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**INTRODUCTION:** Smoking has been associated with increased wound healing complications and overall morbidity in multiple specialties, including plastic surgery. From 2005–2014, the smoking rate among U.S. adults decreased from 20.9% to 16.8%. This study aims to investigate first, whether smoking prevalence in the plastic surgery patient population paralleled the declining national trend and second, whether smoking remained an independent risk factor for perioperative complications after propensity matching for demographics and other comorbidities.

**METHODS:** We used the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database to examine smoking and 30-day postoperative complications for plastic and general surgical procedures. Patients were propensity-score matched (PSM) for demographics and comorbidities to isolate smoking and minimize confounders.

**RESULTS:** We examined 36,454 patients from the 2005–2014. Overall, a significantly smaller percentage of plastic surgical patients were smokers compared to the corresponding annual national average (p=0.01). There was a bimodal age distribution of smokers in the plastic surgical patient population, and smokers were generally more comorbid than were non-smokers. After PSM, smokers and nonsmokers did not differ significantly in preoperative variables. Smokers continued to have significantly higher rates of deep surgical site infections (SSI) (p<0.01), incisional dehiscence (p<0.01), and need for reoperation (p<0.01). Incidences of superficial SSI were not significantly different between smokers and non-smokers (p=0.18). Smokers with ≥11 pack-years were significantly more likely to suffer deep SSI and require reoperation (p<0.01) compared with light or non-smokers (<11 pack-years). There were no significant differences in incidence of graft/flap loss (p=0.07), bleeding (p=0.40), sepsis (p=0.87) or venous thromboembolic frequency (p=0.16) between smokers and non-smokers.

**CONCLUSION:** This study is the first large-scale database analysis isolating smoking as a risk factor for postoperative complications in plastic surgical procedures. Propensity-score matching ensures a more uniform comparative cohort in an effort to eliminate confounders and bias. Our data suggests smoking to be an independent risk factor for serious deep SSI, incisional dehiscence, and need for reoperation. Interestingly, superficial SSI rates were not significantly different which may be either a true finding or a result of report bias, which is a limitation in this retrospective analysis. We recommend continued judicious patient selection and careful preoperative counseling about smoking in order to optimize postoperative patient outcomes and satisfaction.

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**RESEARCH AND TECHNOLOGY SESSION 2**

**Patient-Specific 3D Models for Autogenous Ear Reconstruction**

**Presenter:** Kimberly S. Khouri, BS

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**INTRODUCTION:** Autogenous ear reconstruction remains one of the most technically challenging procedures in plastic surgery. Current standards of practice entail tracing the unaffected contralateral ear and using this two-dimensional outline as a surgical model. We present the effectiveness and feasibility of sterilizable, patient-specific and departmentally produced 3D-printed constructs as intraoperative models for autogenous ear reconstruction.

**METHODS:** 3D photographs (3DMD, Atlanta, GA) of the unaffected ears of three patients with unilateral microtia are taken and uploaded into Amira (FEI Company, Hillsboro, Oregon, USA), where they are transformed to (.stl) digital models.
These models are rendered and imported into Blender™ (Amsterdam, The Netherlands). They are then inverted along the vertical axis to create a working template of the contralateral ear. The depths of the scapha, triangular fossa and cymba are deepened to accentuate contours. Additional relief is added to the helical root for further definition. The final template is digitally separated to create the requisite components for the Nagata technique: helix; antihelical fold with the superior and inferior crus; tragus; and base frame. The helix is digitally straightened to optimize modeling. Finally, the complete auricular model and its components are individually 3D-printed (Builder Premium 3D Printer, Noordwijkerhout, The Netherlands) using polylactic-acid filament and sterilized according to manufacture’s specifications (121°C for 1 hour and 30 minute dry cycle).

RESULTS: Average time of digital preparation and 3D-printing was 5 and 5.5 hours, respectively. Total cost of consumables was $1.00/construct. On the day of surgery, the sterilized, patient-specific 3D models were brought to the operating room and placed alongside the sculpting tools and carving block. The models were placed on the cartilage grafts so that the forms and relief of the cartilage construct can be easily appreciated and incorporated into the cartilage shape. All three reconstructions were completed without complication and with a high patient satisfaction. Compared to the classic auricular tracings also present during surgery, the 3D printed models provided more detailed anatomic information and eliminated much of the guesswork involved in 3-dimensional auricular reconstruction.

CONCLUSION: By leveraging software platforms, hardware and expertise already available within academic medical centers, sterilizable, patient-specific auricular 3D models can be affordably manufactured and used during autogenous ear reconstruction.

3D Printed Ceramic Scaffolds: A Novel Approach to Mandibular Regeneration

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INTRODUCTION: Vascularized bone flaps, commonly used to reconstruct critical sized defects, have several limitations in terms of complications, donor-site morbidity, and costs, thereby advocating for innovative treatment options. Biomaterials offer virtually limitless quantities of bone tissue substitute, and 3D printing permits geometric design control for osteoconductive porous scaffolds as an alternative approach for bone regeneration. This pilot study presents a novel 3D printed ceramic scaffold with osteoconductive properties to treat segmental, critical size mandibular defects in a rabbit model.

METHODS: Critical sized defects were created at the mandibular body of six rabbits and replaced by 3D printed ceramic scaffold made of 100% β-tricalcium phosphate, fit to defect based on CT imaging. After 8 weeks, animals were euthanized, mandibles were retrieved, and bone regeneration was assessed. Bone growth was quantified both histologically (area) and with microCT and advanced 3D image software (volume), and compared to unoperated mandible segments (UMS). Data was presented as mean values with 95% confidence intervals.

RESULTS: UMS baseline bone area and volume occupancy averaged 55.8±4.4% and 33.4±3.8% respectively. Histology quantified scaffold + newly formed bone area occupancy at 54.3±11.7%, and bone area occupancy as a function of scaffold free space at 52.8±13.9%. 3D analysis quantified scaffold + newly formed bone volume occupancy at 36.3±5.9%, and bone volume occupancy as a function of free scaffold space at 57.4±12.7%.

CONCLUSION: Bone growth comprised over half of free space available in both 2D and 3D analysis, and regenerated segmental defect scaffold + new bone area/volume occupancy matched UMS at 8 weeks. Studies to determine scaffold replacement through bone formation and remodeling over extended periods of time are warranted.

Mandibular Reconstruction Using Cost-Effective Three-Dimensional Printing

Presenter: Silviu Diaconu, MD