severity of DP. Based on these principles, a tool for non-experts may be developed to diagnose severity and to guide management decisions.

**Learning Objectives:**

- *To describe; the features of deformational plagiocephaly, the importance of severity classification scales and the use of anthropometric measurements in craniofacial assessment.*

## 53
## THE IMPACT OF UN-BIOPSIED SKIN CANCER REFERRALS ON THE PLASTIC SURGEON AND PATIENT

**K Steen, S Leonard, D McKay**
**Kingston, ON**

**PURPOSE:** The diagnosis of cutaneous malignancy is confirmed with a tissue biopsy. Delays in diagnosis lead to delays in treatment, increasing morbidity and mortality, and decreasing system efficiency. We quantify the proportion of un-biopsied skin lesions referred to a Plastic Surgeon and investigate the correlation between the hypothesized and true diagnosis.

**METHODS:** A six month retrospective chart review of all referrals made to a tertiary centre surgeon was conducted to quantify the frequency at which lesions are biopsied by primary care physicians, and determine the correlation between the hypothesized and final diagnoses.

**RESULTS:** Of the 280 patients referred for skin malignancy, 120 (43%) were biopsied. 63 (39%) of the 160 un-biopsied lesions were not malignant. 58% of the final pathology reports agreed with the physicians' hypothesized referred diagnosis. Appropriate treatment was delayed as a result.

**CONCLUSIONS:** Many patients are unnecessarily referred to Plastic Surgeons with non-malignant skin lesions; this is stressful for patients and these unnecessary procedures delay the time to treatment for patients with a malignancy. More than half of the referring primary care physicians did not biopsy skin lesions; more than half of the referring physicians have difficulty correctly diagnosing cutaneous malignancy using clinical exam. Over one half of the referred patients were incorrectly triaged, delaying appropriate treatment.

**Learning Objectives:**

- *To appreciate the proportion of biopsied to un-biopsied skin cancer referrals made to a Plastic Surgeon. To understand the impact of un-biopsied skin cancer referrals made to a Plastic Surgeon.*

## 54
## THE ALT BAIL OUT BRANCH

**A Steve, C White, A Alkjawaji, T Hayakawa, E Buchel, S Morris**
**Regina, SK**

**PURPOSE:** The purpose of this study was to evaluate the cutaneous territory supplied by the lateral circumflex femoral artery (LCFA) for a consistent proximal perforator that could be used as an alternative pedicle for an anterolateral thigh (ALT) flap if the dominant perforator is unavailable. It is hypothesized that a proximal 'bail out' perforator would facilitate ALT flap harvest, with minimal modification to flap design.

**METHOD:** Computed tomography images of 9 fresh cadavers were imported using Materialize's Interactive Medical Imaging Control System software to create surface-rendered three-dimensional reconstructions of 15 lower limbs. All perforators of the LCFA were identified in the thigh based on standardized landmarks. Perforators emerging proximally and laterally to a circle (3 cm radius) drawn at the midpoint of the anterolateral thigh were considered potential 'bail out' perforators and evaluated for their number, emerging diameter, length, course, and location relative to the ASIS.

**RESULTS:** Forty perforators were identified, with an average of 2.9±1.8 per limb. Mean pedicle length was 111±20 mm, measured from the origin in the LCFA to where perforators emerged through the deep fascia directly

overlying the thigh muscles. Average diameter at origin in the LCFA was 2.8±0.8 mm and at emergence through the deep fascia was 1.1±0.3 mm. Ninety-three percent of perforators emerged between 12-20 cm inferior and 0-6 cm lateral to the ASIS.

**CONCLUSIONS:** A 'bail out' perforator consistently supplies the proximal anterolateral thigh and may be used as an alternative vascular pedicle for ALT harvest if a perforator identified within the conventional landmarks takes a difficult intramuscular course.

**Learning Objectives:**

- *Recognize that a 'bail out' perforator may facilitate a faster, easier harvest when the dominant perforator takes long musculocutaneous course.*
- *Identify the location of this 'bail out' perforator relative to the ASIS.*

## 55

## BUFFERED LIDOCAINE AND BUPIVICAINE – IN SEARCH OF THE IDEAL LOCAL ANESTHETIC SOLUTION

**C Best, A Best, T Best, D Hamilton**
**Sault Ste Marie, ON**

**PURPOSE:** To investigate the buffering characteristics of solutions of lidocaine and bupivicaine, as sole agents and combined together. These solutions were tested plain and with epinephrine, both commercially prepared and with freshly added epinephrine. The ratio of local anesthetic to sodium bicarbonate for an optimally-buffered solution of lidocaine and bupivicaine in a 1:1 ratio will be determined.

**METHOD:** Thirteen different solutions of lidocaine and bupivicaine, plain and with epinephrine, as sole agents and combined, were tested. The pH of all solutions was measured both before and after each addition of $NaHCO_3$; each was diluted until neutral pH or macroscopic precipitation was observed. Relative increase in the non-ionized fraction was calculated using the Henderson-Hasselbalch equation.

**RESULTS:** Local anaesthetics with commercially added epinephrine had lower initial pH, and when buffered, had the highest relative increases in non-ionized fraction. Adding epinephrine to plain local does not considerably modify pH. For the combined solution of 2% lidocaine with 1:100,000 epinephrine and 0.5% bupivicaine with 1:200,000 epinephrine in a 1:1 ratio, 9.6cc of local anesthetic with 0.4cc of 8.4% sodium bicarbonate yielded the optimally buffered solution, with a pH of 7.1 and a 700-fold increase in the non-ionized fraction of drug.

**CONCLUSIONS:** Lidocaine and bupivicaine solutions differ in their buffering characteristics. Commercially added epinephrine significantly lowers the pH of all solutions, and increases the amount of sodium bicarbonate required for optimal buffering, but also its potential benefits. Combined solutions of the two local anesthetic drugs can also be buffered, albeit in different ratios to either of the single agent solutions.

**Learning Objectives:**

- *To learn details of the buffering characteristics of lidocaine and bupivicaine, and the effects of epinephrine*
- *To learn the ideal ratio of local anesthetic to sodium bicarbonate to produce a combined solution of lidocaine and bupivicaine for clinical use*

## 56

## A THREE-DIMENSIONAL ANATOMICAL STUDY OF THE SUPERFICIAL FEMORAL ARTERY PERFORATOR FLAP

**H El-Hadi, A Alkhawaji, S Morris**
**Halifax, NS**

**PURPOSE:** To comprehensively describe the vascular anatomy of the superficial femoral artery (SFA) perforators by use of three-dimensional analysis and angiography. The description of the SFA perforator flap includes the number, diameter, length, course and location of perforators of the SFPA.

**METHODS:** Ten fresh cadavers underwent whole body injection of lead oxide and gelatin preparation through the femoral artery. All cadavers then underwent spiral computed tomography scanning and three-dimensional evaluation of the injected cadavers using Materialise's Interactive Medical Imaging Control System; 15 thighs were available for analysis.

**RESULTS:** All perforators of the medial thigh were analyzed. Of the 297 perforators identified, each thigh had an average of 20±8 perforators larger than or equal to 0.5 mm in diameter, with an average diameter of 0.8±0.3 mm (range 0.5 mm to 2.1 mm). The average length of each perforator was 69±32 mm; 45% were septocutaneous and 55% were musculocutaneous perforators. The location of each perforator was recorded on a scatterplot of the thigh and it was found that the majority of the perforators were located in the posterior distal third (35%) of the thigh and a substantial number were also located in the anterior distal third of the thigh (31%).

**CONCLUSIONS:** The use of three-dimensional modelling allowed for the comprehensive study of the superficial femoral artery perforator flap. This information can provide greater anatomical vascular knowledge and assist in the application of the SFAP flap for reconstructive surgeries.

**Learning Objectives:**

- *Describe the SFAP flap*
- *Discuss the strengths and weaknesses of the SFAP flap*

## 57

## LONG-TERM OUTCOMES OF MAJOR UPPER EXTREMITY REPLANTATIONS IN HAMILTON, ONTARIO

**W Ng, M Kaur, A Thoma**
**Hamilton, ON**

**INTRODUCTION:** Long term outcomes of major upper extremity replantations are infrequently reported. It is believed that replantation is indicated for amputations at all levels in children, and for all distal amputations in adults. Replantations of arm or proximal forearm amputations in adults are controversial. In our study, we evaluate results of major upper extremity replantations defined as those that are transmetacarpal, through the wrist, forearm, elbow or arm.

**METHODS:** We reviewed such replantations from 2002 to 2012. Patient's strength, range of motion, and 2 point discrimination were assessed. Patients completed the Disabilities of the Arm, Shoulder and Hand (DASH), the Michigan Hand Questionnaire (MHQ), and the Hospital Anxiety and Depression scale (HADS).

**RESULTS:** Seventeen patients underwent major upper extremity replantation surgery at our centre. The majority of the included patients were males (16/17 patients, 94.1%). Out of 17 patients, 13 (76.5%) required reoperations. One patient returned to work.

The mean DASH score of 7 patients who consented to completing all questionnaires was at 75.4 out of 100 (range, 59.2 to 91.1; SD=14.2). On the MHQ, the mean score for affected hand function was 16%, compared to 84% in the unaffected hand. Patients generally demonstrated at least mild levels of anxiety and depression on the HADS.

**CONCLUSION:** Our results suggest that major upper extremity injuries and replantations have a significant impact on patient's long term hand function, and produce long term anxiety and depressive symptoms.

**Learning Objectives:**

- *Participants will be able to screen patients with major upper extremity replantations for concomitant psychiatric conditions.*
- *Participants will be able to describe long term functional outcomes for patients who have undergone major upper extremity replantations.*
- *Participants will be able to consider risk factors for the development of anxiety and depression in plastic surgery trauma patients.*

## 58

## AN ANALYSIS OF CANADIAN PLASTIC SURGERY RESIDENT PROCEDURE LOGS FOR AESTHETIC SURGERY

**B Courteau, M Gilardino, D Courtemanche**
**Montréal, QC**

**PURPOSE:** A number of studies have shown that Plastic Surgery programs worldwide have concerns over the level of exposure their residents have to Aesthetic Surgery procedures during training. The purpose of the present study was to assess the exposure of Canadian Plastic Surgery residents to aesthetic procedures, based on data from a national procedure log (T-Res), as well as the residents' self-reported competence scores for each procedure.

**METHODS:** The resident procedure logs from the past 10 years for all participating Plastic Surgery programs in Canada were collected from the T-Res database, with a primary focus on surgeries of the breast. Data was collected for volumes of reconstructive (hospital-based) and aesthetic breast procedures. Each resident and program was assigned a code that was blinded to the authors in order to maintain anonymity.

**RESULTS:** The results demonstrated a significant difference in procedure volume with over three times more reconstructive breast procedures performed compared to aesthetic procedures for the breast. Reconstructive procedures were significantly more likely than aesthetic procedures to have the resident recorded as the primary operator ("surgeon" or "co-surgeon"). Reconstructive procedures also had higher self-reported competence scores.
**CONCLUSION:** Canadian plastic surgery residents are exposed to a significantly higher volume of reconstructive breast surgery than aesthetic surgery procedures for the breast. The statistically significant differences seen in the self-reported competence scores for these procedures correlates to both the volume and the number of cases in which the resident was the primary surgeon.
**Learning Objectives:**

- *The learner will be able to recognize the rates of various training opportunities for Plastic Surgery residents in surgery of the breast. Also, they will be able to understand how such opportunities might impact resident self-reported competence levels.*

## 59
## ACCURACY AND COMPLETENESS OF ELECTRONIC MEDICAL RECORDS (EMRS) OBTAINED FROM REFERRING PHYSICIANS IN A HAMILTON PLASTIC SURGERY PRACTICE: A PROSPECTIVE FEASIBILITY STUDY

**CJ Hong, MN Kaur, F Farrokhyar, A Thoma**
**Ottawa, ON**

**PURPOSE:** The purpose of our study was to assess the feasibility of auditing EMRs in plastic surgery in a future large-scale research study. The secondary objective was to ascertain the accuracy and completeness of EMRs accompanying referral requests by physicians for plastic surgery consultation from July to December 2013.
**MATERIALS AND METHODS:** EMRs of 30 patients were reviewed and crosschecked independently by two reviewers and subsequently verified by a third using pre-defined criteria to determine whether they were accurate and/or complete. Descriptive analysis was performed to calculate the frequency of inaccuracies and incompleteness for each EMR information field. Comparison was made between information fields to assess whether the frequency of inaccuracies and incompleteness varied between information fields.
**RESULTS:** Of the 270 information fields reviewed, four (1.48%) information fields were inaccurate while sixty-six (24.4%) information fields were incomplete. The most common field of inaccuracies was current medications followed by past medical history and medical allergies. The most common field of incompleteness was history of presenting illness followed by past surgical history.
**CONCLUSION:** Despite the purported benefits of EMRs, inaccuracies and incompleteness are a frequently occurring problem in EMRs. A large-scale study may be beneficial in determining the efficacy of EMRs in the future.
**Learning Objectives:**

- *Understand how EMRs have changed the practice of plastic surgeons in Canada*
- *Key elements of performing a feasibility study to assess accuracy of EMRs and need for a large province-wide study*

## 60
## PUBLICATION TRENDS IN THE PLASTIC AND RECONSTRUCTIVE SURGERY JOURNAL: 1945–2010

**R Seay, W Parker, M Czerwinski**
**Cedar Park, Texas, USA**

**PURPOSE:** The *Plastic and Reconstructive Surgery Journal* (PRS) has been a leading resource for plastic surgeons. Our study's objective was to quantify the journal's distribution of articles within major disciplines of plastic surgery as a function of time to 1. Correlate publication trends with the metamorphosis of our specialty and 2. Hypothesize reasons for and consequences of the observed changes.
**METHODS:** All PRS issues (1945 to 2010) were reviewed at the journal's official website. Articles were classified into categories: breast-cosmetic, breast-, head and neck-, trunk-, extremity-, and general-reconstructive, pediatric/craniofacial, hand/peripheral nerve, cosmetic, experimental. CMEs, editorials, reviews, viewpoint articles and letters were not included. The number of articles/issue in each category was divided by total number of articles/issue, to remove confounding influences of alterations in total article number. The resultant percentage of articles/issue in each category was averaged for each decade and plotted from 1945-2010 using Microsoft Excel software.
**RESULTS:** The distribution of articles within major sections of plastic surgery as a function of time is presented in Figure 1. Notable trends include: 1. Five-fold increase in breast surgery (cosmetic and reconstructive) articles, 2. Eight-fold increase in cosmetic (excluding breast) articles, 3. Two-fold decrease in each head and neck-reconstructive, general-reconstructive, pediatric/craniofacial surgery articles, 4. Three-fold increase in experimental articles. Cosmetic and breast sections have risen from the two lowest to two highest categories, measured by percentage of articles.
**CONCLUSIONS:** The general publication trend of PRS appears to demonstrate increasing focus on cosmetic and breast surgery, with diminishing emphasis on reconstruction. This reflects the field's evolution, and also highlights dominated areas lost to other specialties. Furthermore, increasing emphasis on breast and cosmetic surgery may inaccurately depict plastic surgery to future surgeons, other specialties and general public.
**Learning Objectives:**

- *Participants will gain insight into the PRS journal article publication trends and its relation to the transformation of the specialty.*
- *Participants will evaluate potential etiologies and implications for these changes.*

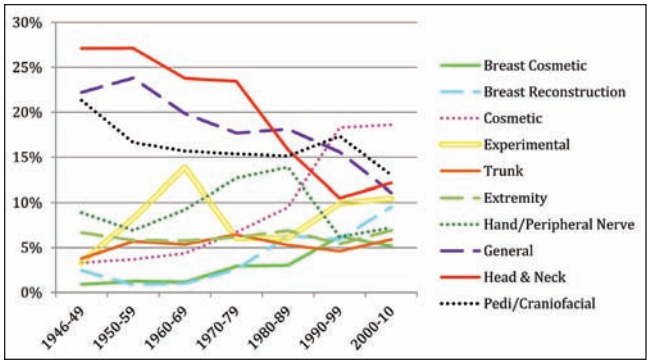


*Figure 1*

## 61
## SMART PHONES FOR PATIENT PHOTOGRAPHY

**N Chan, J Charette, D Dumestre, F Fraulin**
**Calgary, AB**

**PURPOSE:** To determine the prevalence of smart phone use for patient photography in Plastic Surgery.
**METHODS:** Survey Monkey was used to distribute a 26 question survey to all members of the Canadian Society of Plastic Surgeons. The questions encompassed categories of smart phone use, storage of photos, consent process and privacy issues.
**RESULTS:** Survey participation rate was 27.2% (148/545) with 103 Plastic Surgeons and 45 Residents. 89.1% of responding surgeons and 100% of responding residents have taken photographs of patients using smart phones, and believe they are practical and necessary. Patient photographs are stored with personal photographs by 73% (74/101) of respondents. Verbal consent is most common 85.9% (122/142), but only 74.6% (106/142) believe it is sufficient to ensure patient privacy. Written consent is not commonly taken – only by 29.6% (41/142) – but 82.9% (116/140) would obtain it, if it could be done more efficiently. None of the participants have texted/emailed a patient's photograph to the wrong person, but 21.5% (31/144) have accidentally shown one to friends or family. Despite the common use of smart phones for patient photography, 45.7% (59/129) remain reluctant, as they are unsure of hospital policies, fear it appears unprofessional, and worry about security breaches. A smart phone application that incorporates a consent process and allows photos to be immediately stored externally is perceived by 59% (83/140) to be a possible way to address confidentiality issues.

**CONCLUSIONS:** Smart phones are commonly used to obtain patient photographs in Plastic Surgery with only verbal consent from the patient. There is a need for a novel smart phone photography app that will allow enhanced patient security.

**Learning Objectives:**

- *To describe the prevalence of, and implications of, the use of smart phones to take patient photographs in Plastic Surgery.*

## 62

## MANAGEMENT OF INCIDENTAL INTERNAL MAMMARY NODES DURING AUTOLOGOUS BREAST RECONSTRUCTION

**A Grant, K Lutz, C Temple-Oberle**
**Calgary, AB**

**PURPOSE:** To review the management of internal mammary (IM) nodes exposed during recipient vessel preparation in breast reconstruction.

**METHODS:** A systematic review of the literature was conducted using two surgeons who independently assessed multiple databases (PUBMED, Embase, Cochrane, Microsurgical Meeting abstracts and Google). Eligibility criteria included autologous free flap breast reconstruction using IM recipient vessels and concurrent IM node biopsy. Prospective and retrospective reviews and case reports from all dates up to January 2014 were included. Articles using thoracodorsal recipient vessels and letters to the editor were excluded. Pooled data was analyzed for incidence of IM node biopsy and node positivity.

**RESULTS:** Nine published reports met inclusion criteria. Sample size ranged from 44 to 519 with a total of 2023 patients. Articles described both Immediate and delayed reconstruction using TRAM, DIEP, SIEA, and/or GAP flaps. Heterogeneity was noted regarding the indication to sample the nodes: seven articles described sampling only clinically suspicious nodes, whereas two articles sampled any node encountered. Overall, 34% of patients had nodes submitted for biopsy. IM positivity ranged from 1.2% to 13%, with a median of 2.9% in individual studies. A simple combined statistic of x nodes positive/y nodes sampled showed a gross overall incidence of 2.7%. 41 of the 55 patients with a positive IM node received additional adjuvant therapy (chemotherapy &/or radiation) however there is insufficient data to determine effects on survival.

**CONCLUSIONS:** Positive internal mammary node metastasis are discovered in 1.2-13% of women during IM vessels dissection. Additional treatment is generally added, with an unknown effect on survival. Node biopsy may be considered if nodes are easily sampled without morbidity as it may provide extra information for planning adjuvant therapy.

**Learning Objectives:**

- *Attendees should understand internal mammary node drainage and the incidence of IM node positivity during breast reconstruction.*

## 63

## THE DECISION TO UNDERGO MASTOPEXY FOR BREAST PTOSIS: ANALYSIS OF PATIENT PREFERENCES USING UTILITY OUTCOME SCORES

**A Ibrahim, H Sinno, A Izadpanah, J Vorstenbosch, T Dionisopoulos, B Lee, S Lin**
**Boston, Massachusetts**

**PURPOSE:** Breast ptosis can occur with aging and after weight loss and breast feeding. The authors set out to quantify the health state utility outcome assessment of living with bilateral Grade III breast ptosis requiring mastopexy.

**METHODS:** Utility assessments using the visual analog scale (VAS), time trade-off (TTO), and standard gamble (SG) were used to obtain utilities scores for breast ptosis, monocular blindness, and binocular blindness from a sample of the general population and medical students. Linear regression and student t-test were used for statistical analysis. A $P<0.05$ was deemed statistically significant.

**RESULTS:** Measures for breast ptosis in the 107 volunteers (VAS, 0.80±0.14; TTO, 0.87±0.18; SG, 0.90±0.14) were significantly different ($P<0.0001$) from the corresponding measures for monocular blindness and binocular blindness. When compared to the sample of the general population, having a medical education demonstrated a statistical significance of being less likely to trade years of life and less likely to gamble risk of death for a procedure such as a mastopexy. Race and sex were not statistically significant independent predictors of risk acceptance.

**CONCLUSIONS:** We have quantified the health burden of living with breast ptosis requiring mastopexy indicating that is comparable to other breast-related conditions (breast hypertrophy and bilateral mastectomy). A numeric value has been assigned to this health state (VAS, 0.80±0.14; TTO, 0.87±0.18; and SG, 0.90±0.14) which can be used to form comparisons with the health burden of living with other disease states.

**Learning Objectives:**

- *Participants will be able to quantify the health burden of living with breast ptosis requiring mastopexy.*
- *Participants will be able to form comparisons with the health burden of living with other disease states which will improve both the surgeons' and the patients' knowledge regarding the quality of life expected when a patient consents to a specific procedure.*

## 64

## OUTCOMES OF BREAST RECONSTRUCTION IN OLDER WOMEN

**V Hayward, A Alqahtani, T Zhong, S Hofer, A O'Neill**
**Toronto, ON**

**PURPOSE:** As the population ages the number of women over the age of 60 being diagnosed with breast cancer is rapidly increasing. A recent large-scale multi-centre review indicates the rate of breast reconstruction in women over 65 years is less than 6%. These low rates may be partly due to physician bias as breast reconstruction may be considered to carry higher risks of complications with decreased improvement in quality of life in the older population. The objective of this study is to evaluate both the efficacy and safety of breast reconstruction in women aged >60.

**METHODS:** A retrospective chart review was conducted of all women who underwent breast reconstruction at University Health Network between 2008 and 2013. Both autologous (N=384) and implant-based reconstructions (N=219) were included. Patient demographics, comorbidities, adjuvant therapies, timing and nature of surgery were recorded. General post-operative complications and complications specific to breast reconstruction were recorded as well as BREAST-Q scores pre-operatively and 12 months post reconstruction. Patients were grouped into >60 and <60 age groups. Bivariate and multivariate analysis was carried out to identify significant differences between these two groups.

**RESULTS:** Older patients had no significant increase in overall complication rates compared to younger women. Age was not identified to be an independent risk factor for either general or specific complications in women undergoing either autologous or implant based breast reconstruction. Self-reported outcome measures showed that older women show equal benefit to younger women following reconstruction.

**CONCLUSIONS:** Both autologous and implant based reconstruction is as safe and effective in older women as in a younger patient cohort. Age should not be considered a barrier to breast reconstruction following breast cancer surgery.

**Learning Objectives:**

- *At the end of this lecture, participants will be able to value the safety and efficacy of breast reconstruction in older women.*

## 65

## BREAST RECONSTRUCTION USING THE FREE POSTERIOR MEDIAL THIGH PERFORATOR FLAP: INTRAOPERATIVE ANATOMICAL AND CLINICAL RESULTS

**T Satake, M Muto, M Ogawa, S Ko, K Yasumura**
**Yokohama, Japan**

**PURPOSE:** The free posterior medial thigh perforator flap is a fasciocutaneous flap on the posterior and medial thigh, based on perforators from deep femoral vessel. Angrigiani et al. reported this flap "the adductor flap" and Allen used this perforator flap for 27 breast reconstructions. We have had satisfactory outcome using the Posterior medial thigh perforator flap for 109 breast reconstructions. The purpose of this study is to evaluate the anatomical basis of the posterior and medial thigh perforators from deep femoral vessel.

**METHODS:** Between June of 2006 and present, 105 patients underwent breast reconstruction using the posterior medial thigh perforator flap. The following parameters were recorded intraoperatively: diameter and length of the pedicles, distance of pedicles from proximal thigh crease, and number and locations of perforators.
**RESULTS:** The pattern of the perforator which coursed through adductor magnus muscle was the largest number, followed by which coursed between adductor magnus and semimembranosus muscle septocutaneously. Number of perforators larger than or equal to 0.5 mm was detected in the posterior medial thigh plane in each dissections. The average number of perforators was 3.8. The highest distribution of perforators was found between 5 and 13 cm below base of the thigh. Musclocutaneous perforators from adductor magnus were situated more proximally to the septocutaneous perforator between adductor and semimembranosus muscle.
**CONCLUSIONS:** The Posterior medial thigh perforator flap is suitable as a first-line option in small to moderate breast women. This flap provides enough large cutaneous perforators supporting adequate amount of soft tissue transfer from posterior and medial thigh.
**Learning Objectives:**
- *To demonstrate the clinical results of autologous breast reconstruction using the posterior medial thigh perforator flap.*
- *To outline the anatomy of the perforators from deep femoral vessel at the proximal third of the thigh.*

## 66
## CLINICAL EXPERIENCE WITH USE OF SERI® IN TWO-STAGE IMPLANT-BASED BREAST RECONSTRUCTION: 6-MONTH FOLLOW-UP OF 239 PATIENTS

**M Choi, N Karp, J Ippolito, M Lehfeldt, M Jewell, N Fine**
**New York, NY**

**PURPOSE:** SERI® is a silk-derived, long-term bioresorbable scaffold developed for soft tissue support.
**METHODS:** SURE-001(NCT01256502) is a prospective, single-arm, multicenter study in patients undergoing two-stage breast reconstruction. Institutional Review Board approvals were obtained from all study sites. At the time of mastectomy/stage I surgery, SERI was placed during subpectoral placement of a tissue expander, which was replaced with a permanent implant during stage II surgery.
**RESULTS:** A total of 139 subjects (214 breasts) were enrolled in SURE-001 and will be followed for 24 months; data on all patients followed for 6 months are reported here. At 6 months, 75 subjects (118 breasts) had undergone stage II surgery. Subject satisfaction score (mean±SD; 5=very satisfied) was higher at 6 months (4.3±0.91) compared with screening (3.6±1.05; P<0.0001 [paired t-test]). Investigator satisfaction score (mean±SD; 10=very satisfied) at 6 months was 9.4±0.84. SERI was assessed as easy/very easy to use in >98% of instances across five categories during stage I surgery (before implantation: preparation, cutting/shaping; during implantation: positioning/drapability, suturing; after implantation: cutting/shaping). Key AEs in 214 breasts: tissue necrosis (6.1%), seroma (6.1%), hematoma (2.8%), breast infection (1.9%), cellulitis (1.9%), implant loss (1.9%), capsular contracture (0%). None were assessed by investigators as due to SERI.
**CONCLUSIONS:** In the 139 patients enrolled and prospectively followed in SURE-001, subject satisfaction with the treated breasts increased from screening through 6 months. High degrees of investigator satisfaction and ease of use with SERI were reported. AE rates are comparable with those reported for implant-based breast reconstruction with ADMs.
**Learning Objectives:**
- *To discuss clinical experience with SERI, a new silk-derived product for soft tissue support*
- *To understand the near-term outcomes observed in the SURE-001 study including the complication profile of SERI*

## 67
## AUTOLOGOUS FAT GRAFTING USING STROMAL VASCULAR FRACTION INDUCES PROLIFERATION OF BREAST PARENCHYMAL CELLS

**M Laliberte, S Blelloch, S Chatterjee, I Ratanshi, A Raouf, E Buchel**
**Winnipeg, MB**

**PURPOSE:** Autologous fat grafting is a popular technique for managing contour deformities in breast reconstruction. Breast parenchyma is capable of expanding 2-10 fold during menstrual cycles and pregnancy from differentiating mammary epithelial progenitors. Adipose tissue contains a rich population of multipotent mesenchymal stem cells (adipose-derived stem cells, ASCs). When isolated, the cellular fraction of adipose tissue containing ASCs is referred to as stromal vascular fraction (SVF). Despite widespread clinical use, interactions between the SVF of lipoaspirate and breast parenchyma remains poorly understood. We describe a study to identify if progenitor-rich SVF influences the behavior of mammary epithelial progenitor cells within breast parenchyma.
**METHOD:** Samples (n=4) of abdominal lipoaspirate and breast tissue were obtained from patients undergoing elective abdominal liposuction and reduction mammoplasty, respectively. The SVF was isolated from lipoaspirate and breast parenchymal cells were isolated from reduction mammoplasty samples. The ASCs within the SVF were quantified using colony-forming cell (CFC) assay and confirmed using cell surface marker and differentiation assays1. The SVF and breast parenchymal cells were co-cultured in a three-dimensional matrix called Matrigel. A control culture consisted of breast parenchymal cells in the absence of SVF. After 14 days, the total cell numbers and mammary epithelial progenitor cell populations from each culture group were quantified using CFC assays.
**RESULTS:** Surface marker, differentiation and CFC assays demonstrated the presence of ASCs in SVF samples. Co-cultures of breast parenchymal cells with SVF led to a 5.5-fold expansion of mammary epithelial progenitor cells, compared to a 3-fold expansion when cultured alone.
**CONCLUSIONS:** SVF is capable of increasing the proliferation of mammary epithelial progenitor cells. As a result, this study demonstrates the potential for interaction between the SVF within autologous fat grafts and progenitor cells contained within breast parenchymal tissue. This finding may have in vivo implications in patients undergoing breast reconstruction.
**Learning Objectives:**
- *At the end of this session, participants will be able to describe (1) the cellular composition of abdominal fat grafts and (2) the cellular interaction between lipoaspirate and breast tissue.*

**Reference:**
- *Bourin P, et al. Cytotherapy 2013;15:641-648.*

# CANADIAN EXPERT

## 67A
## RECENT ADVANCES IN PEDIATRIC PLASTIC SURGERY

**P Bortoluzzi**
**Montréal, QC**

## 68
## DEVELOPMENT OF A CLEFT LIP TRAINING MODEL

**S Shiga, C Petropolis, L Sigurdson**
**Winnipeg, MB**

**PURPOSE:** Operative training in cleft lip surgery during residency is limited by the inherent complexity of the procedure and a low margin for error. Current adjunctive learning tools such as photograph marking and computer-based simulators lack realism and adequate haptic feedback. We sought to create an inexpensive, non-proprietary physical cleft lip simulator to address these concerns.
**METHODS:** A three-dimensional model of an incomplete unilateral cleft lip and nasal tip was created using photographs and anatomical references, including separate internal tissue layers. 3D printing was used to create prototypes of each component, which were then refined and used to create a multipart mould for reproduction. Silicone and plastic materials were used to replicate the various tissue types.

**RESULTS:** We developed a cleft lip surgical model with distinct bone, mucosa, muscle, cartilage, and skin layers, and adequate fidelity for both surgical marking and cleft repair practice. The cost per unit is approximately CAD$20.
**CONCLUSIONS:** By providing an outlet for deliberate practice, this cleft lip model may help bridge the gap between textbook study and intraoperative training. Further evaluation by residents and cleft lip surgeons will enable validation and refinement of the model.
**Learning Objectives:**

- *At the end of this presentation, the learner will be able to identify the current limitations of cleft lip surgical education, and consider the potential benefit of a physical 3D training model.*

## 69
## THE LITTLE AVM: A NEW ENTITY IN THE SPECTRUM OF HIGH FLOW VS. LOW FLOW VASCULAR MALFORMATIONS

**M Stein, R Guilfoyle, D Courtemanche, W Moss, M Bucevska, J Arneja**
**Vancouver, BC**

**PURPOSE:** Arteriovenous Malformations (AVMs) are high flow lesions with abnormal connections between arteries and veins without an intervening capillary bed. The diagnosis is classically made clinically, yet current treatments for AVMs require radiographic data to support the diagnosis. Infrequently, there are "discrepant" lesions where the radiographic diagnosis does not support the clinical diagnosis producing a treatment dilemma for the involved practitioner. The purpose of this study is to review our center's experience and introduce a new entity in the paradigm of vascular malformations where incongruity in a patients' clinical and radiographic presentation produce a diagnostic and therapeutic challenge.
**METHODS:** A retrospective chart review of patients with atypical AVM presentations was performed, which are not adequately captured in the current ISSVA classification system. Parameters reviewed included patient history, demographics, clinical presentation, radiological imaging and treatment.
**RESULTS:** Over a 15-year period, we identified 7 cases of vascular malformations with discrepant clinical and radiological findings concerning flow characteristics. The primary modality to illustrate this incongruity was angiogram (5 of 7 patients) and MRI/MRA (2 of 7 patients). All patients were treated based on their radiological diagnosis and managed either conservatively, using sclerotherapy, or surgically. No lesions evolved into a high flow process and there was no recurrence at 24 months follow up.
**CONCLUSION:** We have identified and described a unique, yet rare, subcategory of vascular malformations that have clinical features of high flow malformations but radiological features of low flow malformations. From both a clinical and natural history standpoint, these lesions behave like low flow malformations and should be treated as such.
**Learning Objectives:**

- *The importance of evaluating vascular malformations by both clinical and radiological means*
- *Treatment should be preferentially based on radiological diagnosis*

## 70
## INCREASED FISTULA RATE FOLLOWING CLEFT PALATE REPAIR IN ADOPTED CHILDREN

**A Viezel-Mathieu, J Diaz Abele, S Aldekhayel, T Al-Humsi, Y Tahiri, M Gilardino**
**Montréal, QC**

**PURPOSE:** The delayed repair of cleft palates often encountered in children adopted from other countries is a challenge for cleft teams. Issues such as malnutrition, increased cleft width due to delayed repair, poor dental hygiene and a lack of alveolar alignment can all conceivably contribute to increased complications following surgical repair. The purpose of the present study was to determine whether delayed cleft palate repairs in our adopted patients are associated with an increased rate of fistula formation.
**METHODS:** All children who underwent CLP repair at the Montreal Children's Hospital Craniofacial Unit between January 2008 to September 2013 were included in the study. Patient demographics, surgical history, and complications (fistula formation) were reviewed. The control group consisted of non-adopted children.
**RESULTS:** A total of 23 adopted patients (13 male, 10 female) were treated during the study period. The mean age of the children at the time of adoption was 3.13 years. Seventeen children (74%) presented with cleft lip and palate, two children (9%) with isolated cleft palate and four (17%) with isolated cleft lip. Seven patients had bilateral CLP, whereas the remainder were unilateral. Eleven of 17 patients (65%) with CLP had undergone previous lip repair prior to presenting to our institution. The mean age at the time of cleft palate repair in our adopted children group was significantly higher than that of the control group (183 weeks vs. 59.5 weeks, P=0.019). Fistula rate was also significantly higher in the adopted group compared to the control group (33% vs. 7.9%, P=0.011).
**CONCLUSIONS:** Delayed repair of cleft palates in adopted children is associated with a higher complication (fistula) rate in our experience.
**Learning Objectives:**

- *At the end of this presentation, the learner will be able to identify the specific challenges involved in treating adopted children who present with CLP.*

## 71
## TRANSVERSE SLICING OF THE SIXTH-SEVENTH COSTAL CARTILAGINOUS JUNCTION: A NOVEL TECHNIQUE TO PREVENT WARPING IN NASAL SURGERY

**TL Stewart, H Cheng, A Padkel, J Fialkov**
**Toronto, ON**

**PURPOSE:** Costal cartilage is an important reconstructive tool for correcting nasal deformities following cancer resection, trauma, and congenital deformities. Warping of costal cartilage can lead to functional breathing problems and suboptimal results leading to a significant decreased quality of life of patients. We have developed a novel technique to prevent warping that involves harvesting cartilage from the sixth-seventh costal cartilaginous junction, a unique site in the thorax that allows long narrow grafts to be cut transversely and perpendicular to the long axis of the rib junction. Our objective is to measure the differences in cartilage warp between our novel technique and traditional concentric carving techniques.
**METHOD:** Costal cartilage samples obtained from human subjects were cut transversely from the sixth-seventh costal cartilaginous junction or shaped from the sixth costal cartilage by traditional concentric and eccentric techniques. Serial photography over various time points was performed and warp was quantified by calculating the radius of curvature of the graft. ANOVA was used to compare differences in warp between the various cutting techniques. Cellular architecture and collagen and elastin content were analyzed using immunohistochemistry.
**RESULTS:** Statistical analysis shows significantly more warp in concentric and eccentric carving methods compared to transverse slicing from the sixth-seventh costal cartilaginous junction.
**CONCLUSIONS:** Our novel technique of transverse slicing costal cartilage harvested from the sixth-seventh costal junction minimizes warp compared to traditional carving methods and provides adequate length and versatility for reconstructive requirements. Biomechanical explanations of the apparent success of this technique supported by histological analysis will be discussed.
**Learning Objectives:**

- *Perform the technique of harvesting and cutting cartilage for the sixth-seventh costal cartilaginous junction.*
- *Understand the theories of costal cartilage warp.*
- *Understand and potentially adopt a novel technique for preventing costal-cartilage warp.*

## 72
## AN ANALYSIS OF ZYGOMATIC SYMMETRY IN NORMAL, UNINJURED FACES

**A Belcastro, R Willing, T Jenkyn, M Johnson, K Galil, A Yazdani**
**London, ON**

**PURPOSE:** Current approaches to facial reconstruction are based on the assumption of facial symmetry. The purpose of this study is to evaluate the degree of symmetry of the zygomatic complex in normal male faces.
**METHODS:** Three-dimensional models generated in OsiriX from the CT scans of 30 adult male patients displaying normal skeletal anatomy were

used to assess zygomatic symmetry. Seven zygomatic landmarks were selected for analysis and were manually identified by a single observer on two separate occasions to assess for intra-rater reliability. Landmark symmetry scores were calculated based on the average deviation distance upon reflection of one hemiface across the facial symmetry plane. Deviation maps were also generated for each zygomatic pair to enable visualization of asymmetry.

**RESULTS:** All landmarks displayed a deviation from perfect symmetry, ranging from 1.41 mm at the frontozygomatic suture to 3.13 mm at the zygion. Variability was greatest at the zygion (SD: 1.688), while asymmetry at the frontozygomatic suture was the least variable (SD: 0.607). Statistically significant differences were observed in the landmark symmetry scores with the zygion demonstrating significantly greater asymmetry than the orbitale ($P<0.005$), jugale ($P=0.016$), and frontozygomatic suture ($P<0.005$). Furthermore, a large correlation was observed between trial measurements ($r[33]=0.753$; $P<0.005$), and deviation maps confirmed the presence of asymmetry at the zygion and along the zygomatic arch.

**CONCLUSIONS:** In the zygomatic complex of normal male faces, symmetry appears to be highly conserved at the frontozygomatic suture and poorly conserved at the zygion. Knowledge of the extent and localization of asymmetry present in the zygomatic complex of normal faces can provide insight into the proper approach to zygomatic restoration in cases of zygomatic fracture.

**Learning Objectives:**

- *The participants will be able to describe the distribution of asymmetry in the zygomatic bones of non-injured faces.*

## 73

## THE ROLE OF OSSEOINTEGRATED AURICULAR RECONSTRUCTION IN PATIENTS WITH A COMPROMISED IPSILATERAL SUPERFICIAL TEMPOROPARIETAL FASCIAL FLAP

**K Zuo, G Wilkes**
**Edmonton, AB**

**PURPOSE:** Patients with major ear deformities and associated compromise of the superficial temporal artery are poor candidates for autogenous reconstruction because of a tenuous ipsilateral superficial temporoparietal fascial flap (TPFF). Osseointegrated prosthetic ear reconstruction is an alternative to contralateral free TPFF reconstruction. We evaluated the indications, outcomes, and patient satisfaction with this procedure.

**METHOD:** We reviewed charts of patients with ear loss or major deformity and a compromised superficial temporal artery who underwent osseointegrated prosthetic ear reconstruction from 1989-2013. Patient satisfaction was assessed using a questionnaire based on a 5 point Likert scale.

**RESULTS:** We identified 32 patients (8 female, 24 male) with mean age 41.8 years (range 10 to 70 years) who received 88 osseointegrated implants. The ipsilateral superficial TPFF was compromised due to major trauma (17), cancer extirpation (9), previous harvest (5), or arteriovenous malformation (1). All but 2 patients had an associated craniofacial defect such as soft tissue deformity (87.5%), hearing loss (46.9%), and bony deformity (31.3%). 7 patients underwent prior head and neck irradiation. Overall implant success rate was 87.5% at mean follow up 7.6 years after surgical installation. Prostheses were worn on average 12.2 hours/day and 6.6 days/week (80.5 hours/week). All 5 patients who experienced implant failures had received prior radiotherapy. Questionnaire response rate was 53.1% (17 patients). With their prosthesis, 76.4% (13 patients) stated that their self-consciousness in public was 'better' or 'much better', while 58.8% (10 patients) stated that their outlook on the future was 'better' or 'much better'. All patients declared that they would go through the treatment again.

**CONCLUSION:** Osseointegrated prosthetic ear reconstruction is a reliable option for this particularly challenging patient population. Patient satisfaction is high. Prior radiotherapy is associated with higher chance of implant failure.

**Learning Objectives:**

- *Describe indications for osseointegrated auricular prostheses.*
- *Recognize risk factors for osseointegrated implant failure.*
- *Appreciate success and failure rates for auricular osseointegration.*

## 74

## SINGLE STAGE AUTOLOGOUS EAR RECONSTRUCTION FOR MICROTIA: 10 CONSECUTIVE CASES

**L Kasrai, DM Fisher**
**Toronto, ON**

**PURPOSE:** To demonstrate a single stage ear reconstruction technique with 10 consecutive cases and to compare complication rates between single and 2-stage methods.

**METHODS:** This study is a retrospective review of a prospectively acquired database. The series is restricted to primary reconstructions performed for congenital microtia. Photographs of 10 consecutive patients are presented to demonstrate the results of the technique. Surgical complication rates are discussed.

**RESULTS:** One hundred ear reconstructions were performed in 96 patients. There were 75 primary cases of congenital microtia. Twenty-four ears underwent a two-stage reconstruction, while 51 ears were reconstructed with a Nagata stage I procedure or a single stage reconstruction. There was a gradual shift in technique, with a trend to perform fewer Nagata stage II outsetting procedures and more single stage reconstructions. In patients that underwent an ear reconstruction in two stages the early surgical complication rate was 22%. In the last 40 consecutive ear reconstructions since abandoning the two-stage approach, the early surgical complication rate is now 15%.

**CONCLUSIONS:** A modification of Nagata's technique of autologous ear reconstruction for microtia is described. Modifications of the 3D framework address the contour of the inferior crus, and control tragal projection and position. Inclusion of a projection block and recruitment of retroauricular skin allow for symmetric projection of the ear in a single stage.

**Learning Objectives:**

- *The audience will have an opportunity to review the goals of ear reconstruction for microtia. They will see modifications of the Nagata method that will allow for ear reconstruction in a single stage. They will be able to assess the efficacy of the technique by reviewing photographs of results in 10 consecutive cases.*

# CANADIAN EXPERT

## 74A

## RECENT TRENDS IN THE ASSESSMENT AND TREATMENT OF THE AGEING FACE

**TAB Bell**
**Toronto, ON**

The 3 D's (Deflation, Descent and Deterioration) of the aging face will be described on a time line through various decades. Current thoughts on the appropriateness of surgical vs. non-surgical techniques will be highlighted. An emphasis on a normal, natural look will be made.

**Learning Objectives:**

- *At the end of this lecture the learner will be able to describe current thoughts on the assessment of the aging face.*
- *An objective of this lecture will be to help distinguish when non-surgical, minimally invasive and various surgical techniques are to be used to treat the aging face.*

## 75

## TEN-YEAR RESULTS FROM THE NATRELLE® 410 ANATOMICAL FORM STABLE SILICONE BREAST IMPLANT CORE STUDY

**GP Maxwell, BW Van Natta, BP Bengtson, DK Murphy**
**Parsippany, NJ, USA**

**BACKGROUND:** Natrelle® 410 silicone gel breast implants were approved by the FDA on February 20, 2013, and the 10-year study supporting their approval has been completed. This publication updates the previously reported 6-year results.

**METHODS:** This prospective, pivotal, multicenter study enrolled 941 subjects: 492 augmentation, 156 revision-augmentation, 225 reconstruction, and 68 revision-reconstruction. Annual clinic visits collected complications, reoperations, explantations, and subject satisfaction, and one-third of subjects

underwent biennial MRI rupture screening. Kaplan-Meier risk rates were calculated for all local complications, reoperations, and explantations.

**RESULTS:** Capsular contracture rates increased approximately 1% per year from the previously reported 6-year rates to the final 10-year by-subject rates of 9.2% for augmentation, 11.9% for revision-augmentation, 14.5% for reconstruction, and 26.8% for revision-reconstruction (by-implant rates of 6.9%, 7.8%, 10.3%, 20.5%). These rates are significantly lower than those from the Natrelle® round gel core study (51% lower for augmentation and 59% lower for revision-augmentation). The overall rupture rate in the MRI cohort for all indications was 16.4% for subjects and 9.7% for implants. Eleven late seromas were reported (0.6% of study devices), and there was 1 occurrence reported of implant-associated ALCL. For both augmentation and reconstruction subjects the most common reason for explantation was subject request for size/style change. Satisfaction rates remained high through 10 years, with the percentage of subjects saying they were somewhat or definitely satisfied with their implants at 96.2% for augmentation, 87.5% for revision-augmentation, 93.3% for reconstruction, and 90.0% for revision-reconstruction.

**CONCLUSION:** Natrelle® 410 anatomical form stable implants have demonstrated long-term safety and effectiveness, with low complication rates and high satisfaction rates.

**Learning Objectives:**

- *Discuss the 10-year safety and effectiveness of Natrelle® 410 silicone gel breast implants. Describe the 10-year satisfaction rates with Natrelle® 410 silicone gel breast implants.*

## 76

## LYMPHATIC MALFORMATION ARCHITECTURE AND ITS IMPLICATION ON TREATMENT WITH OK-432

**C Malic, R Guilfoyle, D Courtemanche, J Arneja, M Heran**
**Vancouver, BC**

**PURPOSE:** To report our centre's experience with OK-432 (Picibanil) as a sclerosing agent for the treatment of lymphatic malformations.

**METHOD:** We performed a retrospective chart review of all pediatric and adult patients with lymphatic malformations treated by the Vascular Anomalies Clinic at British Columbia Children's Hospital from December 2002 to January 2012.

**RESULTS:** 30 charts were reviewed and 27 patients were included in the study. Review of our flouro-guided sclerotherapy injections revealed five distinct architecture types within the accepted nomenclature; traditional macrocystic lesions (>2 cm), "open cell" microcystic lesions (<2cm) in which adjacent cells freely communicate, "closed cell" microcystic lesions (<2 cm) in which the adjacent cells did not communicate, mixed cystic lymphatic malformations, and lymphatic channels that are not cystic in nature. The majority of cases (74%) treated were found to be macrocystic in architecture and over half (55%) had either complete or good response to treatment. The two microcystic lesions that were successfully treated in our study both had "open cell" architecture. A total of 19% had poor response. There was one patient whose lesion was made worse by treatment with OK-432.

**CONCLUSIONS:** Of our series, only macrocystic lesions were found to have complete response to treatment. The identification of "open cell" microcystic lesions and lymphatic channels was a serendipitous finding in our study. We feel that both architectural subtypes may respond to treatment with OK-432 as they facilitate the free flow of sclerosing agent within the lesion. Adverse events from treatment were minor and infrequent apart from one notable case in which the lesion increased in size after treatment. This is presumably a result of incomplete treatment causing increased swelling and inflammation of adjacent intact lymphatic malformation.

**Learning Objective:**

- *To become familiar the architecture of lymphatic malformations and its response to treatment with OK-432.*

## 77

## MAXIMIZING SUCCESS OF BRA DAY EVENTS

**C Temple-Oberle, R Harrop, B Mehling, J Temple-Oberle, C Webb, L Rollheiser**
**Calgary, AB**

**METHODS:** Plus/Delta methodology applied to a facilitated BRA day event debriefing identified areas of excellence and those needing change. The naugural Alberta event was held in Calgary, October 16, 2013, and was advertised via letters, posters, media clips, and Willow BRA Day website presence. Participant registration was requested, with all comers welcomed. The event structure included including lectures, hosted displays, partners' lounge, "show and tell" area, and food/beverage areas for mingling. All feedback was analyzed.

**RESULTS:** Solicited (volunteers, display hosts) and unsolicited (attendees) emails, verbal comments, and surgeon and organizer perceptions were mapped during the debrief. Strengths noted were high attendance (220 registrants, 300 attendees), ease of volunteerism (women and surgeons), an impactful partner's lounge, high-demand show and tell area, and positive vibe of the event. Changes required included better advertising, longer event, larger venue, improved training of peer volunteers, and expanded show and tell opportunities. A unifying theme of the negative feedback reflected that attendees have different expectations from the event, are at different stages of their journey, may be sensitized due to past personal complications, and have variable tolerance for information and intraoperative images. This heterogeneity may require emphasis away from large generic lectures toward specific breakout sessions, panels, surgeon facilitated show and tell areas, and increased one-on-one discussion opportunities. Earlier engagement of political/medical leaders will enhance uptake of the BRA day vision and mission. Funding requires attention: the Alberta event required $10,000, primarily funded by in kind donations and industry grant.

**CONCLUSIONS:** Lessons learned from the inaugural Alberta event will form a platform for continued quality improvement of future events.

**Learning Objective:**

- *To understand an evaluative method for quality improvement of BRA day events.*

## 78

## PREDICTIVE VALUE OF THE ACS NSQIP SURGICAL RISK CALCULATOR IN MICROVASCULAR BREAST RECONSTRUCTION

**A O'Neill, M Barandun, T Zhong, S Hofer**
**Toronto, ON**

**PURPOSE:** The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) has developed a surgical risk calculator that predicts the risk of 11 post-operative complications. This is a web-based tool that is available to both health professional and the general public. The purpose of this study was to determine whether the risks quoted for microvascular breast reconstruction correlated with the actual post-operative complication rates observed in a large series of patients.

**METHODS:** Four hundred and fifty patients who underwent microvascular breast reconstruction at our centre were identified. A retrospective chart review was performed and patient characteristics, operative details and post-operative complications were recorded. From this data the 21 required patient parameters were entered into the ACS NSQIP surgical risk calculator. The predicted risk of the 11 featured complications were recorded. The mean predicted risk and mean incidence of each complication for this patient cohort were then compared.

**RESULTS:** The risk of overall complications predicted by the calculator (10.4%) was greater than that observed in the retrospective patient cohort (5.1%). The effect of factors such as obesity, patient age and comorbidities on the predicted risk of serious complications was also greater that that observed in our patient population. Discrepancies between the risk of overall and serious complications were frequently encountered.

**CONCLUSION:** The ACS NSQIP surgical risk calculator may be a useful tool in the prediction of post-operative complications in many surgical specialties. However, in microvascular breast reconstruction, it consistently overestimates the risk of serious complications, which may cause undue anxiety in patients undergoing this procedure.

**Learning Objective:**

- *Understanding the potential role of the ACS NSQIP risk calculator in microvascular breast reconstruction.*

## 79
### PROCESS IMPROVEMENT IN MINOR OPERATING ROOMS
**L Sigurdson**
**Winnipeg, MB**

**INTRODUCTION:** The seemingly simple treatment of skin cancer is often a complex network of caregiver interactions when viewed from the patient perspective. It is not uncommon for a given patient to have numerous separate interactions with caregivers before treatment is complete. These multiple interactions create unnecessary inefficiencies for providers, duress for patients and needless costs to the system. Eliminating redundant steps and leveraging database technology, online scheduling systems, and new provider roles can dramatically improve efficiency and lower costs in the treatment of skin cancer.

**PURPOSE:** The goal of the project was to develop a more efficient skin cancer treatment clinic.

**METHODS:** Aspects of Lean Six Sigma were used to analyze process and flow in the treatment of skin cancer. A skin cancer treatment clinic was subsequently developed which represented a significant departure from the previous state.

**RESULTS:** The number of patient caregiver interactions was decreased from 28 to 7. Secretarial staff assumed certain duties previously assigned to nursing staff. Consultations were performed on the same day as surgery. Patient data was collected electronically using a filemaker® database. Consultation letters, operative notes, pathology requisitions, labels and tariff sheets were automatically generated. The majority of patient follow-up was eliminated using electronically generated patient and pathology-specific communications. Patients were booked every 15 minutes with an average of 24 to 30 cases performed per day. In 2012, 851 patients were treated and 1013 in 2013 with average wait times of less than 1.1 months between referral and surgery dates.

**CONCLUSIONS:** Outpatient procedure clinics can be modified through process improvement to increase efficiency of care, simplify the patient journey and reduce wait times to treatment.

**Learning Objectives:**

- *To review strategies for improving efficiency in the treatment of skin cancer.*

## 80
### EFFECTIVENESS OF DIRECT OBSERVATION OF PLASTIC SURGERY TRAINEES IN A CLINICAL ENCOUNTER
**S Frank, P Rasmussen, J Williams**
**Dalhousie, NS**

**PURPOSE:** To determine the effectiveness of direct observation in evaluating the skills of plastic surgery trainees in a clinical examination setting, specifically using the Mini-CEX questionnaire.

**METHOD:** Plastic surgery residents at Dalhousie University performed a new patient consultation in the clinic. A web camera was used to film the history and physical examination, and an attending staff observed their performance during this encounter. Each resident's performance was evaluated using the Mini-CEX instrument, which has been well-validated. At the conclusion of the interview, the resident was given verbal and written feedback on their performance by the attending staff. Both residents and staff evaluated their satisfaction with the direct observation process and the Mini-CEX tool via quantitative scoring as well as a structured interview.

**RESULTS:** The use of direct observation and the Mini-CEX instrument both received uniformly positive scores from attending staff and residents. The residents' qualitative feedback suggests that direct observation of the clinical examination feels natural, that the Mini-CEX allows for helpful written and verbal feedback on their strengths and weaknesses, and can act as a benchmark assessment of their performance over the course of their training.

**CONCLUSION:** The clinical examination is a key component of a plastic surgery resident's training, but is rarely observed or evaluated. This method of direct observation of the clinic visit and evaluation with the Mini-CEX is easy to implement, and is an effective and feasible way for this component of residency training to be evaluated.

**Learning Objectives:**

- *The audience will learn about an easily implemented and well-received tool for evaluating residents in a clinical encounter setting. After attending this session, audience members will be able to incorporate this tool into their residency program for purposes of both training and evaluation.*

# CANADIAN EXPERT

## 80B
### PLASTIC SURGERY IN BURN CARE
**Robert Cartotto**
**Toronto, ON**

**Learning Objectives:**

- *Participants will learn about the need for care of burn injury in Canada;*
- *Participants will learn about how burn care in Canada is changing;*
- *Participants will learn how a declining number of plastic surgeons are coping with these changes and how this affects the adequacy of training of residents.*

# GENERAL POSTER SESSION

## GP01
### A RANDOMIZED, CONTROLLED STUDY OF HYALURONIC ACID FILLERS FOR LIP AND PERIORAL ENHANCEMENT
**H Raspaldo, S Connolly, A Meyer, V Gassia, DK Murphy**
**Parsippany, NJ, USA**

**PURPOSE:** This study examined the effectiveness of a new hyaluronic acid dermal filler, VYC-15L (Juvéderm® Volbella® with Lidocaine; Allergan, Inc.), available in Europe.

**METHODS:** At 12 European sites, 280 randomized subjects who desired lip volume enhancement were treated, 139 with VYC-15L and 141 with a control (Restylane-L® [RES-L]; Galderma Q-Med). Before treatment and at post treatment visits through 3 months, investigators rated outcomes on the 5-point Lip Fullness Scale, 4-point Perioral Lines Scale, and 4-point Oral Commissures Scale. An Independent Central Reviewer (ICR) used 3-dimensional digital photographs taken before treatment and at all follow-up visits to perform blinded assessments using the same scales as investigators. Primary endpoint included constructing a 1-sided 97.5% confidence interval for the difference in responder rates (≥1-point improvement on ICR lip fullness assessment) at month 3 to determine non-inferiority.

**RESULTS:** Subjects were primarily female (98%), mean age was 48 years, and most had Fitzpatrick skin type II (37%) or III (34%). Baseline lip fullness was similar between treatment groups, as was total injection volume (1.97 mL, VYC-15L; 1.86 mL, RES-L). The primary endpoint was met; VYC-15L was non-inferior to RES-L in overall lip fullness at month 3, based on ICR assessments. Lip fullness responder rates based on investigator assessments at month 3 were 84.2% for VYC-15L and 81.4% for RES-L. Investigator assessments showed perioral line improvement for 77.3% of VYC-15L subjects and 61.3% of RES-L subjects, and oral commissures improvement for 69.9% of VYC-15L and 58.7% of RES-L subjects at month 3. Responder rates based on ICR assessments were lower than those for investigator assessments but were similar between products.

**CONCLUSION:** VYC-15L was effective for aesthetic lip enhancement and for improvement in perioral lines and oral commissures.

**Learning Objective:**

- *Participants will be able to compare the effectiveness of VYC-15L versus RES-L® for lip volume and perioral enhancement.*

## GP02
### EXTENDED STRIP CRANIECTOMY (ESC) AND SAGITTAL CRANIOSYNOSTOSIS: A TWIN CASE STUDY IN MORPHOMETRIC ANALYSES
**MS Attia, A Clausen, E Ho, C Forrest**
**Toronto, ON**

**PURPOSE:** In an attempt to demonstrate the effectiveness of Extended Strip Craniectomy (ESC) as an intervention, dizygotic twins are used as an internal control for comparison. We present serial 3D photogrammetric images in different time points before and after ESC and report the differential dynamic skull changes that occur until final follow-up.

**METHOD:** Two sets of dizygotic twins were compared. Within each set, one twin had been diagnosed with scaphocephaly, the other unaffected. 3D Images were taken for both pairs of twins before surgical intervention of the affected twin, at two months and again thirteen months post-surgical

intervention. Three measures were obtained: circumference, volume, and the Root Mean Square (RMS), a quadratic mean calculation. Analyses of circumference, volume and RMS were then trended over a year until follow up.

**RESULTS:** The biggest change observed in skull morphometry was between pre-surgical and 13 months post ESC, with a reduction in bitemporal pinching and AP-bossing. RMS analyses at 13 months post ESC demonstrated qualitatively near-identical skull shapes and sizes in the affected and unaffected cases in both twins. ESC was observed to introduce a modest restriction in potential calvarium growth.

**CONCLUSIONS:** Findings demonstrate the effectiveness of ESC as a surgical intervention to reconstruct synostotic anomalies in scaphocephaly. The intervention reduced bitemporal narrowing and AP-bossing, while enhancing the 'roundedness' of the skull. The findings in this case study may also shed some light onto the dynamic skull growth differences that start occurring after ESC up to a year after the intervention.

**Learning Objectives:**

- *Participants will understand how ESC is a favourable surgical intervention for sagittal craniosynostosis*
- *Participants will understand how RMS can be used as a quadratic mean calculation that yields the mean value of the aggregate distance between two surfaces.*

## GP03

## ASSESSMENT OF THE METHODOLOGICAL QUALITY OF SYSTEMATIC REVIEWS PUBLISHED IN THE PLASTIC SURGERY LITERATURE

**O Samargandi, H Hasan, A Thoma**
**Hamilton, ON**

**PURPOSE:** Well-conducted systematic reviews (SRs) provide the highest quality of evidence for clinical research questions. We aimed to assess the methodological quality of SRs in plastic surgery and identify areas of deficiency.

**METHODS:** We searched MEDLINE from 2003-2013 to identify all SRs published in three major plastic surgery journals. The methodological quality was assessed independently by 2 reviewers using AMSTAR, a validated 11-point instrument after a pilot-testing phase. Disagreements were discussed and resolved by consensus.

**RESULTS:** The systematic literature search identified 157 articles. After screening titles and abstracts, 33 articles were excluded. Full-text review of the remaining 124 articles resulted in further exclusion of five articles. Ultimately, 119 SRs met our eligibility criteria. Eleven (9.2%), 35(29.4%) and 73(61.4%) SRs were published in 2003 to 2006, 2007 to 2010 and 2011 to 2013, respectively. The majority of SRs were published in Plastic and Reconstructive Surgery® (n=82). Using AMSTAR the mean (SD) quality score was 4.42(2.1) points. The majority of SRs performed a systematic search that included at least two databases (70.6%). Less than half of all SRs searched unpublished studies (31.1%), or provided a list of included and excluded studies (16.8%). Of the SRs, 36.1% assessed the methodological quality of included studies.

**CONCLUSIONS:** Over the past decade, there has been an increase in the number of SRs published in the plastic surgery literature. The included SRs demonstrated inadequate adherence to methodological standards of quality, which raises concerns about validity. The use of the AMSTAR tool in designing SRs is recommended to further promote higher quality of SRs in the plastic surgery literature.

**Learning Objectives:**

- *Participants will learn about the role of a systematic review in plastic surgery.*
- *Participants will learn about the methodological issues in the execution of a systematic review and the AMSTAR instrument and its use in systematic reviews.*

## GP04

## CRIB MATTRESS INVESTIGATION – A QUALITY IMPROVEMENT STUDY TO ASSESS MATTRESS COVER PERMEABILITY AND BACTERIAL GROWTH IN CRIB MATTRESSES

**M Yu, K Cross, A Petrich, J Fish**
**Toronto, ON**

**PURPOSE:** Any opening in a medical bed mattress cover (i.e. cracks, zippers) may allow bodily fluids to enter the mattress, leading to contamination and subsequent nosocomial infection. Burn patients can have significant fluid seepage from wounds and increased infection risk. This study's purpose was: 1) assess permeability of crib mattress covers and 2) measure bacterial growth within and on the surface of crib mattresses.

**METHOD:** Bonne's blue dye was applied over mattress covers to assess permeability. Mattress cover surface swabs of 50 $cm^2$ were acquired from 1) each vertical third, 2) cracks of defined size (small <2 cm, medium 2-10 cm, large >10 cm), and 3) zipper. Samples of mattress foam were acquired under sterile conditions from under cover cracks and zipper. All samples were collected with the Eswab™ system and MRSA broth (Copan Diagnostics Inc., Brescia, Italy). Samples were plated onto blood agar and bile salt plates and incubated at 35°C for 18-24 hours. Total aerobic bacteria count and colony types were assessed. Results are presented as mean±SEM, independent t-tests and ANOVA were used to analyze data, and significance achieved with $p<0.05$.

**RESULTS:** All mattresses (n=7) had Bonne's blue dye visible on underlying mattress foam. Surface swabs of mattress covers (n=49) and foam samples (n=28) had total bacterial counts of 0.2-11.6 colony forming units (cfu)/$cm^2$ with mean of 2. Surface swabs (1.5±0.4cfu/$cm^2$) had greater bacterial content than foam samples (0.2±0.1cfu/$cm^2$; $p<0.001$). Coliforms and non-fermenters were the most common microorganisms cultured. All samples were negative for *Staphylococcus aureus* including MRSA.

**CONCLUSIONS:** Any crack in the mattress cover renders it permeable – allowing fluid to enter the mattress. Bacterial growth was present on mattress cover surfaces, cracks and within mattress foam. Mattress cover cracks may be related to the presence of bacteria on and within crib mattresses.

**Learning Objectives:**

- *Identify mattress cover damage as a source of contamination and subsequent nosocomial infection*
- *Identify that burn patients may contribute to contamination and be vulnerable to nosocomial infection from mattresses*

## GP05

## C-SPINE NECK HEALTH AMONGST SURGEONS: A SURGEON'S TIME OUT

**S Gregory, A Moghaddamjou, M Zarbafian, Y Hsiang**
**Vancouver, BC**

**PURPOSE:** There are currently no standardized programs utilized to prevent or treat the high incidence of neck pain in surgeons. The long-term deleterious consequences of non-ergonomic positioning and the use of microsurgery equipment have been well-documented. There is nothing to suggest that the incidence on cervical spine neck health will decrease spontaneously. This study aims to determine if a formalized neck strengthening and stretching program has value and reduces episodes of neck fatigue or pain.

**METHOD:** Didactic and video instruction was provided to members of the UBC Department of Surgery. This was followed by a pre-survey, an 8 week intervention period and a pending post-intervention-survey.

**RESULTS:** An instructional video presenting, background, vulnerable muscle groups, as well as step-by-step instructions for four exercises that comprise the neck-strengthening exercise program was created. 100% of respondents believe that there is a benefit in a formalized strengthening and stretching program designed to prevent and treat neck fatigue and/or pain. All respondents have experienced neck fatigue in the OR and 67% of respondents report experiencing neck pain in the OR.

**CONCLUSION:** Preventing premature cervical spine degeneration in surgeons is important to their livelihood. Presenting an easy to follow step-by-step instructional video provides an effective educational resource aimed at promoting neck health. Improvements in muscular endurance and range of motion coupled with improvements in postural awareness and more ergonomic surgical equipment may be an effective strategy to prevent debilitating cervical spine injury. Preliminary data suggest a benefit after learning and practicing prescribed exercises.

**Learning Objective**

- *Participants will understand the importance of maintaining cervical neck health as a surgeon.*
- *Participants will understand the pathomechanics of operating, the muscle imbalances implicated in neck fatigue and understand a strategy attempting to prevent C-spine neck injury over their careers.*

## GP06

### CASE SERIES ON THE ANATOMY OF HAND CENTRAL SYNPOLYDACTYLY

**P Grenier-Vallée, É Bougie-Richardson, J Dubois, EP Egerszegi**
**Montréal, QC**

**METHODS:** Hand radiographs and angiograms of 10 children with central hand synpolydacty, involving 15 hands, were reviewed. In each case, the cutaneous syndactyly was classified according to the number of digits involved. A simplified classification system was developed to describe the skeletal anomalies present. A classification system previously presented was used to define the digital arterial patterns.

**RESULTS:** All 15 hands presented a syndactyly including the supernumerary digits: 2 involved 2 digits, 10 involved 3 digits, 1 involved 4 digits and 2 involved 5 digits. Skeletal abnormalities were present in every hand. All hands presented with skeletal fusion between the duplicated digits. Many hands also presented a bony fusion between one of the duplicated fingers and an adjacent digit. Several digital arterial patterns were identified and all presented missing arteries.

**CONCLUSIONS:** Multiple skeletal anomalies are specific to central synpolydactyly. This underlines the usefulness of pre-operative radiographs. The previously reported importance of angiograms in these hands remains essential in the planning of surgery in these hands.

**Learning Objectives:**

- *Recognize and classify the bony anomalies present in hand central synpolydactyly using the simplified method presented*
- *Recognize the importance of radiographs in the pre-operative evaluation of central hand synpolydactyly*
- *Recognize the importance of angiograms in the pre-operative evaluation of central hand synpolydactyly*

## GP07

### A UNILATERAL BREAST RECONSTRUCTION WITH THE DIEP FLAP AND SIMULTANEOUS CONTRALATERAL BREAST AUGMENTATION WITH THE SIEA FLAP

**M Ogawa, T Satake, M Muto, S Ko, K Yasumura, J Maegawa**
**Yokohama, Japan**

**PURPOSE:** For the women with small-size breast, contralateral breast augmentation during unilateral breast reconstruction is one of the good options. In selected patients who have adequate lower abdominal tissues, the DIEP flap is often the first choice for unilateral autologous breast reconstruction and we use zone IV which is usually excised for insufficient blood circulation as the SIEA flap for simultaneous contralateral breast augmentation. As we have had satisfactory results of unilateral DIEP flap breast reconstruction and contralateral SIEA flap breast augmentation, we present our surgical techniques and outcomes.

**METHOD:** Between October of 2004 and present, twenty patients with a mean age of 47.8 underwent unilateral breast reconstruction using the DIEP flap and simultaneous contralateral breast augmentation with the SIEA flap. All patients underwent delayed reconstruction. After the lower abdominal flap with both unilateral DIEP flap and contralateral SIEA flap was elevated, the entire abdominal flap was then split into two separate flaps. In eighteen patients, ipsilateral internal mammary vessels were used as the recipient vessels for the DIEP flap breast reconstruction. The pedicle of SIEA flap was anastomosed to distal end or limb of the DIEAV. Then the SIEA flap was inset beneath the contralateral breast tissue through the midline. During the nipple-areola reconstruction or the secondary revision, liposuction above the sternum is required to repair iatrogenic symmastia.

**RESULTS:** All DIEP flaps survived and one SIEA flap was failed due to postoperative venous thrombosis. Mean flap weight final inset for reconstruction and augmentation was 391 g (range, 228 to 494 g), and 92 g (range, 46 to 150 g), respectively.

**CONCLUSIONS:** We conclude unilateral DIEP flap breast reconstruction and simultaneous contralateral SIEA flap breast augmentation may be performed safely with satisfactory outcomes.

## GP08

### THE STROMAL VASCULAR FRACTION OF AUTOLOGOUS FAT GRAFT INDUCES PROLIFERATION OF TUMOUR-ADJACENT BREAST TISSUE

**M Laliberte, S Blelloch, S Chatterjee, I Ratanshi, A Raour, E Buchel**
**Winnipeg, MB**

**BACKGROUND:** Autologous fat grafting is frequently performed in breast cancer patients following breast conserving surgery and mastectomy. Recent studies have shown an interaction between multi-potent mesenchymal stem cells (adipose-derived stem cells, ASCs) and breast tumor cells. However, no study has looked at the direct effect of ASCs in the stromal vascular fraction (SVF) of autologous fat graft on mammary parenchymal cells outside the tumor free margin of a cancer-bearing breast. This study investigates the in-vitro effect of SVF from autologous fat graft on the growth of breast parenchyma found adjacent to breast cancers.

**METHODS:** Samples (n=4) of abdominal fat and histologically normal breast tissue outside the tumor-free margins of mastectomy specimens were obtained. The ASCs within the SVF were quantified using colony-forming cell (CFC) assay and confirmed using cell surface marker and differentiation assays1. The SVF cells and tumour-adjacent parenchymal cells were cultured together in a three-dimensional matrix called Matrigel. A control culture consisted of breast tumour-adjacent parenchymal cells in the absence of SVF. After 14 days, the total cell numbers and mammary epithelial progenitor cell populations from each culture group were quantified using CFC assays.

**RESULTS:** Surface marker, differentiation and CFC assays demonstrated the presence of ASCs in SVF samples. Cultures of breast tumour-adjacent parenchymal cells with SVF led to a 9-fold expansion of mammary epithelial progenitor cells, compared to a 2-fold expansion when cultured alone.

**CONCLUSIONS:** SVF is capable of increasing the proliferation of breast progenitor cells in breast tumour-adjacent tissue. As a result, this study demonstrates a significant interaction between the progenitor-rich cellular fraction within autologous fat graft and cancer-adjacent breast tissue.

**Learning Objectives:**

- *At the end of this session, participants will be able to describe a possible cellular interaction between autologous fat graft and breast parenchyma outside of the tumor-free margins in breast cancer patients.*

***References:***

*1. Bourin, et al. 2013 Cytotherapy*

# RESIDENTS POSTER CORNER COMPETITION

## RP01

### COMPLICATIONS WITH FOREARM PEDIATRIC COMPARTMENT SYNDROME

**N Ziolkowski, L Zive, E Ho, R Zuker**
**Toronto, ON**

**PURPOSE:** To describe complication rates of forearm compartment syndrome in pediatric patients. Currently, there is minimal literature describing outcomes in this population.

**METHOD:** Seventy-nine pediatric patients with upper extremity compartment syndrome were studied from the January 2000 -
March 22, 2013 at The Hospital of Sick Children, in Toronto, Canada were included in this study. Demographic information, time to treatment, and complications were recorded. Exclusion criteria were: developmental delay, necrotizing fasciitis, and isolated hand compartment syndrome. Decompression was defined as external (removal of constricting cast) or internal (fasciotomy).

**RESULTS:** 35 patients met inclusion criteria (74.3% males; 2-16 years of age, mean=8.97 w/STDEV=4.12). The right upper extremity was predominantly involved (54.3%) with a predilection for ulnar fractures (65.7%). Fasciotomies were completed for 32 patients (91.4%), external decompression for 1, and no decompression for 2 patients.
Average time to fasciotomy was less than 12 hours (45.7%), 12-48 (42.9%), or 49-72 hours (11.4%) post-injury. Three patients didn't have fasciotomies due to late referrals.
Complications (62.9% of patients) included: nerve injury (40%), skin grafts (37.1%), contractures requiring serial casting (17.1%), scar revision (11.4%), and reconstructive surgery (8.6%) involving the gracilis muscle flap.

Timing of decompression and the rate of gracilis and/or serial casting (severe long term complications) were statistically significant. Decompression after 48 hours post-injury resulted in an increase in serious complications necessitating more extensive interventions.
**CONCLUSIONS:** Fasciotomy after 48 hours resulted in significantly higher rates of severe complications requiring long-term conservative management (serial casting) or reconstructive surgery (gracilis muscle flap reconstruction).
**Learning Objectives:**
- *Complication rate in pediatric forearm compartment syndrome is very high*
- *Decompression of forearm compartment before 48 hours syndrome can decrease the incidence of extensive long-term morbidity in the pediatric population*

## RP02
## COMPARISON OF OPEN REDUCTION INTERNAL FIXATION AND MANDIBULOMAXILLARY FIXATION FOR THE TREATMENT OF MANDIBULAR FRACTURES

**M Lyons, K Dalke, L Sigurdson, E Buchel**
**Winnipeg, MB**

**PURPOSE:** The two main treatment modalities currently used for mandibular fractures are mandibulomaxillary fixation (MMF) and open reduction internal fixation (ORIF), with very occasional use of external fixation. Historically, the outcomes of MMF vs. ORIF appear to favor MMF. The difference in complication rates between MMF and ORIF is often attributed to the lower complexity fractures selected for MMF treatment.
In our centre, one senior surgeon treats mandibular fractures with MMF (4 post fixation) nearly exclusively while another uses ORIF nearly exclusively. Patient referral is through a centralized booking unit, thus limiting a referral bias.
The purpose was to evaluate these two methods of mandibular fracture treatment in a uniform patient population. Descriptive statistics on demographics, fracture characteristics, time from injury to definitive treatment, operative time, hospital stay, and complications were recorded.
**METHODS:** Ethics board approval was obtained for a retrospective cohort study of 70 patients. Thirty-five adult patients with no more than two fracture sites were treated by each surgeon from 2008 to 2013.
**RESULTS:** No significant difference in demographics pertaining to number of fractures, age, or tobacco, alcohol, and drug use was found between the two groups. There was a higher incidence of complications as well as postoperative hospitalization in the ORIF patients than in the MMF patients. There was also a statistically significant increase in operative time in the ORIF cases compared to the MMF cases.
**CONCLUSIONS:** Our study demonstrates that for the treatment of mandibular fractures, MMF can produce a lower incidence of complications and significantly shortened operative time than ORIF in comparable patient groups.
**Learning Objectives:**
- *Our colleagues will be presented new data showing that MMF and ORIF used in similar patient populations for the treatment of mandibular fractures produce a lower incidence of complications and shorter operative time in MMF patients.*

## RP03
## RECONSTRUCTION OF DIAPHRAGMATIC DEFECTS USING HUMAN ACELLULAR DERMAL MATRIX

**V Hurdle, K Ly, J Yeung, A Graham, G Gelfand, C Schrag**
**Calgary, AB**

**PURPOSE:** Large diaphragmatic defects present a reconstructive challenge, often necessitating the use of synthetic materials. We report our initial experience reconstructing large diaphragmatic defects using human acellular dermal matrix (HADM).
**METHODS:** Patients unable to undergo primary repair of diaphragmatic defects from 2009-2013 were reconstructed with HADM. Information was obtained from chart review to investigate immediate (infection, fluid collection, extubation, time to drain removal) and late post-operative outcomes (hospital length of stay, graft failure, infection). Construct stability was assessed with repeat imaging.
**RESULTS:** Four patients required reconstruction of large hemi-diaphragmatic defects; three in the setting of combined chest wall and diaphragm resection for primary neoplasm and one for a chronic, traumatic diaphragm rupture. None of the patients received radiation therapy. All patients had chest tubes placed intra-operatively which remained in situ from 4-10 days post-operatively. Two patients also had drains placed in dead-space surrounding HADM; these were removed between 6-9 days post-procedure. Post-operative complications were seen in two patients: surgical site cellulitis and failure of extubation due to persistent respiratory failure. Length of hospital stay ranged from 8-65 days. There were no adverse events related to HADM, and all patients remained disease free without evidence of repair failure on radiographic follow-up, which ranged from 9-50 months.
**CONCLUSION:** HADM for reconstruction of large diaphragmatic defects is limited to a small number of patients and modest follow up periods. These results, in conjunction with previously published data, indicate that HADM is a reasonable option for diaphragm repair.
**Learning Objective:**
- *Awareness of HADM use and merits in diaphragm reconstruction.*

## RP04
## OBSTETRICAL BRACHIAL PLEXUS INJURY (OBPI): A NATIONAL CLINICAL PRACTICE GUIDELINE

**C Coroneos, S Voineskos, M Coroneos, A Thoma, J Bain, M Brouwers**
**Hamilton, ON**

**PURPOSE:** To establish an evidence based clinical practice guideline for the primary management of obstetrical brachial plexus injury (OBPI). Two major gaps in OBPI care exist: 1) Timing of referral to a multidisciplinary centre; 2) Treatment of infants with Narakas I-III injuries who do not demonstrate full recovery in the first months of life. Management varies between centres and as a result, may not optimized.
**METHODS:** The working group consists of 12 surgeons representing all 10 Canadian OBPI centres. Canadian incidence and risk factors were reviewed with a prospective national newborn database, 2004-2012. Data was correlated with consultations at Canadian centres to determine referral patterns. A systematic review of primary management was completed. The guideline panel's recommendations were distributed to the working group. A modified Delphi approach to consensus was used; agreement was defined by RAND criteria (panels over 9 members).
**RESULTS:** Incidence is 0.96/1000 births. Risk factors reflect known literature. Systematic review included 7881 patients from 110 articles. Low quality evidence suggests nerve repair reduces functional impairment in OBPI meeting operative indications. Recommendations are summarized: 1) Physically examine for OBPI in newborns with arm asymmetry or identified risk factors; 2) Refer newborns with OBPI to a multidisciplinary centre by 1 month of age; 3) Provide complete pregnancy/birth history and physical exam findings at birth; 4) Multidisciplinary centres should include a therapist and peripheral nerve surgeon experienced with OBPI; 5) Physical therapy should be advised by a multidisciplinary team; 6) Microsurgical nerve repair is indicated in root avulsion and other OBPI meeting centre operative criteria; 7) Common data set includes Narakas classification, limb length, AMS and BPOM for 2 years after birth/surgery.
**CONCLUSION:** Implementation and dissemination of recommendations will guide primary management of OBPI.
**Learning Objectives:**
- *Participants will describe evidence-based best practice for infants with OBPI.*

## RP05
## NEAR-INFRARED IMAGING INEFFECTIVE MODALITY TO ASSESS SKIN GRAFT PERFUSION

**J Brown, D Nickerson, V Gabriel, J Biernaskie**
**Calgary, AB**

**PURPOSE:** Near-Infrared light (NIR) absorption may estimate burn depth by quantifying changes in tissue perfusion. This pilot study used the NIR spectra in a digital image to quantify the changes to the perfusion of a skin graft (SG) in a mouse model to assess its potential use in burn depth assessment.
**METHODS:** One to four month old CD-1 Nude mice had human skin grafted to their backs. At different points after the SG, the mice were anaesthetized and NIR images taken (4 wavelengths: 670, 730, 890, 940). Based on relative oxy and deoxy-hemoglobin concentrations and tissue absorption at specific wavelengths, a relative tissue perfusion value was obtained for the center of the graft

and two points of surrounding skin (cranial and caudal to graft). A t-test determined perfusion differences between the SG and adjacent skin. A linear regression was used to assess the predictive value of time since SG on perfusion.

**RESULTS:** Eight mice were imaged. Relative perfusion values were obtained from the graft and adjacent sites. The range in post- SG time was 11-73 days. Visually, the device inaccurately measured the surface area and the picture quality was insufficient to produce clinically meaningful results. Despite this, the device did detect statistically significant differences between graft and normal skin areas. Skin grafts had an average relative tissue saturation level of ~9% compared to ~32% cranial and ~56% caudal to the graft ($P<0.05$). However, time since the graft was not strongly predictive of the relative saturation of the grafts as detected by NIR ($R^2=0.39$).

**CONCLUSIONS:** The device requires further refinement to measure oxygen levels at a level of sensitivity that would be predictive in either animal models or clinically.

**Learning Objective:**

•*Clinical viability of NIR to assess SG perfusion.*

## RP06

## QUANTIFYING SKIN CHANGES AFTER TOPICAL TREATMENT WITH A NOVEL HYALURONIC ACID-PHOSPHATIDYLETHANOLAMINE CREAM IN A MURINE MODEL

**C Symonette, AK Mann, XW Tan, C Toelg, A Yazdani, E Turley**
**London, ON**

**PURPOSE:** With aging, keratinocytes have a diminished proliferative capacity resulting in atrophic skin with reduced barrier function. This investigation aims to evaluate the effect of daily topical applications of a novel high-molecular weight hyaluronic-acid phosphatidylethanolamine (HA-PE) cream (CA Patent PCT/CIPO 2,703,532) on keratinocyte renewal and epidermal thickness.

**METHODS:** Unmodified hyaluronan (HA) and HA-PE, both containing 500kDa hyaluronan, were mixed separately into a vehicle cream. Each topical formulation was applied once daily onto the shaved backs of female C57BL6 retired breeder mice. At days one, five, and ten following the initial cream application, full-thickness biopsies of treated skin were obtained. In addition, a cardiac puncture was performed for serum C-reactive protein (CRP) analysis. Skin samples were analyzed for markers of keratinocyte proliferation (Ki67), keratinocyte differentiation (K10), and local inflammation (F4/80 murine macrophage marker, TNFα). Validated image analysis software (Image J, NCBI) was used to measure epidermal thickness and quantify the immunohistochemistry markers.

**RESULTS:** The HA-PE treated mice had greater epidermal thickness across all time points compared with controls. The HA-PE group also demonstrated an increase in staining for markers of keratinocyte proliferation (Ki67). However, there was no difference between groups for markers of keratinocyte differentiation (K10).

There was also no difference in either local (F4/80, TNFα) or systemic (CRP) markers of inflammation between groups.

**CONCLUSIONS:** Topical HA-PE shows promise as a novel skin care technology to increase epidermal thickness through enhanced keratinocyte proliferation. In addition, topical HA-PE does not elicit either a local or systemic inflammatory response in a murine model.

**Learning Objectives:**

- *Describe the benefit of high molecular weight hyaluronan on skin*
- *Identify the role of HA-PE on keratinocyte renewal*

## RP07

## REDUCTION IN ALLOGENIC BLOOD TRANSFUSION WITH THE USE OF RECOMBINANT HUMAN ERYTHROPOIETIN IN PEDIATRIC CRANIOSYNOSTOSIS SURGERY: A SYSTEMATIC REVIEW

**H Aljaaly, J Diaz Abele, M Garunanayka, S Aldekhayel, M Gilardino**
**Montréal, QC**

**PURPOSE:** To identify whether preoperative treatment with recombinant human erythropoietin (RHE) reduces blood transfusion requirements for craniosynostosis surgery.

**METHODS:** A systematic review of the literature was conducted using the following keywords: craniosynostosis, cranioplasty, blood loss, blood transfusion, and recombinant human erythropoietin. Included studies provided quantitative measures on perioperative blood transfusions as an outcome following treatment with erythropoietin.

**RESULTS:** We identified 1,335 articles. Of these articles, 8 met inclusion criteria with a total of 603 patients. There were similar demographics between both groups with mean age at surgery of 9.9 months (RHE) vs. 8.1 months. Mean preoperative hematocrit & hemoglobin were higher in RHE group compared to control (39.5% vs. 35.0%, 13.6 g/dL vs. 11.8 g/dL, respectively). While surgical time was comparable (237 minutes vs. 208 min), amount of blood transfused were higher in control group (44.5 mL vs. 220.5 mL). In contrast, rate of allogenic blood transfusion was much less in the RHE group (24.5% vs. 97%).

**CONCLUSIONS:** Preoperative treatment with RHE increases preoperative hematocrit and hemoglobin and decreases the amount and rate of blood transfusion. Future studies may determine whether the risk of RHE administration justifies the benefit of lower transfusion requirements in patients undergoing surgical correction of craniosynostosis.

**Learning Objectives:**

- *Participants will recognize the current evidence supporting the use of preoperative RHE in pediatric craniosynostosis surgery.*

## RP08

## RECONSTRUCTION OF LARGE FACIAL DEFECTS BY A GIANT BILOBED DELTOCERVICAL FLAP: A RETROSPECTIVE STUDY OF 9 CASES

**MA Collin, G Ferland-Caron, JP Giot, L Paek, M Danino**
**Montréal, QC**

**PURPOSE:** Reconstruction of large cervicofacial defects can be challenging. The axial vascularisation of the medially based deltopectoral flap and the platysma flap is well known. Combination of these two flaps to create a large bilobed flap permits the reconstruction of large cervicofacial defects, with respect of color-match skin, axial vascularisation reliability, tissue proximity and ease of closure. To our knowledge, this flap has not been previously described. The purpose of this work is to present the Giant Bilobed Flap in a case-series of 9 patients.

**METHOD:** A retrospective study was conducted in 9 patients who underwent a facial reconstruction with a Giant Bilobed Deltocervical Flap between January 2007 and December 2013. The mean age of the patients was 65 (58-78). Patient demographic and etiologic data were collected. Flap lobes angles and size were measured and analyzed.

**RESULTS:** The study includes 7 males and 2 females. The tissue defect (TD) ranges between 7 and 11cm in the temporofacial, cervical and cheek areas. No primary complications were encountered. The color match, scarring and global aesthetic appearance was judged to be satisfactory.

**CONCLUSION:** The Giant Bilobed Deltocervical Flap is the extension of Zitelli principle to a biaxial flap which is simple, reliable and very flexible for large cervicofacial defect reconstructions with a low rate of complications. It offers a great color match and satisfactory aesthetic results in a single-staged procedure.

**Learning Objective:**

- *At the end of this lecture the learner will be able to describe and consider the use of the Giant Bilobed Deltocervical flap.*

## RP09

## PLASTER VERSUS THERMOPLASTIC SPLINT FOR THE TREATMENT OF A PEDIATRIC METACARPAL NECK FRACTURE: A RANDOMIZED TRIAL

**P Davison, K Wilson, R Burrows, M Bezuhly**
**Halifax, NS**

**PURPOSE:** Does a hand-based thermoplastic splint lead to less stiffness and better compliance than a conventional plaster splint for the immobilization of a pediatric fifth metacarpal neck (boxer's) fracture?

**METHOD:** Pediatric patients who presented with an isolated acute boxer's fracture were recruited. Eligible patients were randomized to receive one of the two splint types, applied by a resident. Patients were immobilized for 3 weeks and then seen for a blinded clinical assessment by the surgeon. Grip strength and range of motion (ROM) measurements were

recorded by a blinded physiotherapist at weeks 3, 6, and 12, after enrollment. Subjects completed the Pediatrics Outcome Data Collection Instrument (PODCI), which is validated for the outcome of an orthopedic injury on quality of life, at weeks 3 and 12. Subjects recorded a daily pain score (0-10 visual analogue scale) during the 3 weeks of immobilization.

**RESULTS:** Forty subjects were enrolled, 20 in each group. There were no major complications and all subjects had satisfactory fracture healing. There was full compliance wearing the splints for all subjects in both groups. There was subjectively greater stiffness immediately after splint removal in the plaster group, but objective ROM measurements were not statistically different (P>0.05). There were differences in several subcategories of the PODCI between the two groups, including the ability to do certain daily activities, wear their desired clothing, and happiness. Daily pain scores were similar between the two groups.

**CONCLUSIONS:** A hand-based thermoplastic splint did not result in superior compliance or ROM compared to a plaster splint. However, it allowed for improved daily function with certain activities and happiness of the subjects during immobilization without adversely affecting pain or clinical outcome.

**Learning Objective:**

- *Participants will learn about a well-tolerated and effective hand-based splint for pediatric boxer's fracture immobilization.*

## RP10

## AUTOLOGOUS BREAST RECONSTRUCTION IN WOMEN OVER VS. UNDER 65 YEARS OF AGE: A MULTI-CENTRE ANALYSIS

**D Song, K Slater, T Zhong, A Hazen, A Pusic, S Madacam**
**Vancouver, BC**

**PURPOSE:** To compare complications and satisfaction following abdominally-based autologous breast reconstruction in patients over versus under the age of 65. Our hypothesis is that autologous reconstruction results in similar outcomes and satisfaction in both groups making it a viable reconstructive option for the elderly patient population.

**METHODS:** A mixed retrospective and cross-sectional study was performed with data from five North American centres (University of British Columbia, New York University, University of Toronto, Memorial Sloan-Kettering Cancer Center, Dartmouth Medical Center) from 2002-2012. Patients were identified retrospectively and chart reviews were performed for demographic information. Patients were sent the BREAST-Q questionnaire and a self-addressed, postage-paid return envelope by post. A $5 Starbucks card was included as an incentive to respond. Non-responders were contacted 2 months after the first mail-out. One additional copy of the questionnaire was distributed to non-responders three months after the first mail-out. Additional patient-reported data collected from the questionnaire included: marital status, level of education, employment status, income, ethnicity, and medical history.

**RESULTS:** A total of 1934 patients were included. 1859 patients were under age 65 and 75 patients were over age 65. Complication rates and patient satisfaction are currently being analyzed.

**CONCLUSION:** This is the largest study to compare patients undergoing breast reconstruction above and below age 65 within the same cohort. Women over the age of 65 represent a minority of patients undergoing this type of reconstruction. The results of this study will determine if complication rates and satisfaction are comparable across these two age groups.

**Learning Objectives:**

- *Understand autologous reconstruction outcomes and satisfaction in post-mastectomy patients over age 65*
- *Compare outcomes and satisfaction for women over age 65 to those for women under age 65*
- *Understand when autologous reconstruction is appropriate for women over age 65*

## RP11

## COMPARISON OF SCAR FORMATION IN BILAYERED CULTURED SKIN SUBSTITUTE VERSUS SPLIT THICKNESS AUTOGRAFT

**J Lee, J Kanevsky, A Bussières, I Perreault, B Nedelec**
**Montréal, QC**

**BACKGROUND:** Hypertrophic scarring and scar contraction dramatically impacts functional outcomes and quality of life. To date there is no objective assessment that compares the scarring outcomes for a bilayered cultured skin substitute (BCSS) compared to split thickness autograft (STAG). Thus, the objective of this cross sectional study is to determine the different scar characteristics of burn patients treated with STAG versus cultured BCSS.

**METHODS:** Burn scars from patients treated with BCSS and STAG were matched for anatomic location and analyzed for comparison. Patient chart review was performed to identify patient demographics, burn injury history, total burn surface area, total full thickness burn area, surgical history and operative notes. Characterization of elasticity, thickness, and pigmentation of burn patients' normal skin, burn wounds treated with BCSS and STAG was done using Cutometer, Mexameter, and high-frequency ultrasound. Statistical comparison between BCSS and STAG sites was done with Wilcox-ranked sum.

**RESULTS:** Six patients were identified as candidates having undergone procedures with both BCSS and STAG. One patient was lost to follow up. The average time to BCSS/STAG procedure post burn was 5 months (SD 1 month). Patient scars were matched by anatomic location and measured on upper and lower extremities and chest wall. There was no statistically significant difference BCSS and STAG with regard to thickness, elasticity, melanin, or erythema. BCSS and STAG sampling showed the burn therapies to be thicker, more firm, less elastic, and more erythematous than normal skin.

**CONCLUSION:** The use of BCSS has comparable outcomes with respect to normal skin in comparison to STAG.

**Learning Objectives:**

- *The participant will understand the principles of cultured bilayered autografts in treating severe burns*
- *The participant will learn the technique and evaluation of implementing a cultured bilayered autograft*
- *The participant will understand why new skin substitutes are necessary in severe burn patients*

## RP12

## CONGENITAL ABSENCE OF THE LATISSIMUS DORSI MUSCLE DURING BREAST RECONSTRUCTION: REPORT OF TWO CASES

**M Secretan, D Edwards, J Wolfli**
**Edmonton, AB**

**PURPOSE:** Congenital absence of a muscle is a rare event but it has been described for a variety muscles in the upper extremity. Isolated congenital absence of the latissimus dorsi muscle outside of Poland's Syndrome is very infrequent with only one case found in the literature. Herein we present two cases of unilateral absence of the latissimus dorsi muscle in the setting of attempted breast reconstruction using a latissimus dorsi musculocutaneous flap.

**CASES:** The first case is a 66-year-old female who underwent a left mastectomy with radiation therapy and was selected to have a reconstruction with a left latissimus dorsi musculocutaneous flap. Intraoperatively the patient was found to have an absent latissimus muscle with only a layer of vestigial fibrous tissue in its place. Pathological analysis of this tissue revealed no muscle.

The second case is a 55-year-old female who had a right mastectomy and axillary node dissection. She had inadequate abdominal tissue for reconstruction and was therefore selected to undergo a right latissimus dorsi flap. During dissection of the latissimus flap she was found to have no latissimus dorsi muscle and a similar layer of fibrous tissue in its place. A CT scan done preoperatively was reviewed following the case and there was no right latissimus muscle present.

**CONCLUSIONS:** Congenital absence of the latissimus dorsi muscle is a rare anatomic variant that anyone who uses this muscle for breast reconstruction should be aware of.

**Learning Objectives:** •*Participants will learn that congenital absence of the latissimus dorsi muscle is a rare event that should be recognized, as this muscle is often used for reconstructive procedures.*

# ABSTRACTS/RÉSUMÉS

## Groupe pour L'Avancement de la Microchirurgie Canada (GAM)

Abstracts presented at the 34th Annual Meeting / 34e Réunion annuelle
**Dr Lucie Lessard:** President / Présidente
**Dr Sheina Macadam:** Secretary / Secrétaire

### 01

### ENHANCED RECOVERY AFTER MICROSURGICAL BREAST RECONSTRUCTION: A COHORT STUDY

**V Lemaine, NJ Batdorf, JJ Martinez-Jorge, KV Ballman, WJ Goede, M Saint-Cyr**
**Rochester, MN, USA**

**PURPOSE:** No data exists on the use of Enhanced Recovery after Surgery pathways (ERAS) in plastic surgery. This study's goal was to evaluate the use of ERAS in microsurgical breast reconstruction (MBR).

**METHOD:** A multimodal ERAS was developed to address unique needs of MBR patients and instituted in 11/2012. Between 11/2011 and 10/2013, consecutive cases were reviewed. In this retrospective cohort study, the ERAS group was compared with historical controls. The primary outcome was a reduction in hospital length of stay (LOS). Thirty-day surgical outcomes were assessed to evaluate safety. Continuous variables were compared with a Wilcox rank sum test and categorical variables were compared with a chi-squared or Fisher's exact test.

**RESULTS:** Fifty-one women were included in the ERAS group and 52 in the control group. Length of PCA use decreased from 59.6 hours in controls to 21.4 hours in the ERAS group (P<0.0001). ERAS resulted in a 2.1-day reduction in LOS (P<0.0001) with stable unplanned readmission rates at 30 days (P=0.28). No difference was observed in rate of postoperative complication at 30 days (P=0.51). Thirty-day rates for flap loss (ERAS group 3.9% versus control group 0%, P=0.24), hematoma (ERAS group 5.9% versus control group 7.7%, P=1.0), pulmonary emboli (ERAS group 0% versus control group 3.9%, P=0.50) and deep venous thrombosis (ERAS group 0% versus control group 1.9%, P=1.00) did not significantly differ between the two cohorts.

**CONCLUSION:** To date, this is the first ERAS specific to MBR. It promotes successful early recovery and is associated with reduced LOS and opioid intake without increase in surgical morbidity.

**Learning Objectives:**

- *Can explain the concept of ERAS*
- *Can demonstrate the efficacy and safety of ERAS in microsurgery*
- *Can effectively apply ERAS to their microsurgery practice*

### 02

### FACTORS AFFECTING MICROVASCULAR COMPLICATIONS IN AUTOLOGOUS BREAST CANCER RECONSTRUCTION

**S Haykal, S Bagher, J Cha, S Hofer, T Zhong, A O'Neill**
**Toronto, ON**

**PURPOSE:** There are a number of factors that are frequently cited as contributing to microvascular complications following free-flap reconstruction including previous treatment modalities, patient co-morbidities and lifestyle factors. In many cases however there is a lack of evidence to support these widely held beliefs. This study will provide a critical review of the existing literature and also determine the factors affecting microvascular complications in our own large series of consecutive breast reconstructions.

**METHODOLOGY:** A Medline database review was performed to identify all human clinical studies specifically examining risk factors for microvascular complications in breast reconstruction up to July 2013. A retrospective review was performed of all patients undergoing microvascular breast reconstruction at University Health Network, Toronto over a 5-year period. The timing and nature of the surgery, adjuvant therapies, co-morbidities and lifestyle factors were recorded. Intra-operative events and post-operative microvascular complications were identified and recorded. Descriptive statistics were performed and the significance of each bivariate analysis was calculated using the Fisher's exact test (categorical variables) and Wilcoxin rank sum test (continuous variables).

**RESULTS:** Sixty papers met the search inclusion criteria. No independent risk factors specific to microvascular complications are identified in the current literature. Three-hundred and eighty five consecutive free flap breast reconstructions were reviewed. Smoking was associated with an increase in intra-operative events (P=0.03; OR 3.3) but not post-operative complications. Intra-operative events were predictors of post-operative complications (P=0.04; OR 2.3).

**CONCLUSION:** Perceived risk factors for microvascular complications are not supported by the current literature. Our findings of our large series of consecutive autologous breast reconstructions suggest that smoking may make the intra-operative course more challenging but did not have an effect on post-operative microvascular complications.

**Learning Objectives**

- *To evaluate the relationship between co-morbidities and intra-operative events.*
- *To evaluate the relationship between co-morbidities and post-operative complications*

### 03

### A PROSPECTIVE STUDY EVALUATING THE VIABILITY OF THE SIEA FLAP IN PATIENTS WITH PFANNENSTIEL SCARS

**W Jalil, L Sigurdson, T Hayakawa, K Dalke, E Buchel**
**Winnipeg, MB**

**PURPOSE:** The Superficial Inferior Epigastric Artery (SIEA) flap is arguably the least traumatic abdominal based free flap available for breast reconstruction. Unfortunately, in many cases prior scars make its use questionable. Traditionally, Pfannenstiel scars have resulted in most surgeons not considering the SIEA flap as an available option for breast reconstruction. This study proposes to prospectively evaluate the presence, and viability of the SIEA vascular system in these patients for autologous breast reconstruction.

**METHOD:** An ethics board approved, prospective, randomized trial looking at the differences between the DIEP and SIEA flap underwent a subset analysis of all patients with Pfannenstiel scars. Sixty-two patients receiving 96 abdominal based free flaps (28 unilateral and 34 bilateral) completed the study to date. All patients with Pfannenstiel scars were evaluated after randomization into either the DIEP or SIEA flap group.

**RESULTS:** Of the sixty-two patients receiving free-flaps, eighteen had Pfannenstiel scars directly affecting thirty-one flaps. Pre-operative randomization resulted in 14 SIEA flaps and 17 DIEP flaps. Of the 14 flaps assigned to the SIEA group, six (43%) SIEA flaps were suitable for use. In the 17 flaps assigned to the DIEP group, 7 (~41%) had sufficient SIEA pedicles to allow free flap transfer.

**CONCLUSIONS:** This is the first prospective study looking at the SIEA flap in patients with Pfannestiel scars. In patients randomized to either SIEA/DIEP flaps, 13 (42%) had sufficient vessels to perform a SIEA Flap. This is in contrast to other studies reporting the superficial system to be preserved in 5 percent of their patients with Pfannenstiel scars undergoing DIEP reconstruction. In conclusion, the presence of a Pfannenstiel scar should not exclude the patient from the benefits of a SIEA flap for breast reconstruction.

**Learning Objectives:**

- *The audience will understand the impact of a previous Pfannenstiel scar on the SIEA Flap*

## 04

## THE CLINICAL VALIDITY OF CT ANGIOGRAPHY IN DIEP FLAP BREAST RECONSTRUCTION

**S Sikora, E Bovill, M Martin, S Macadam**
**Vancouver, BC**

**PURPOSE:** CT angiography (CTA) has been described as the gold-standard imaging modality prior to DIEP-flap breast reconstruction. Recent studies show excellent correlation between CTA and operative perforator location, but not their clinical significance. This study seeks to evaluate the validity of CTA in DIEP reconstruction.

**METHODS:** Preoperative CTA of the deep inferior epigastric system was obtained in 37 patients (49 flaps). Perforators were described by a single radiologist, according to an algorithm designed by the primary surgeon. This comprised DIEA-branch anatomy, perforator location, size, and intramuscular course of perforators. The primary surgeon documented planned and used perforators before and after the operation. A second plastic surgeon blinded to the planned perforator also reviewed each CTA report. A nationwide survey was then performed to assess current practice regarding the use of preoperative CTA in DIEP breast reconstruction.

**RESULTS:** A total of 36 out of 47 (77%) planned DIEP flap perforators were correctly predicted. This included 2/47 where an unplanned additional neighbouring perforator was added intraoperatively. The correct side was predicted in 34/35 (97%) of unilateral DIEP flaps. Of the 11 flaps (23%) where an alternative perforator was selected, 6 (55%) were due to better perfusion on differential clamping and 2 were unplanned SIEA flaps. The inter-rater reliability kappa value between the two surgeons was 0.8

**CONCLUSION:** CTA mapping of perforators prior to DIEP flap surgery increases surgeon confidence and reduces operative time. This study highlights the added value of a detailed radiological report describing perforator anatomy rather than a simple description of location. Significant perforators should not be sacrificed until the anticipated perforator(s) have been isolated and evaluated, but in a unilateral flap the donor side may be predicted preoperatively with a very high degree of confidence.

**Learning Objectives:**

- *The clinical validity of CT angiogram in DIEP breast reconstruction and how this may be optimized by close collaboration with radiological colleagues*
- *Current national trends in the use of CTA*

## 05

## MINIMISING BLOOD TRANSFUSION RATES IN MICROVASCULAR BREAST RECONSTRUCTION

**M Barandun, J Cha, S Haykal, SOP Hofer, T Zhong, A O'Neill**
**Toronto, ON**

**PURPOSE:** Avoiding peri-operative blood transfusion is widely accepted to improve the safety of elective surgical procedures. Although microvascular breast reconstruction has become a routine procedure at many centres, high post-operative blood transfusion rates of up to 80% are commonly reported in the literature. This study examines the transfusion rates and associated risk factors in a large series of microvascular breast reconstruction patients at our centre.

**METHODS:** A retrospective review of patients undergoing microvascular breast reconstruction at our institution was performed. We collected patient variables including age and BMI, medical parameters including comorbidities, medications, radiation and chemotherapy history and operative details such as laterality and timing of reconstruction. Intraoperative and post-operative medical and surgical complications were recorded. Haemoglobin, haematocrit and mean corpuscular volumes were measured pre-operatively and on the first post-operative day.

**RESULTS:** The records of 350 patients who underwent microvascular autologous breast reconstruction were reviewed. A total of 1.1% of patients required post-operative blood transfusions. All patients who received transfusions had developed post-operative hematomata, requiring surgical evacuation. There was no significant association between laterality, timing of reconstruction or adjuvant therapies and transfusion rates. Similarly we did not identify any relationship between patient factors such as age, obesity or medical co-morbidities and transfusion rates. No complications attributable to low haemoglobin levels were encountered in non-transfused patients.

**CONCLUSION:** This study demonstrates that post-operative blood transfusion can be avoided in the majority of microvascular breast reconstructions. We did not identify any factors that may positively predict the need for transfusion. Our conservative approach to post-operative transfusion is well tolerated by patients with no adverse effect on post-operative complication rates or recovery.

**Learning Objectives:**

- *Participants will understand that microvascular breast reconstructions can be safely performed with low transfusion rates.*

## 06

## FIRST REPORT AND CASE SERIES OF THE PERFORATOR DCIA FLAP FOR BREAST RECONSTRUCTION

**E Buchel, T Hayakawa**
**Winnipeg, MB**

**PURPOSE:** The deep circumflex iliac artery (DCIA) flap was first described in 1979 by Taylor. As the main supply of the groin flap and free osteocutaneous flap, its donor site morbidity and difficult harvest limited its use. Hartrampth described the "Rubens" flap in 1998 as a myocutaneous flap. In 2007 Morris described the anatomic basis of the DCIA perforator flap, as a potential way to lengthen the pedicle for the osteocutaneous flaps. Recently we introduced the perforator DCIA flap for autologous breast reconstruction. The purpose is to document a harvest technique, ICG perfusion results, indications, and outcomes of the perforator DCIA flap.

**METHOD:** The study is a retrospective review of our first 20 consecutive perforator DCIA flaps in breast reconstruction. The flap was used either as the sole method of reconstruction, or in combination with a DIEP flap as part of a 2 flap to one breast method of reconstruction. Indications were either absence of DIEP perforators, or insufficient tissue requiring the recruitment of the adjacent DCIA perforatorsome

**RESULTS:** Twenty consecutive DCIA flaps were reviewed. Patient's ages ranged from 33- 67 years, average BMI of 28. One patient was an active smoker. 90% percentage were bilateral reconstructions. Three patients had prior harvest of the abdominal tissue, while 9 did not have enough anterior abdominal tissue for the required reconstruction. Average pedicle length measured 6 cm with 1.5 and 2.0 mm artery and vein diameters respectfully. All flaps survived. Reconstructed breast volumes were subjectively equivalent or greater than the original breast volumes. Donor site complications occurred in 2 of 12 patients. One emergent return to the OR occurred for pedicle twisting.

**CONCLUSIONS:** The perforator DCIA flap is an excellent option for secondary autologous breast reconstruction when anterior abdominal tissue is unavailable or as a DIEP-DCIA combination flap for increased volume. Knowledge of the perforator anatomy limits donor morbidity, expedites harvest, allowing for rapid reliable flap transfers.

**Learning Objectives**

- *Describe the anatomy of the DCIA perforator flap*
- *Understand the indications for the perforator DCIA flap in autologous breast reconstruction.*
- *Understand the limitations of the DCIA perforator flap in autologous breast reconstruction.*

## 07

## FREE FLAP SOFT TISSUE RECONSTRUCTION OF COMPLEX TRAUMATIC UPPER EXTREMITY INJURIES: AN ALGORITHMIC APPROACH IN THE NORTH AMERICAN POPULATION

**Arash Izadpanah, T Hayakawa, A Islur**
**Winnipeg, MB**

**INTRODUCTION:** Complex soft tissue defects of the hand are common. Obtaining durable soft tissue coverage is often the only consideration chosen by the reconstructive surgeon when deciding upon their reconstruction. Existing algorithms for these defects are outdated and incorporate reconstructions that sacrifice adjacent digital tissue or use of pedicle flaps, both of which require prolonged immobilization of the extremity or cause significant donor site morbidity. Furthermore these algorithms do not take into account the need for tendon gliding, pliability of the reconstruction or sensory/tactile requirements. With advances in microsurgery and technical innovations over the past decade, we present our reconstructive algorithm for microsurgical reconstruction of traumatic upper extremities defects.

**MATERIAL AND METHODS:** All cases performed by 2 upper extremity reconstructive surgeons between 2007-2014 at our institution were reviewed. We present several illustrative cases for different zones, size, and extent of injury in the upper extremity including partial and circumferential defects of the fingertips, digits, palm, dorsum, 1st webspace, and forearm. Functional and aesthetic requirements of each zone and the ideal free tissue reconstructive options available to meet those requirements are discussed. Reconstructions include traditional free flaps as well as newer innovations such as 2nd toe pulp flaps, venous-flow-through-flaps, and partial muscle flaps. A new algorithm for microsurgical reconstruction of complex hand soft tissue defects will be presented.
**CONCLUSIONS:** Current algorithms available for soft tissue defects of hand and upper extremities are often associated with significant donor site morbidity and lack sensibility and tendon gliding abilities. A new algorithm is proposed using microsurgical techniques for coverage of extensive soft tissue defects of upper extremities.
**Learning Objectives:**
- *The listeners will be introduced to a new algorithm for coverage of complex soft tissue defects of upper extremities depending on size and location of defect.*

## 08
## MICROSURGICAL FLAP FAILURE CAUSED BY HEPARIN-INDUCED THROMBOCYTOPENIA: A REVIEW OF THE LITERATURE AND AN ALGORITHM

**S Aldekhayel, H Retrouvey, A Izadpanah, T Zadeh**
**Montréal, QC**

**PURPOSE:** Identify the prevalence and management approach of Heparin-Induced Thrombocytopenia (HIT) among patients presenting with venous thromboembolisms (VTEs) who are considered for microsurgical procedures.
**METHODS:** MedLine Hematological literature review of prevalence of HIT among VTEs was done. Also, a review of all reported cases of HIT in microsurgical reconstruction has identified 6 studies that are included in our review.
**RESULTS:** Twelve flaps were performed in 8 patients who developed HIT postoperatively. Only two flaps were salvaged (17%) with the prompt use of Argatroban (direct Thrombin inhibitor). All other attempts of flap salvage were futile. Classic thrombocytopenia manifested early in two patients (17%) and in delayed fashion in 3 patients (25%). Our patient manifested his HIT with multiple preoperative VTEs without thrombocytopenia. His subsequent free flap reconstruction had failed. A review of Hematology literature revealed a prevalence of HIT of as high as 12% amongst patients presenting with VTEs. Such a high prevalence would require extra vigilance in managing such a cohort. An algorithm is proposed to approach such a dilemma and implement adequate treatment measures prior to commencing any microsurgical procedures in those patients in order to minimize any untoward consequences.
**CONCLUSION:** HIT is a serious adverse effect of heparin particularly in the setting of microsurgery and requires a particular awareness of the microsurgeon for prompt management of such an entity. It is potentially preventable if high index of suspicion is entertained and proper treatment is implemented in a timely fashion.
**Learning Objectives:**
- *Participant will be able to outline different manifestations and management approaches of HIT in patients undergoing microsurgical reconstruction.*

## 09
## REPLACING LIKE WITH LIKE: AN ALGORITHMIC APPROACH TOWARDS TOTAL FUNCTIONAL ABDOMINAL WALL RECONSTRUCTION

**IR MacArthur, T Hayakawa, E Buchel**
**Winnipeg, MB**

**PURPOSE:** Functional abdominal wall reconstruction remains challenging as no single operation can be reliably chosen for all patients, due to complexities like large defects, functional loss, and the presence of infected mesh, ostomies, and enterocutaneous fistulas. An algorithmic approach would assist in choosing a reconstructive procedure for this patient population.
**METHODS:** A retrospective review of all abdominal wall reconstructions performed at our institution over a 5 year period was conducted. The algorithm used to choose treatment options was also described.
**RESULTS:** Forty-nine patients met inclusion criteria (average BMI 27.7). Enterocutaneous fistulas were present in 40% of patients, ostomies in 30%, and exposed, infected mesh in 42%. Mean number of previous abdominal surgeries was 4. Component separations alone were used in 19 patients, and were combined with either synthetic mesh or acelluar dermal matrix in 4 and 6 patients respectively. 17 patients required free flaps. Two free flap patients underwent flap loss, due to pedicle avulsion from the DIEA recipient vessels. Because of this, the intra-abdominal gastroepiploic vessels became the chosen recipient vessels. Seven patients receiving free flaps had innervated chimeric rectus femoris and anterolateral thigh (ALT) free flap reconstructions. In these patients, acellular dermal matrix was used as an underlay, followed by chimeric rectus femoris – ALT flaps to restore the normal anatomy of fascia – muscle – fascia of the functional abdominal wall. Primary healing was achieved in 84%.
**CONCLUSIONS:** Individualized treatments are required for patients undergoing abdominal wall reconstruction. An algorithm including microvascular reconstructive options permits restoration of the abdominal wall to as close to normal anatomy as possible.
**Learning Objectives:**
- *Participants will learn an algorithmic approach to abdominal wall reconstruction*
- *Participants will appreciate the role of microsurgical reconstruction for the abdominal wall*

## 10
## ARTERIOVENOUS FISTULAE FOR MICROVASCULAR HEAD AND NECK RECONSTRUCTION: ONE OR TWO-STAGE TECHNIQUE?

**S Moubayed, JP Giot, L Guertin, P Harris, J Boumerhi, M Danino**
**Montréal, QC**

**PURPOSE:** To describe the indications, technique and complication rate of our series of head and neck microvascular reconstruction using arteriovenous fistula in a two-stage procedure. These results will be compared to published data on the one-stage procedure.
**METHOD:** Retrospective observational case series at a tertiary referral hospital center. Included cases will have underwent two-stage microvacular reconstruction for head and neck defects. Patient demographics, indication for reconstruction and defect description will be reported. Technique including fistula length, type of flap, and recipient vessels will be described. Major (flap failure or death) and minor (any other) complications will be reported. These rates will be compared to a literature review of cases of one-stage microvascular head and neck reconstruction.
**RESULTS:** We report 7 cases of two staged head and neck reconstruction using arteriovenous fistulae. All fistulas were created 4 to 6 weeks prior to free flap with a saphenous venous graft. Arterial anastomosis was latero-terminal on the subclavian artery. The venous anastomosis was termino-terminal on the external jugular vein for 3 cases and latero-terminal on the subclavian vein for 4 cases. The reported major complication rate in the literature for the one- and two-stage techniques are 13% and 7%, respectively, and minor complication rates were 31% and 28%.
**CONCLUSIONS:** The two-stage arteriovenous fistula technique for microvascular head and neck reconstruction is a technique with low reported complication rates both in the literature and in our experience.
**Learning Objectives:**
- *Participants will be able to identify the indications for microvascular head and neck reconstruction using arteriovenous fistulae*
- *Participants will be able to describe the two different techniques for microvascular head and neck reconstruction using arteriovenous fistulae*
- *Participants will be able to compare the published complication rates between the one and two staged techniques*

## 11
## MICROSURGICAL PRESERVATION OF AMBULATION IN LOWER EXTREMITY SARCOMA TREATMENT

**IR MacArthur, E Buchel, T Hayakawa**
**Winnipeg. MB**

**PURPOSE:** Lower extremity sarcoma treatment has evolved from primarily amputation towards limb salvage when possible to preserve ambulation. Sarcoma resections frequently result in massive defects which usually require microsurgical reconstruction. Until now, success has been defined largely as having a flap to survive in the hostile conditions of a radiated surgical field.

This series demonstrates that not only can massive tissue defects be reliably reconstructed with preservation of ambulation, but that immediate functional reconstructions can be successful at restoring ambulation, potentially expanding the indications for limb salvage procedures.

**METHODS:** A 5-year retrospective review of microsurgical reconstructions for limb salvage in lower extremity sarcoma patients.

**RESULTS:** Over a five-year period, 22 patients (average age 52.2 years) underwent free flap reconstructions for 23 sarcomas with an average follow-up of 14 months. 85% of patients underwent neoadjuvant radiation therapy. The thigh was the most common tumor site (56.5%) and 3 named muscles were resected on average. Perforator flaps were used in the majority of reconstructions (68.18%), and functional muscle transfers or immediate tendon transfers were used in three patients. There were no flap take-backs or failures, and all patients achieved ambulation. Two patients in the series died, each from metastatic disease and not local recurrence.

**CONCLUSIONS:** Microsurgical reconstruction of lower extremity sarcoma defects enables patients to resume ambulation. The treatment model is now beyond achieving success in a radiated tissue bed. Both preservation and restoration of function utilizing functional microsurgical reconstructions should now be considered safe and effective in lower extremity sarcoma limb salvage.

**Learning Objectives:**

- *Participants will be able to describe the role of free flap reconstruction in lower extremity sarcoma treatment*
- *Participants will appreciate the role of tendon transfers and functional muscle transfers in lower extremity sarcoma treatment*

## 12

## SIMULATION FOR MICROVASCULAR ANASTOMOSIS TO THE INTERNAL MAMMARY VESSELS

**D Kozan, C Petropolis, T Hayakawa**
**Winnipeg, MB**

**PURPOSE:** Performing microsurgical anastomosis to the internal mammary vessels for breast reconstruction is a difficult skill for learners to acquire due to often adverse physical characteristics of the surgical field. Typically, anastomosis must be performed in a deep cavity and in the face of uncontrollable movement from the heart and lungs. We describe a surgical simulator that mimics these adverse conditions to provide learners with a high fidelity practice environment in which to hone their skills.

**METHOD:** A simulation rig was constructed using two linear actuators, controlled by laptop-programmable microcontroller, distorting a fluid filled bag which served as a platform for the surgical field. Fresh porcine internal mammary vessels were situated in the bottom of a cavity to simulate the depth and narrowness of the working space. The actuators were programmed to oscillate at different frequencies, resulting in multi-phasic movement of the simulation tissues.

**RESULTS:** The element of depth forces the learner to operate in a more vertical orientation, which closely approximates operating in the typical cavity of the chest wall. Motion of the simulation tissues allows the learner to become more familiar with the real-world conditions in which they will be required to perform microsurgery. Porcine internal mammary artery is of adequate size and wall-thickness for microvascular anastomosis. The layer of adventitia surrounding the artery is similar to that of human vessels, allowing for realistic vessel preparation and handling.

**CONCLUSIONS:** This microsurgical simulation model provides increased fidelity and difficulty over traditional models for teaching microvascular anastomosis to the internal mammary vessels.

**Learning Objectives:**

- *The audience will understand the ways in which this simulation prepares the learner for the challenges of microvascular anastomosis to the internal mammary vessels.*

## 13

## PRIMARY NERVE REPAIR IN OBSTETRICAL BRACHIAL PLEXUS INJURY (OBPI): A SYSTEMATIC REVIEW AND META-ANALYSIS

**C Coroneos, S Voineskos, M Coroneos, A Thoma, J Bain, M Brouwers**
**Hamilton, ON**

**PURPOSE:** To determine the effectiveness of primary nerve repair compared to non-operative management for physical function in obstetrical brachial plexus injury (OBPI). This is the first review comparing operative and non-operative outcomes.

**METHODS:** Electronic databases were searched (MEDLINE, EMBASE, CINAHL, Cochrane Central). Included studies were randomized controlled trials, observational studies and case series (n>9) of patients under 2-years-old undergoing nerve repair and/or non-operative management of OBPI and reporting incidence of functional impairment. Two reviewers independently screened articles and extracted study, population, intervention and outcome data using objective a priori criteria. Bias was assessed for each study. Overall quality of evidence was evaluated for each outcome. Subgroup analyses explored clinical and methodological heterogeneity.

**RESULTS:** Nine cohort studies including 222 patients directly compared nerve repair and non-operative management in patients meeting criteria as defined by the author of each study. Nerve repair significantly reduces functional impairment, RR 0.58, 95% CI 0.43 to 0.79, P<0.001, $I^2$=0%. Thirty case series including 1128 patients undergoing operative management were indirectly compared to 19 case series including 444 "gray zone" patients with non-operative management. With nerve repair, functional impairment occurs in 23% (95% CI 17-30%) versus non-operative, 58% (95% CI 42-73%); comparison RR 0.39, (95% CI 0.33-0.45. The difference in proportions is significant, $\chi^2$=147.8, P<0.001. In operative management, death occurs in 0%, major adverse events in 1.5% and minor in 5.0%.

**CONCLUSION:** Low-quality evidence suggests nerve repair reduces functional impairment in OBPI meeting operative indications. Non-operative management in author-defined gray zone patients leads to a high proportion of functional impairment. Residual impairment with non-operative management is underreported in the literature. Mortality is not a common risk of modern paediatric microsurgical nerve repair.

**Learning Objectives:**

- *Participants will identify the benefit of nerve repair in OBPI.*
- *Participants will describe common sources of bias in the plastic surgery literature.*

## 14

## ROBOTIC MICROSURGERY: VALIDATING AN ASSESSMENT TOOL AND PLOTTING THE LEARNING CURVE

**T Alrasheed, J Selber, J Liu, M Hanasono, C Butler**
**Toronto, ON**

**BACKGROUND:** The surgical robot has emerged as a potentially useful tool in microsurgery. The purpose of this study was to develop a validated assessment instrument, and assess the learning curve for robotic microsurgery. The authors hypothesized that subjects would demonstrate improvement across multiple domains of performance with repetition of robotic microsurgical tasks.

**METHODS:** In part 1, a novel assessment instrument called the Structured Assessment of Robotic Microsurgical Skills (SARMS) was tested. Four blinded expert evaluators graded 6 robotic microsurgery videos and inter-rater reliability was determined. In part 2, a cohort of 10 participants at various skill levels performed five robotic microvascular anastomoses. All 50 sessions were subjected to blind evaluation using SARMS. Primary outcome measures included changes in operative time over the 5 sessions, and changes in SARMS scores for all skill areas.

**RESULT:** Inter-rater reliability for the SARMS instrument was excellent for each skill area, demonstrated by Cronback alpha scores greater than 0.9 in each category across evaluators. All skill areas improved significantly for all participants and operative time decreased for all participants over the course of the study. The results showed an initial steep ascent in technical skill acquisition followed by more gradual improvement, and a steady decrease in operative times that ranged from 1.2 hours to 9 minutes.

**CONCLUSION:** The Structured Assessment of Robotic Microsurgery Skills is a valid instrument for assessing microsurgical skill. Subjects at all levels of training, ranging from minimal microsurgical experience to expert microsurgeons gained proficiency over the course of 5 robotic sessions.

# POSTERS

## P01

### REVERSE RADIAL ARTERY FLAP PERFORATOR ANATOMY AND CLINICAL APPLICATIONS

Colin P White[1], Anna Steve[2], Edward W Buchel[3], Thomas E Hayakawa[4], Steven F Morris[5]
[1]CSPS Member; [2]University of Saskatchewan, Saskatoon, SK; [3,4]University of Manitoba, Winnipeg, MN; [5]Dalhousie University, Halifax, NS

**PURPOSE:** The pedicled radial forearm flap is a well-known option for the treatment of dorsal hand wounds. The flap is notorious for venous congestion in the post-operative period. We documented all cutaneous perforators of the radial artery in human cadavers after whole body lead-oxide injection to quantify and confirm previous reports of the abundance of distal perforators. We give an example of the clinical perforator applications using a modified reverse radial forearm flap.

**METHOD:** Four human cadavers (n=6 forearms) underwent whole body injection using the modified lead- oxide injection technique. Computed tomography (DICOM) images were imported using MIMICS software to create three-dimensional (3D) reconstructions of each specimen. The number, emerging diameter, length from origin, course and location of all perforators of the radial artery were documented in the six forearms.

(17%) and in delayed fashion in 3 patients (25%). Our patient manifested his HIT with multiple preoperative VTEs without thrombocytopenia. His subsequent free flap reconstruction had failed. A review of Hematology literature revealed a prevalence of HIT of as high as 12% amongst patients presenting with VTEs. Such a high prevalence would require extra vigilance in managing such a cohort. An algorithm is proposed to approach such a dilemma and implement adequate treatment measures prior to commencing any microsurgical procedures in those patients in order to minimize any untoward consequences.

**CONCLUSION:** HIT is a serious adverse effect of heparin particularly in the setting of microsurgery and requires a particular awareness of the microsurgeon for prompt management of such an entity. It is potentially preventable if high index of suspicion is entertained and proper treatment is implemented in a timely fashion.

**Learning Objectives:**

- *Participant will be able to outline different manifestations and management approaches of HIT in patients undergoing microsurgical reconstruction.*

## P02

### THE USE OF THE RADIAL STYLOID IN OSTEOCUTANEOUS RADIAL FOREARM FREE FLAP RECONSTRUCTION OF MANDIBULAR DEFECTS

Jennifer Matthews[1], Wendy Ng[2], Stuart Archibald[3], Carolyn Levis[2]
[1]McMaster University; [2]McMaster University, Plastic Surgery; [3]McMaster University, Head & Neck Surgery, Hamilton, ON

**PURPOSE:** The osteocutaneous radial forearm free flap (OC-RFFF) is an extremely usefully tool in mandibular reconstruction, particularly inpatients who are not candidates for a fibular bone flap. In the study we report our experience with incorporating the radial styloid as part of the OC-RFFF to optimize mandibular reconstruction.

**METHODS:** The OC-RFFF is raised in the typical fashion with the following modifications: (1) the brachioradialis (BR) insertion is sharply removed from the radius. (2)The radial styloid is exposed and included in distal osteotomy. (3) The defect in the radius is packed with synthetic bone substitute. A reconstruction plate is applied if the harvested bone is >30% of the cross-sectional area in a select group of patients. (4) The styloid is used specifically to recreate the contour of a manidular symphyseal/parasymphyseal region which can reduce the need for multiple osteotomies. (5) The BR tendon is re-inserted via drill holes to the remaining radius. A retrospective chart review of patients having mandibularre construction with the OC-RFFF including the radial styloid will be conducted (N?10). Patient profiles and post-operative complications will be reported.

**RESULTS:** To be reported.

**CONCLUSION:** The radial styloid contains quality bone that is ideally shaped to reconstruct the contour of the mandibular symphysis without additional osteotomies. Use of the styloid provides access to several centimeters of extra bone distally and it is not an essential component of the radiocarpal joint. The retrospective review will determine the rate of complications associated with this procedure.

**Learning Objectives:**

- *To understand the surgical technique for harvesting the OC-RFFF with the radial styloid.*
- *To understand the value of harvesting the radial styloid for mandibular reconstruction.*
- *To learn the types of patients who undergo this procedure and the postoperative complications in this group.*

## P03

### RESTORING PREHENSION/WRIST FLEXION AND DECREASING SPASTICITY 11 YEARS FOLLOWING SPINAL CORD INJURY: A CASE STUDY OF USE OF THE BRACHIALIS NERVE TRANSFER

Kristen M Davidge[1], Lorna C Kahn[2], Christine Novak[1], Neringa Junknis[2], Rimma Ruvinskaya[2], Ida K Fox[2]
[1]University of Toronto, Toronto, ON; [2]Washington University in St Louis, St Louis, MO, USA

**PURPOSE:** Nerve transfers are a novel technique to restore function in patients with spinal cord injury (SCI). The purpose of this study was to review the evaluation, management and preliminary outcome of the brachialis-to-anterior interosseous nerve (AIN) transfer for restoration of prehension in cervical SCI.

**METHODS:** A case study was performed of a patient undergoing brachialis-to-AIN and brachialis-to-flexor carpi radialis (FCR) nerve transfers 11 years following an incomplete C4-level SCI. Donor morbidity and functional outcome were evaluated at 6 weeks and then every three months post-operatively using quantitative and self-report measures. The preoperative clinical and electrodiagnostic assessments were reviewed in relation to functional outcome.

**RESULTS:** This 31-year old patient demonstrated normal deltoid, biceps and brachialis function, MRC 4- wrist extension, and MRC 3 pronation in the right extremity at presentation. Hand function was achieved through the tenodesis effect and was complicated by significant spasticity. Preoperative electrodiagnostic evaluation suggested no superimposed lower motor neuron injury.

Nerve transfers were performed 9 cm proximal to the antecubital fossa. Intraoperatively, both donor and recipient nerves demonstrated excellent motor response to nerve stimulation indicating continuity of the neuromuscular junction. Operative time was 162 minutes, and length of hospitalization was 1 day. There were no complications.

Motor recovery was first noted at 5 months postoperatively. Examination at 9 months follow-up demonstrated volitional control over wrist, thumb, index and middle finger flexion.

**CONCLUSION:** With appropriate patient selection, the brachialis-to-AIN transfer can successfully restore volitional hand function and may play a role in managing dysfunctional spasticity even more than 10 years following SCI. In so doing, such nerve transfers have the potential to significantly improve independence in performing daily tasks, such as feeding, as well as quality of life, while having minimal donor morbidity and post-operative down-time.

**Learning Objectives:**

- *To review the novel application of nerve transfers in SCI*

## P04

### DEMYSTIFYING MICROSURGERY: EMERGING TRENDS IN CURRENT PRACTICE

Ian Robert MacArthur[1], A Islur
[1]University of Manitoba, Winnipeg, MN

**INTRODUCTION:** Certain aspects of microsurgical practice remain controversial. These include issues pertaining to patient selection, preoperative investigations, flap choice and post-operative anti-coagulation / thromboembolic prophylaxis. This study attempts to characterize current practices regarding these topics.

**METHODS:** A 33 question survey was designed and disseminated to the membership of the American Society for Reconstructive Microsurgery (ASRM). Topics included practice demographics, patient selection,

anti-coagulation, breast reconstruction, lower extremity reconstruction and replantation/upper extremity reconstruction.

**RESULTS:** 93 ASRM members responded (14% response rate), the majority in practice for 5-10 years (30.1%) or less than 5 years (26.9). The majority performed head and neck (75.3%), breast (82.8%), upper extremity (74.2%) and lower extremity (92.4%) reconstruction, but only 47.3% performed replantation. ASA was the most common post-operative anti-coagulant used (62.4%), followed by heparin (17.2%), dextran (9.68%), and toradol (6.4%), with 30.2% noting that they did not employ these methods. 51.8% of respondents did not restrict caffeine intake post-operatively. Most surgeons performed free flaps on patients who smoked (63.7%), and the majority of respondents did not obtain pre-operative imaging of flap harvest sites for breast reconstruction (55.8%). The most commonly performed breast reconstructions flaps were the DIEP (97.4%), SIEA (67.5%) and TRAM flaps, followed by TUG (54.6%), SGAP/IGAP (49.4%) or other (11.7%) flaps. Regarding lower extremity reconstruction, 91.5% of respondents perform free flaps in diabetic patients, and the majority of those questioned reported using vacuum-type dressings to treat Gustillo 3B fractures (81.5%).

**CONCLUSION:** Current trends in microsurgery perioperative management appear to be changing. Among other findings, this survey notes a greater acceptance of perforator flap - based breast reconstruction, vacuum-type dressings for Gustillo 3B fractures, and lesser reliance on pre-operative imaging.

**Learning Objectives:**

- *Participants will learn current patient care trends amongst practicing microsurgeons*

## P05

## BILATERAL UPPER EXTREMITY RECONSTRUCTION UTILIZING THREE SIMULTANEOUS FREE FLAPS FROM A SINGLE CONTIGUOUS DONOR SITE: A 3-2-1 RECONSTRUCTION

**Arash Izadpanah, Avi Islur[1]**
**[1]University of Manitoba, Winnipeg, MN**

**INTRODUCTION:**Complex soft-tissue defects of the hand are devastating injuries. Etiologies include high-energy trauma, burns, frostbite, crush injuries, or tumor extirpation. The majority of these processes require reconstruction of only a single extremity or defect location. Simultaneous bilateral soft tissue defects of the upper extremity are rare. This often requires staged operations of multiple pedicled flaps or free flaps from different donor sites to obtain coverage. We present a unique case of bilateral hand reconstruction involving three defects utilizing three flaps harvested from a single contiguous donor site, a 3-2-1 reconstruction.

**MATERIAL AND METHODS:** A 42-year-old right hand dominant male, elementary school teacher presented to our centre with new onset of bilateral severe hand frostbite. He underwent variable level amputations proximal to the PIP joint of all digits except his left thumb following declaration of his frostbite injury. In an effort to preserve: a) length of the proximal phalanges for potential future free toe transfers, b) key pinch, c) 1st web-space, and minimize donor site morbidity, the patient underwent bilateral hand free flap reconstruction utilizing a single anterolateral thigh donor site. A TFL, ALT and Vastus Lateralis free flap were harvested as a single contiguous flap and divided on the back table into their separate entities in order to provide three flaps for soft tissue reconstruction of three separate defect sites.

**DISCUSSIONS:** Soft tissue reconstruction of bilateral hand defects is often associated with multiple donor sites and thus potentially higher patient morbidity. We present a single unique case of bilateral hand coverage using a complex chimeric flap raised from a single contiguous donor site for coverage of bilateral unstable hand soft tissue defects following extensive frostbite amputations.

**Learning Objectives:**

- *The audience will learn about use of multiple flaps raised from a single donor site, in a single operation for coverage of potential complex soft tissue defects.*

## P06

## DELAYED, BUT NOT AUTOLOGOUS, BREAST RECONSTRUCTION IS ASSOCIATED WITH IMPROVED BREAST CANCER-SPECIFIC SURVIVAL: A POPULATION-BASED STUDY

**Amanda Murphy[1], Jason Williams[2], Leif Sigurdson[3], Michael Bezuhly[4]**
**[1,2,4]Dalhousie University, Halifax, NS; [3]University of Manitoba, Winnipeg, MN**

**PURPOSE:** Although post-mastectomy breast reconstruction is known to improve quality of life, reconstruction rates in Canada remain low. One possible explanation is continuing concern that reconstruction may impair recurrence detection or delay adjuvant therapy. Previous population-based studies have demonstrated equal or decreased breast cancer-specific mortality among patients who have undergone immediate reconstruction compared with mastectomy alone. It remains unclear, however, whether any survival difference exists based on type (autologous vs. implant) or timing (immediate vs. delayed) of reconstruction.

**METHODS:** All Nova Scotia women who underwent unilateral mastectomy for breast cancer between 1989 and 2007 were identified using theCancer Care Nova Scotia registry and additional linkages with provincial medical insurance and vital statistics databases. Breast cancer-specific-survival was compared between patients who did or did not undergo reconstruction using Cox proportional hazards models. Models were fitted-adjusting for demographic, comorbidity, and disease severity variables, and stratifying on reconstruction type and timing.

**RESULTS:** Improved breast cancer-specific survival was observed among all breast reconstruction patients (331 patients) compared to patients whounderwent mastectomy alone (6459 patients; hazards ration [HR]=0.64; 95% CI 0.48 to 0.86). Stratifying by timing of reconstruction, delayed reconstruction patients demonstrated improved survival compared to mastectomy patients (HR=0.53; 95% CI 0.34 to 0.83), while immediate reconstruction patients did not. No differences in breast cancer-specific survival were observed based on type of reconstruction. Contralateral balancing breast reduction was also associated with reduced mortality (HR=0.52; 95% CI 0.32 to 0.84).

**CONCLUSION:** Breast reconstruction is associated with decreased breast cancer-specific mortality. This finding is driven by apparent improved breast cancer-specific survival among delayed reconstruction patients. We believe this latter observation is attributable to upstaging among immediate and some delayed reconstruction patients early on in their disease history. Overall, our findings suggest that breast reconstruction carries no increased risk of breast cancer-specific mortality compared to mastectomyalone.

## P07

## ORTHOPAEDIC OUTCOMES IN LOWER EXTREMITY FREE FLAP RECONSTRUCTION

**Priscille Grenier-Vallée, Adrian Heller, Christopher Coroneos, Allan Bradley, Ronen Avram**
**McMaster University, Hamilton, ON**

**PURPOSE:** We reviewed adults with tibia fractures who required free flap reconstruction to determine the rate of union and the proportion of patients progressing to functional weight-bearing.

**METHOD:**Adults with tibial fractures undergoing reconstruction with microsurgical free tissue transfers were included in this retrospective review. Two reviewers extracted data including patient demographics, comorbidities, fracture pattern, timing and type of reconstruction. Outcomes included fracture union, ability to weight-bear and amputation.

**RESULTS:** During a 5 year period, thirty consecutive patients with tibial fractures were reconstructed with free flaps. Fifteen presented with distal tibia and ispilateral fibular fractures and 15 with isolated tibial fractures. Seven patients required early (within 1 month of trauma) reconstruction and 23 patients required delayed reconstruction. Free flap reconstruction included: 22 anterolateral thigh (ALT) flaps, 3 tensor fascia lata (TFL) flaps, 1 latissimus dorsi flap, 1 fibular flap, 1 osteocutaneous fibular flap, 1 medial thigh flap and 1 fasciocutaneous radial forearm flap. Of the 7 patients with early reconstructions (within 1 month of trauma), 3 patients progressed uneventfully to union while 4 patients required further surgical intervention to obtain union. All patients were fully weight-bearing at final follow-up.

Twenty-three patients required delayed reconstruction for infected non-union. Of those 23 patients with non-union, 3 patients required a below knee amputation. All other delayed cases went on to unite with full functional weight-bearing after further orthopaedic intervention.

**CONCLUSIONS:** Of all the surgeries, 90% (27/30) were successful in providing patients with union of their fractures and functional weight-bearing status.

**Learning Objectives:**

- *Recognize the success of free flap reconstruction in complex traumatic lower leg fracture.*
- *Complex lower leg soft tissue reconstruction are often associated with non-union fractures. Free flap coverage can help in the process to consolidation.*

## P08

## CONTRA-LATERAL POLLICIZATION OF THE DIGITI MINIMII FOR THUMB RECONSTRUCTION IN AN ELECTRIC BURNED: PATIENT A CASE REPORT AND LITERATURE REVIEW

**Jean-Philippe Giot, Laurence Paek, Edouard Coeugniet, Joseph Bou-Merhi, Patrick Harris, Alain Danino**
**Department of Plastic Surgery, Hand Center, Centre Hospitalier de l'Université de Montréal, Montréal, QC**

**PURPOSE:** Usually the reconstruction of the proximal amputation of the thumb can be performed by pollicization of another finger or free toe transfer. We present the result of contra-lateral digiti minimi pollicisation for the thumb reconstruction in an electric burned patient.

**METHOD:** We report the case of a 30-year-old male how was burnt at 52% of the superior half of the body by high voltage electricity. He presented a cervical burn with necrosis of the platysma, alteration of the left brachial plexus, bilateral forearm compartment syndrome and extensivesoft tissue burn of the right hand. Three months later he presented anextensive fibrosis of the first commissure and an osteomyelitis of the first metacarpal bone requiring thumb amputation below the MCP joint. After initial cares and rehabilitation, he presented a left forearm palsy but undamaged and supple fingers and a four long digits right-hand with a thumb stump. Rather than performing a toe-to-hand transfer, we have reconstructed his right thumb by pollicizing the left digiti minimi, with transfer of the third digit superficialis-flexor tendon to animate the flexion.

**RESULTS:** Surgery was followed by rehabilitation with occupational therapists and physiotherapists. Four months after the procedure, patient-present a functional pinch between the pollicized thumb and the long fingers, with beginning of sensation recovery and a good cosmetic result.

**CONCLUSION:** Contralateral digit pollicization for thumb reconstruction has only been reported in one case of traumatic amputation. This plan allow us to use a finger from the contralateral palsied finger-bank to restore the thumb with minimal morbidity.

**Learning Objectives:**

- *The participant should be able to discuss the unusual thumb reconstruction by use of a contra-lateral finger pollicization.*

## P09

## LATISSIMUS DORSI AS A SUBACUTE FUNCTIONAL RECONSTRUCTION IN LOWER LIMB TRAUMA

**Julie Chakriya Kvann, Stephanie Thibaudeau, Teanoosh Zadeh**
**McGill University, Montreal, QC**

**PURPOSE:** In mangled lower extremities reconstruction, muscle flaps are reliably used as soft tissue coverage. Very few reports have documented their functional reconstruction potential as neurotized muscle flaps.

**METHOD:** A case was analyzed and a literature review using Medline database was performed.

**CASE:** Post motor vehicle accident, a 32-year-old female suffered from mangled bilateral lower extremities, including a left open mid-shaft comminuted femur fracture with a near total amputation of the quadriceps femoris muscle. A neurotized latissimus dorsi free flap was used not only for soft tissue coverage, but also as a subacute functional reconstruction of the quadriceps femoris.

**RESULTS:** One year later, her electromyo graphic studies showed motor units activity, suggesting functional integration of the flap. She has regained partial extension movement of her left knee. In our literature review, only 2 cases similarly explored the functional potential of the free latissimus dorsi in acute lower extremity trauma. Our report is the first case describing a subacute reconstruction of lower extremity post trauma using a neurotized latisimus dorsi muscle flap.

**CONCLUSION:** In addition to its role in soft tissue coverage, free neurotized latissimus dorsi flap is a promising option for long-term functional reconstruction of the mangled lower extremity post trauma. Its functional potential should be further utilized in the subacute setting to achieve the best outcomes in lower extremity trauma patients.

**Teaching Objectives:**

- *Describe the use of the latissimus dorsi flap in acute and subacute lower limb trauma reconstruction.*
- *Describe and use the latissimus dorsi flap not only as a soft tissue coverage in lower limb trauma reconstruction but also as a functional neurotized muscle.*

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