

## Scientific Paper Session: Head and Neck Tuesday January 27, 2015 9:45am-11:00am

### 9:45 AM - 9:49 AM

Maxillary Artery Based Facial Allografts: Indications and Technique  
 Cleveland Clinic, Cleveland, OH, USA

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**Background:** Maxillary artery has been traditionally considered the main blood supply of the facial skeleton. However, the deep and concealed location of the artery in the infratemporal and pterygopalatine fossae enclosed by the cranial base, mandible and maxilla makes the harvest of facial allografts based on this artery challenging and preference has been given to the facial artery to vascularize the facial allografts. The purpose of this study was to investigate the vascular territories of the maxillary artery and vein and modify the available craniofacial techniques in order to allow reliable harvest of a facial osteomyocutaneous allograft based on the maxillary vessels. **Methods:** Eighteen fresh cadaver heads were used in this study. Ten full facial allografts containing mandible, maxilla, zygomatic and nasal bones were harvested through a traditional Le Fort III approach. In 6 cadaver heads, maxillary artery and internal jugular vein were injected with red and blue latex respectively. In two cadaver heads colored lead oxide gel was injected in the maxillary artery (1) or internal jugular vein (1). A modified Le Fort III approach was designed: the orbital floor osteotomy was performed at the posterior-most aspect of the orbit. The zygomatic arch and mandibular condyle were osteotomized and removed. The pterygomaxillary disjunction was performed under direct vision after excising the temporalis and lateral pterygoid muscles. Eight full facial allografts were harvested through the modified approach. Maxillary artery and vein were dissected to assess for damage during the procurement. CT scans were performed of the 2 specimen injected with lead oxide. **Results:** When the traditional Le Fort III approach was used to harvest the facial allograft, the terminal branches of the maxillary artery (the infraorbital and the sphenopalatine arteries) and the pterygoid plexus were injured constantly. The modified approach preserved these branches and allowed the dissection of the maxillary artery and vein under direct vision. **Conclusions:** Maxillary artery should be considered as the main blood supply of the facial allograft when a major portion of the facial bones is to be harvested along with limited amount of facial soft tissues. The described

modified Le Fort III approach allowed the safe dissection of the maxillary artery and vein, preserving the main blood supply to the facial skeleton.

### **9:49 AM - 9:53 AM**

Patient-Specific Auricular Cartilage Constructs Using High-Density Collagen for Ear Reconstruction: Long Term Results

Cornell University, Ithaca, NY, USA

Benjamin P. Cohen, BS<sup>1</sup>; Rachel C. Hooper, MD<sup>2</sup>; Jennifer L. Puetzer, PhD<sup>1</sup>; Rachel Nordberg, MEng<sup>1</sup>; Ope A. Asanbe, MD<sup>2</sup>; Peipei Zhang, MBBS, PhD<sup>2</sup>; Karina A. Hernandez, DO<sup>2</sup>; Lawrence J. Bonassar, PhD<sup>1</sup>; Jason A. Spector, MD, FACS<sup>2</sup>; (1)Cornell University, (2)Weill Cornell Medical Center

**INTRODUCTION:** The gold standard for the reconstruction of pediatric microtia utilizes autologous costal cartilage to create the auricular framework. However, this approach causes obligatory donor site morbidity and often produces suboptimal aesthetic outcomes, making a tissue-engineered alternative desirable. We have previously used digital photogrammetry and CAD/CAM techniques to produce high fidelity, patient-specific auricular constructs, which maintained their shape and biomechanical properties *in vivo* for up to 3 months. Here, we use the same approach and examine construct stability and biomechanics after 6 months *in vivo*.

**METHODS:** Images of a 5 year-old human female ear were obtained by three-dimensional photogrammetry, combined into a continuous surface, and embedded into a block, which was printed as a 7-piece mold. A combination of bovine auricular chondrocytes and type I, 10 mg/mL collagen was injection molded to form hydrogel ear constructs with a cell density of  $25 \times 10^6$  cells/mL. Constructs were subcutaneously implanted into the dorsa of nude rats and harvested after 6 months. Post-harvest, constructs underwent histological, biochemical, and biomechanical testing. Statistical analysis was performed using one-way ANOVA with a Tukey *t*-test pairwise comparison and  $p < 0.05$  indicating statistical significance.

**RESULTS:** Long-term subcutaneous growth of engineered auricular constructs resulted in sustained ear morphology, formation of neocartilage, and mechanical and biochemical properties similar to those of native auricular cartilage. Constructs maintained fidelity long-term upon gross inspection. Safranin O staining for GAG content and Verhoeff staining for elastin fibers revealed cellular deposition of elastic neocartilage and the formation of a perichondrial layer. Mechanical analysis showed that the equilibrium modulus reached levels similar to those of native auricular cartilage within 3 months with reduced variation after 6 months. Deposition of proteoglycan (measured as GAG) and collagen (Hypro) displayed monotonic increases in deposition over the course of 6 months, achieving comparable values to native bovine auricular cartilage.

**CONCLUSIONS:** High fidelity constructs composed of elastic neocartilage were successfully produced following long-term subcutaneous growth of collagen hydrogels seeded with auricular chondrocytes. These engineered constructs featured similar matrix composition to native auricular tissue while maintaining the original, patient-specific ear morphology. These constructs

display the potential for a patient-specific, high fidelity tissue engineered treatment for patients suffering from microtia or traumatic ear injury. Further work using human auricular chondrocytes is required to show translation of this technology, and alternative cell sources such as mesenchymal stem cells will be investigated.

### **9:53 AM - 9:57 AM**

Age and Operating in the Recurrent Head and Neck Squamous Cell Carcinoma Patient  
Montefiore Medical Center, Bronx , NY, USA

Viraj Patel, BS; Amar Miglani, BS; Carrie Stern, MD; Katie Weichman, MD; TJ Ow, MD; Evan Garfein, MD; Montefiore Medical Center/Albert Einstein College of Medicine

Background: Elderly patients undergoing major reconstructive surgery may carry an inherently higher risk of morbidity and mortality. There is little data on postoperative outcomes of elderly patients who present with recurrent head and neck squamous cell carcinoma (HNSCC). We hypothesize that age does not affect reconstructive outcomes in recurrent HNSCC group.

Objective: To compare postoperative outcomes of patients with recurrent HNSCC who are younger than 70 years of age with those who are older than 70.

Methods: A retrospective chart review was performed of patients treated for HNSCC who underwent reconstruction over a 6-year period (2008-2014). Patients with recurrent HNSCC who underwent surgical resection and simultaneous flap reconstruction were included. Data collected included age, gender, primary site of resection, type of reconstruction, postoperative complications (both systemic and reconstructive), and overall survival. Outcomes of HNSCC patients whose age was greater than 70 years (older patients) were compared to those of patients less than or equal to 70 years of age (younger patients).

Results: 55 patients met the inclusion criteria for review. The older group consisted of 16 patients and the younger group 39 patients. 74% of the older group were male compared to 67% in the younger group. 92% of the older group had undergone prior radiation therapy in comparison to 75% of the younger group. Primary SCC sites for the older group included: Skin (38%), Oral cavity (31%), Larynx (23%), Nasopharynx (6%). Primary SCC sites for the younger group included: Larynx (46%), Oral cavity (38%), Oropharynx (5%), Miscellaneous (5%), Skin (3%), Sinonasal (3%). Patients in the older group had significantly lower overall survival (median survival, 8.8 months) compared to the younger group (median survival, 31.0 months) ( $P = 0.019$ ). Rates of reconstructive complications (e.g. dehiscence, hematoma, fistula, vascular congestion, necrosis) were not statistically significant between the older (reconstructive complication rate = 31%) and younger patients (reconstructive complication rate = 56%) ( $P=0.09$ ). Flap survival rates were similar in the older and younger patients with rates of 94% and 100%, respectively ( $p = 0.12$ ). Furthermore, systemic complication rates were not statistically significant in the older group (systemic complication rate = 38%) compared to the younger patients (systemic complication rate = 23%) ( $P=0.25$ ).

Conclusion: There was no statistically significant difference between postoperative reconstructive complications, systemic complications, and flap survival rates between groups.

Therefore, we feel head and neck reconstruction remains an acceptable option for elderly patients undergoing resection for recurrent HNSCC.

**9:57 AM - 10:03 AM**

**Discussion**

**10:03 AM - 10:07 AM**

Head and Neck Reconstruction in the Underserved – A Retrospective Review of Outcomes and Survival

Montefiore Medical Center, Bronx, NY, USA

Amar Miglani, BS; Carrie Stern, MD; Viraj Patel, BS; Katie Weichman, MD; TJ Ow, MD; Evan S. Garfein, MD; Montefiore Medical Center/Albert Einstein College of Medicine

Objective: Disparity in access to and delivery of healthcare is becoming an increasingly important topic of research. In NYC, all-cause death rates are significantly higher in socioeconomically disadvantaged areas. Currently there is limited literature regarding healthcare disparities and outcomes specifically pertaining to head and neck cancer patients. The aim of this study is to assess outcomes among a socioeconomically disadvantaged patient population.

Methods: A retrospective chart review was performed of patients treated for head and neck cancer who underwent reconstruction(2008-2014). Data collected included age, gender, insurance provider, zip code, median household information, primary tumor type, type of reconstruction, post-operative complications and overall survival. Patients were assigned median household incomes based on Zip Code and were separated into two cohorts based on whether they were above or below the US national median household income(\$51,017). Additionally, patients with household median income in the bottom two quintiles were also compared to those in the top two quintiles in order to compare outcomes at the extremes of socioeconomic classes.

Results: 175 patients met the inclusion criteria. 120 males and 55 females, average age of 67(age range: 1-92). 30% had median household incomes greater than national average, while the remaining 70% were below. Tumor types were similar between the two groups with a majority being squamous cell carcinoma. Overall survival for the group above national median was not statistically different from the group below (mean survival 35.0 and 39.1 months, respectively) (p= 0.441). Flap complication rate (above = 40%, below=45%, p=0.58) and flap survival rate (above= 96%, below= 96%, p=0.89) did not have a statistically significant difference. When comparing patients with median household income in the bottom two quintiles to the top two, results showed no statistical significance with mean overall survival of 42.8 months and 28.0 months (p =0.886). 48 % of patients treated were Medicare and there was no difference in terms of survival or complications between these patients and those with private insurance.

Conclusion: One of the broadly imagined goals of the Affordable Care Act and the changing healthcare economics landscape is to limit disparities in the delivery of healthcare based on socioeconomic status. This study demonstrates that with equal access to healthcare, outcomes are similar between those patients from lower and higher socioeconomic groups. Further studies are

needed to better delineate areas of healthcare disparities that still exist in order to provide overall improved healthcare in these disadvantaged communities.

### **10:07 AM - 10:11 AM**

Keeping it Simple: Improving Dental Outcomes With Osseointegrated Implants After “Single Barrel” Free Fibula Reconstruction of the Mandible

New York Presbyterian Hospital, New York, NY, USA

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#### **BACKGROUND:**

The free fibula flap has become the workhorse for reconstruction of the mandible after resection for tumor or osteonecrosis, with aesthetics and dental rehabilitation being the primary goals of reconstruction. A shortcoming of the fibula flap is its lack of height compared to the native mandible. As a result, osseointegrated implants placed into the fibula may be vertically short of the native occlusal plane. Approaches to address the height deficiency have included the “double-barrel” fibula and vertical distraction osteogenesis. However, these confer additional complexity and risk to the reconstruction. We hypothesized that mandible reconstruction using a single barrel fibula placed several millimeters above the inferior border of the native mandible would allow for improved dental rehabilitation without any untoward aesthetic consequences.

#### **METHODS:**

A retrospective chart review was performed for all patients undergoing free fibula reconstruction of the mandible since 2006. Included for study were patients who underwent placement of osseointegrated implants. Charts were reviewed for use of computer-aided modeling and post-operative aesthetics. Panorex images were analyzed at standardized positions for fibula height, mandibular height, crown-to-implant (C/I) ratio, and vertical positioning of the fibula.

#### **RESULTS:**

Ten patients were identified for study out of a total 47 mandibular reconstructions. Computer-aided modeling was used to plan reconstruction in all study patients, and fibula placement was determined preoperatively during the planning session in conjunction with ablative and oral surgeons. Seven patients were reconstructed with the fibula placed above the inferior border of the mandible (group A), and three had the fibula aligned with the inferior border of the mandible (group B). Average follow-up was 15.9 months. Implants in group A were placed into shorter fibulas (14.4mm vs 16.0mm,  $p=0.0002$ ), and were fixed adjacent to vertically longer mandibles (35.1mm vs 32.1mm,  $p=0.04$ ) compared to group B. The fibula was positioned an average of  $4.7\pm 0.6$ mm above the inferior border of the mandible in group A, with improved C/I ratio and alignment of the final crown. Average C/I ratio in group A was  $1.66\pm 0.57$ , representing a decrease of 19.7% compared to if these fibulas had been aligned with the inferior mandibular border. All patients had good post-operative aesthetics and symmetry.

#### **CONCLUSIONS:**

The single-barrel fibula may be positioned 4-5mm above the inferior border of the mandible to

improve alignment of osseointegrated implants with the native occlusal plane without any detrimental effect on aesthetics. Computer-aided modeling is useful for precisely planning fibula positioning for further prosthodontic reconstruction.

### **10:11 AM - 10:15 AM**

Palliative Surgery - A Reasonable Option in the Management of Advanced Head and Neck Squamous Cell Carcinoma

Montefiore Medical Center, Bronx, NY, USA

Carrie Stern, MD; Amar Miglani, BS; Viraj Patel, BS; Katie Weichman, MD; TJ Ow, MD; Evan Garfein, MD; Montefiore Medical Center/Albert Einstein College of Medicine

**Background:** Patients with advanced head and neck cancers are often faced with a difficult decision-whether to undergo extensive surgical care to maximize quality of life even when prognosis is grim. These patients will likely have impaired speech/swallowing, ulcerations, fistulas, and fungating tumors. Case studies exist delineating the role of palliative surgery, but few look at outcomes of patients with head and neck squamous cell carcinoma (HNSCC) who undergo major reconstructive surgery.

**Objective:** Compare survival and surgical outcomes in head and neck cancer patients undergoing resection and simultaneous reconstruction with palliative vs. curative intent.

**Methods:** A retrospective review of patients treated for head and neck cancer(2008-2014) was performed. Patients with HNSCC who underwent surgical resection and flap reconstruction were included. Data collected included age, gender, primary tumor site, type of reconstruction, postoperative complications, achievement of locoregional control, and overall survival.

**Results:** 136 operations in 127 patients met inclusion criteria for the review.19 were cases with advanced disease where patients were undergoing surgical intervention for palliation; the remaining 117 were patients undergoing resection with reconstruction with curative intent. Age in palliative vs curative groups was 64 (41-78) vs 65 (35-89) respectively, and 74% and 71% male. 53% of the palliative group had undergone prior XRT in comparison to 43% of the curative group( $p=0.42$ ). Sites of primary SCC for palliative vs. curative: oral cavity (32% vs 50%), larynx(16% vs23%), skin(16% vs8%), sinonasal(11% vs6%), nasopharynx (5% vs2%). Palliative group, 58% received free flaps, 32% pedicled flaps, and 5% a free flap and pedicled flap simultaneously. In curative group, 83% received free flaps, 11% pedicled flaps, and 6% both. Palliative group had significantly lower overall survival compared to non-palliative patients(4.1 vs 56.1 months respectively, $p< 0.0001$ ). Time to locoregional recurrence was not statistically different between groups(6.4 vs 49.9 months  $p=0.179$ ). Differences in rates of reconstructive complications were not statistically significant between palliative and curative patients(29% vs 43%, $p=0.23$ ). Flap survival rates were similar between groups(95% and 97%, $p=0.64$ ). Systemic complication rates were not statistically significant in patients undergoing palliative and non-palliative patients(32% vs23%, $p=0.39$ ).

Conclusion: Palliative surgery is a relatively under-reported topic. Resection and reconstruction of head and neck tumors carries a high cost to the patient physiologically, as it demands removal of tissues with high functional and aesthetic value. The question is whether aggressive surgical management is appropriate. Although additional work needs to be done on the quality of life benefits for these patients this study demonstrates that it can be done safely and effectively.

**Head and Neck Tuesday January 27, 2015, 9:45am-11:00am**  
**10:15 AM - 10:21 AM**

**10:21 AM - 10:25 AM**

A Modified Free Chimeric Osteocutaneous Fibular Flap Design for Head and Neck Reconstruction

Yen-Chen Yu, New Taipei City, , Taiwan

Yen-Chen Yu, MD; Chi-Ying Hsieh, MD; Tyng-Luen Roan, MD; Far-Eastern Memorial Hospital

### **Background**

Free fibula osteocutaneous flap is a conventional workhorse flap for mandible reconstruction. However, there is limitation of this flap to reconstruct composite defect after resection of segmental mandible and the adjacent soft tissue. We have reported a modified chimeric fibular osteocutaneous flap design based on combination of a traditional fibular flap and a peroneal artery perforator fasciocutaneous flap for composite mandible and soft tissue reconstruction. After accumulating the experience, we reported a larger case series utilizing this new technique.

### **Patients and Methods**

From November 2011 to March 2014, 15 patients who had segmental defect of mandible and adjacent soft tissue defect after composite resection for oral cancer treatment received mandible and adjacent soft tissue reconstruction by the modified chimeric fibular flap.

### **Results**

The detailed data of all flaps were summarized in Table 1. Average patient age was 48.2 years (32-63 years). The skin paddle based on intramuscular perforators ranged from 9x3.5cm to 11x11cm and the mean pedicle length was 8.4 cm. Vascular anastomosis of two flaps needed vein graft. Five patients underwent primary closure of the donor site. Three flap salvage procedures were performed due to vascular thrombosis. All flaps survived well finally. Nine patients had acceptable outer appearance and all patients had at least 3-cm inter-incisor distance during a mean of 12-month follow-up period.

### **Discussion**

The traditional fibula osteocutaneous flap utilizes only the skin paddle supplied by septocutaneous perforators and has some limitation for reconstruction, such as lack of soft tissue and need another flap for soft tissue reconstruction especially with through-and-through cheek defect, and the restriction skin paddle inset due to the attachment of septum to the bony segment. The modified chimeric fibular flap can provide more soft tissue, more freedom of skin paddle rotation, and possible primary closure of donor site.

## Conclusion

The modified chimeric osteocutaneous fibula flaps are reliable choice for reconstruction of composite mandible and cheek defect, which provide more and larger skin paddles with fewer restrictions of flap inset.

**Table 1.** Characteristics of the patients with the modified free chimeric fibular osteocutaneous flaps

Age	Sex	Flap design (cm)			No. of perforators		Pedicle		Vascular anastomosis		Donor site closure	Complication
		Septo-cutaneous perforator (WxL)	Intra-muscular perforator (WxL)	Fibula bone length	Septo-cutaneous	Intra-muscular	Type	Length (cm)	Side	Vessel		
42	M	-	5x10	6	-	2	IAIV	8	Ipsilateral	Lingual a. UV branch	Primary closure	
56	M	8x6	8x10	6	3	2	IAZV	8	Ipsilateral	STA UV branch	STSG	
49	M	8x8	10x10	3+5	2	2	IAIV	12	Contralateral	STA UV branch*	STSG	
62	M	-	5x12	3+5+5	-	2	IAZV	10	Ipsilateral	STA UV branch EV	Primary closure	
40	M	-	9x7	4.5	-	2	IAIV	10	Ipsilateral	STA UV branch	STSG	Venous thrombosis
57	F	8x10	8x10	5+4	2	2	IAIV	10	Contralateral	Facial a. UV branch	STSG	
32	F	-	9x3.5	4.5+3+4.5	-	2	IAZV	5	Ipsilateral	ECA UV branch AV	Primary closure	Arterial thrombosis
63	F	4x3	9x6	4	1	2	IAZV	8	Contralateral	STA UV* EV	STSG	Venous thrombosis
43	M	-	8x8	5	-	1	IAIV	10	Ipsilateral	STA UV	STSG	
50	M	-	9x10	5	-	2	IAZV	8	Ipsilateral	STA UV EV	Primary closure	
53	M	5x6	10x12	6	2	2	IAIV	8	Ipsilateral	STA UV branch	STSG	
59	M	8x8	8x9	6	2	1	IAIV	6	Ipsilateral	STA UV branch	STSG	
31	M	-	10x5	3+2.5+5	-	2	IAIV	10	Ipsilateral	STA UV branch	Primary closure	
47	M	14x6	-	5	2	-	IAIV	5	Ipsilateral	STA UV branch	STSG	
39	M	10x6	11x11	6.5	2	1	IAIV	8	Ipsilateral	STA UV	STSG	
										* Need vein graft		

**Fig.** Case report with free chimeric fibular osteocutaneous flap reconstruction



**10:25 AM - 10:29 AM**

Outcomes and Cost Analysis of Preoperative CT-Guided Virtual Surgical Planning for Free Fibula Mandible Reconstruction

Fox Chase Cancer Center, Philadelphia, PA, USA

Eric I. Chang; Sameer Patel; Neal Topham; Fox Chase Cancer Center

**Introduction:** The osteocutaneous free fibula flap has become the primary reconstructive modality for segmental mandibulectomy defects. The advent of preoperative virtual surgical planning (VSP) with models and templates has led to significant refinements in operative technique. Here, we examine the value of CT-guided preoperative VSP on outcomes and operative efficiency after mandibular reconstruction with free fibula flaps.

**Patients and Methods:** A retrospective review was performed from 2002 – 2013 of all patients undergoing free fibula mandible reconstruction at a single cancer center. Surgical technique and operative time were assessed and cost analysis was performed. Patient demographics, complications, and overall outcomes were also examined.

**Results:** Ninety patients underwent free fibula osteocutaneous flap reconstruction of the mandible during the study period. In 10 patients, the shaping of the neo-mandible was performed without VSP while 28 patients underwent shaping of the fibula based upon the

prefabricated stereolithic models. The remaining 52 patients underwent preoperative CT-imaging to design patient-specific, cutting templates for the native mandible as well as the fibula. There was a wide range of mandibular defects in all three groups that required reconstruction with no significant differences in the number of osteotomies performed. The use of preoperative CT-guided planning resulted in less burring (100% vs. 92.6% vs. 27.5%,  $p < 0.005$ ) as well as decreased use of bone paste or bone grafts (30% vs. 22.2% vs 0%,  $p < 0.005$ ). VSP also significantly decreased operative time (707 min vs. 534 min,  $p < 0.0003$ ) which translated into considerable cost savings. Review of postoperative CT scans demonstrated no differences in rates of bony nonunion or malunion, and there were no significant differences in overall outcomes or complications between the groups.

**Conclusions:** Preoperative VSP has refined mandible reconstruction with osteocutaneous free fibula flaps. In the current era of health care reform, the use of patient-specific, CT-guided modeling with fabrication of osteotomy guides outweighs the costs associated with this adjunctive technology. VSP improves operative efficiency without increasing complications or jeopardizing overall operative outcomes.

#### **10:29 AM - 10:33 AM**

#### **Virtually Designed Custom Reconstruction Plates: The Next Step in Virtual Surgical Planning of Mandible Reconstruction**

NYU Langone Medical Center, New York, NY, USA

Tomer Avraham, MD<sup>1</sup>; Peter Franco, DMD<sup>2</sup>; Patrick L. Reavey, MD, MS<sup>2</sup>; Jamie P. Levine, MD<sup>2</sup>; David Hirsch, MD, DDS<sup>2</sup>; (1)New York University Langone Medical Center, (2)NYU Langone Medical Center

#### **Purpose:**

The use of virtual surgical planning (VSP) in mandibular reconstruction has gained popularity in recent years. Contouring of reconstruction plates to fixate the flap construct, however, remains both time consuming and operator dependent. We report for the first time utilization of VSP for design and fabrication of patient specific plates. Customization includes hole position and number, planned avoidance of tooth roots and nerves, bone sparing cuts, and non-traditional bends.

#### **Methods:**

We reviewed our series of five patients who underwent VSP aided fibula based mandibular reconstruction utilizing a custom reconstruction plate. Patient demographics, case variables, and outcomes were analyzed. VSP was performed as previously described using patient specific imaging data. A custom reconstruction plate was designed and fabricated in conjunction with a commercial vendor (Stryker Leibinger; Portage, MN).

#### **Results:**

Five cases were identified and analyzed. Indications for surgery included ameloblastoma (n=3), hemifacial microsomia (n=1), and osteomyelitis (n=1). Two cases utilized a double barrel segment, and one case was performed in conjunction with extensive orthognathic surgery. In one case the custom plate was designed to incorporate the double barrel segment eliminating the need for a miniplate for separate fixation. There were no deviations from the surgical plan.

Superimposition comparison analysis of plate shape demonstrated that at all points on the plates were within a 0–1.6mm of the virtually planned plate. The volume overlap between the plan and the actual plates was a mean of 81%. Analysis of plate positioning on the neomandible (using the predicted screw holes as a reference) demonstrated that planned position varied from the postoperative by a range of 0.86mm to 1.97mm with an average of 1.72mm. Variance of reconstructed mandibular height, gonial width, and condylar width were 1.23mm, 1.71mm, and 1.69mm from the virtual plan respectively.

### **Conclusions:**

Utilization of prefabricated, precontoured, custom reconstruction plates in concert with VSP fibula based mandible reconstruction has many potential advantages. This represents the next logical evolution in the use of VSP technologies and patient specific therapeutics. This technique removes an operator variable and allows contouring that could not be achieved by hand. Further, the risk of screw interference with tooth roots, nerves, osteotomies, and implants can be mitigated. There are potential biomechanical advantages related to plate shape, width, and hole position customization. We believe our series justifies further studies to definitively establish the superiority of this technique to traditional hand bending, and to define specific indications for its use.

### **10:29 AM - 10:33 AM**

The Effectiveness of Free Vascularized Fibular Grafts in Osteonecrosis of the Femoral Head and Neck: A Systematic Review

University of Pennsylvania, Philadelphia, PA, USA

Cassandra A. Ligh, MD; Jonas A. Nelson, MD; John P. Fischer, MD; Stephen J. Kovach, MD; L. Scott Levin, MD, FACS; University of Pennsylvania

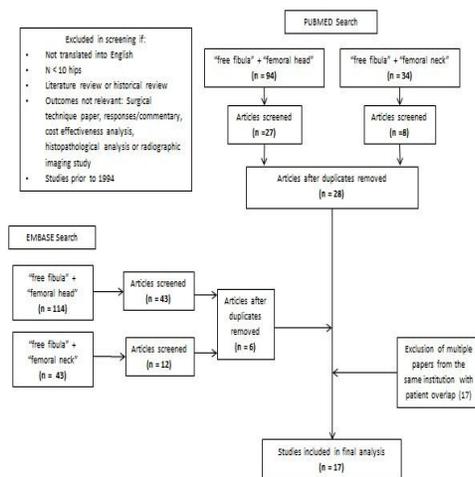
**Background:** The use of FVFG has been an accepted surgical option to treat ONFHN in an attempt to prevent the conversion to a total hip replacement (THR) yet the majority of studies have been single institution cohorts, with little generalizability. We performed a systematic review examining the effectiveness of FVFG to treat ONFHN, particularly in preventing conversion to THR and improving hip function/symptoms.

**Methods:** We searched Pubmed and EMBASE databases (through 2/14/2014). We developed a search strategy using the following key phrases: femoral head, free fibula, and femoral neck. We reviewed all articles to identify if outcomes were applicable to our study. We focused on Harris hip scores (HHS), THR conversion rates, complication rates and radiographic progression rates. Prior to screening, we excluded papers if they were not translated into English, the n<10 hips, the article was a compilation or review, the outcomes were not relevant, or if the studies were prior

to 1994. To address patient overlap from papers originating from the same institution, we included the paper with the largest cohort and excluded those within the same timeline of enrollment. Two investigators independently searched/reviewed articles to determine if they met the pre-determined inclusion criteria. Data obtained included number of patients/hips, average age/follow-up time/ graft survival before THR, HHS (pre and post-operative), THR conversion rate, complications and radiographic progression rates.

**Results:** We identified 128 and 157 papers from Pubmed and EMBASE (Figure). After screening/duplicate removal, 17 studies were included in the final analysis. The majority (76%) of articles were level IV evidence. Articles originated from 11 institutions and 8 countries. When comparing all data, the average number of patients was 123 (range 15-946) and the average number of hips was 159 (range 19-1270). The average age at time of surgery was 33.8 years (range 14-44) and average follow-up time was 94 months (21-216). The average difference in HHS was 20.9 points (4-26.3), the average number of patients that required an eventual THR was 13.7% (3.3-40), the average graft survival time before THR 4.9 years (1-49.9) and the average percentage of hips that showed progression of disease based on radiographic findings were 26% (0-95).

**Conclusions:** There is a significant amount of level IV evidence that describes the role of FVFG to treat ONFHN. While the technique appears to be efficacious based on improved HHS and low conversion to THR, there is still a need for higher level evidence.



Head and Neck Tuesday January 27, 2015, 9:45am-11:00am  
 10:33 AM - 10:39 AM  
 Discussion

### **10:39 AM - 10:43 AM**

#### **Analysis and Optimization of Salvage Techniques for Compromised Free Flap in Head and Neck Reconstruction**

MD Anderson Cancer Center, Houston, TX, USA

Edward I. Chang, MD; Hong Zhang, PhD; Roman J. Skoracki, MD; Peirong Yu, MD; Matthew M. Hanasono, MD; MD Anderson Cancer Center

**Introduction:** Loss of a free flap for head and neck reconstruction can be fatal and devastating, however, the risk factors and techniques for salvaging a failing head and neck flap are poorly described.

**Methods:** Retrospective review of all head and neck free flaps performed from 2000-2010.

**Results:** Overall, 2296 head and neck free flaps were performed with 151 flaps (6.6%) suffering microvascular complications. Patient age (mean: 58.4 years) and BMI (mean: 26.6kg/m<sup>2</sup>) had no impact on flap survival, nor did comorbidities including diabetes, vascular disease, smoking, or prior radiation. However, prior chemotherapy was significantly associated with loss of a free flap (OR: 2.58, CI: 1.21-5.48; p=0.013). Flap type (ALT/AMT: 61, fibula: 33, radial forearm: 24, ulnar forearm: 5, latissimus dorsi: 10, VRAM/TRAM: 7, jejunum: 2, other: 9) had no impact on flap salvage rates; however, muscle flaps had significantly lower salvage rates than fasciocutaneous or osteocutaneous flaps (p=0.002). Surgeon experience also did not affect salvage rates (p=0.88). Vein grafts were used in 23 arterial anastomoses and 26 venous anastomoses and did not affect flap survival; however, venous anastomosis performed with a Coupler had significantly fewer flap complications compared to hand-sewn anastomoses (p=0.03). While venous thromboses were the most common, supercharging a flap did not decrease flap loss rates (p=0.45). Flaps that were found to have an arterial and venous thrombosis had significantly lower salvage rates compared to complications with either the vein (n=59) or the artery (n=26; p<0.0001). The use of aspirin, Fogarty catheter thrombectomy, thrombolytics, and heparin did not improve salvage rates. Flaps requiring multiple takebacks (one takeback: 55.6% vs. 2 takebacks: 3.3% vs. 3 takebacks 1.3%; p=0.003) and late takebacks (>3 days) had significantly worse outcomes (p=0.003). Overall successful salvage rate was 60.3% with 60 total flap losses (2.6%).

**Conclusions:** Microvascular complications in head and neck free flaps are relatively rare occurrences, and salvage techniques do not decrease flap loss rates. While an attempt should be made to salvage a failing flap, multiple attempts are not recommended especially for muscle flaps. Thromboses of the artery and the vein and late thromboses also have an overall dismal prognosis for flap survival.

### **10:43 AM - 10:47 AM**

#### **Immediate Extubation May Improve Outcomes in Patients Undergoing Free Tissue Transfer for Head and Neck Reconstruction**

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**Hypothesis:** Immediate extubation, or the immediate cessation of mechanical ventilation for

tracheotomized patients, in the operating room (OR) after free tissue transfer (FTT) for head and neck reconstruction is associated with reduced medical complications, hospital length of stay, and overall cost compared to delayed extubation in the intensive care unit (ICU).

**Study Design:** Retrospective chart review of a consecutive surgical series.

**Methods:** Medical records of 129 consecutive patients undergoing FTT for head and neck reconstruction between March 2012 and March 2014 by a single reconstructive surgeon were reviewed. Patients immediately extubated in the OR (immediate group, N= 38) were compared to patients who were extubated in the ICU (delayed group, N = 91) by univariate and multivariate analysis.

**Results:** There were no significant differences in preoperative risk factors between the delayed and immediate extubation groups except for a higher rate of preoperative tobacco use (59% vs 34%;  $p=0.009$ ) and radiation therapy (67% vs 41.7%;  $p=0.009$ ) in the delayed extubation group. Perioperatively, the delayed extubation group was more likely to have undergone free fibula transfer (41% vs 21%;  $p=0.033$ ), have a resection that involved the upper aerodigestive tract (71% vs 32%;  $p<0.001$ ), have anesthesia time longer than 12 hours (67% vs 40%;  $p= 0.004$ ), and have a tracheotomy (58% vs 34%;  $p=0.013$ ). Medical complication rates were significantly higher in the delayed extubation group (57% vs 24%;  $p<0.001$ ) with a higher rate of cardiovascular complications (38% vs 8%;  $p<0.001$ ), treatment for alcohol withdrawal or agitation (25% vs 3%;  $P=0.003$ ), longer ICU stays (4.4 days vs 2.7 days;  $p<0.001$ ), and longer hospital stays (11.8 days vs 7.7 days;  $p=0.014$ ), without any significant difference in surgical complication rates. Multivariate analysis revealed that immediate extubation was an independent significant predictor of reduced ICU stay ( $p=0.021$ ).

**Conclusions:** Immediate extubation in the operating room may lead to shorter hospital and ICU stays, reduced post-operative medical complications, and overall cost compared to delayed extubation in the intensive care unit for appropriate patients undergoing FTT for head and neck reconstruction.

#### **10:47 AM - 10:51 AM**

The External Jugular Vein Used as a Recipient Vessel in Head and Neck Free Flap Reconstruction Outcomes Compared to the Internal Jugular Vein

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*Background:* Contradictory and insufficient data exist about the rates of overall complications and flap loss when the external jugular (EJ) vein is used as a recipient vessel for venous outflow in free flap head and neck reconstruction. In this study, the authors describe their experience with the use of the EJ vein compared to the internal jugular (IJ) vein.

*Methods:* This retrospective study of a prospectively collected database includes 578 patients who underwent 639 free flap head and neck reconstructions from Jan 2000 to Feb 2014. 35 free flaps used both IJ and EJ veins as recipients and were excluded from the analysis. The EJ group included 278 free flaps whereas the IJ group (matched per surgeon and period) included 326 free tissue transfers. All possible co-morbidities were included and compared between the two groups. Both groups were compared through the rate of overall, acute and late complications. More specifically, the rate of flap loss, venous and arterial thrombosis, bleeding, hematoma, seroma and infection were evaluated and compared between the two groups. Several additional medical and surgical co-morbidities were evaluated as well between the two groups.

*Results:* Univariate and multivariate analyses were conducted. There were no differences in rates of overall complications, acute vs late complications, flap loss, venous thrombosis, arterial thrombosis, bleeding, hematoma, or infection between the external jugular and internal jugular vein groups. Interestingly, several other risk factors were noticed to be associated with different types of acute or late complications, including previous bilateral neck dissection ( $p=0.03$ ), laryngo-pharyngectomy defect ( $p=0.01$ ), esophageal defects ( $p=0.003$ ), reconstruction plate usage ( $p=0.0008$ ), systemic anticoagulation (Heparin or Aspirin) ( $p<0.0001$ ), preoperative osteoradionecrosis ( $p=0.04$ ), previous use of both EJ and IJ veins ( $p=0.04$ ), use of vein graft for arterial anastomosis ( $p=0.003$ ), young age ( $p=0.04$ ), hypertension ( $p=0.03$ ), preoperative chemotherapy ( $p=0.006$ ) and previous head and neck debridement ( $p=0.02$ ).

*Conclusions:* The external jugular vein as a recipient vessel for venous outflow in head and neck free tissue transfer reconstruction for post-oncologic resection defects is a valid and safe option that can be applied to primary reconstructions or redo-surgeries, whether the internal jugular vein is available or not.

**10:51 AM - 10:57 AM**

**Discussion**