options. The ideal construct would restore the structure of the native scalp and skull, while minimizing the risk of trauma and infection. The optimal way to achieve these goals remains undetermined.

**METHODS:** A retrospective chart review was performed at a tertiary academic medical center for all patients who underwent microvascular surgery of the scalp from July 2011 through December 2016. Reconstructions were evaluated by type of flap utilized (myofascial, myocutaneous, fasciocutaneous, or osteocutaneous) as well as type of cranial reconstruction performed (titanium implant, polyetheretherketone (PEEK) implant, split calvarial graft, or vascularized bone). Fisher’s exact test was used for statistical analysis to compare outcomes between each category of flap and each type of cranial reconstruction.

**RESULTS:** Forty microvascular reconstructions performed in 36 patients were identified during this time. Thirty-two reconstructions included composite scalp and cranial bone or skull base defects. Microvascular flaps used included: myofascial/myocutaneous (n=12), fasciocutaneous (n=10), and osteocutaneous (n=10). No significant differences existed in flap survival or reconstructive outcome based upon type of flap selected for soft tissue coverage. Cranial reconstruction was either autologous (n=15), including vascularized bone grafts (n=10), split calvarial bone grafts (n=4) and banked cranial bone (n=1), or alloplastic (n=13), including titanium (n=6) and PEEK (n=7) cranioplasties. Ten of the 15 (66%) autologous reconstructions and 10 of 13 (77%) alloplastic reconstructions underwent preoperative radiation. Of the radiated patients, 1 of 10 (10%) autologous reconstructions sustained flap or graft complications. In comparison, flap/implant related complications occurred in 5 of 10 (50%) alloplastic cranioplasties (p=0.05). Alloplastic complications occurred in 5 of 6 (83.3%) patients reconstructed with titanium implants compared to only 0 of 7 (0%) of PEEK reconstructions (p=0.0006). All reconstructions were salvaged, with 2 of the titanium cranioplasties requiring conversion to PEEK. Only one complication (partial flap loss) occurred in the non-irradiated patients, secondary to post-operative hematoma.

**CONCLUSION:** Composite reconstruction of the skull and scalp is a difficult problem encountered by the microvascular surgeon. In our experience, complete autologous reconstruction is preferable and demonstrated fewer complications than alloplastic reconstruction.

**Intraoperative Location of the Greater Occipital Nerve in Patients Undergoing Migraine Surgery**

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**PURPOSE:** Migraine headaches are debilitating and widely prevalent. Newer treatment options for migraines include onabotulinum toxin A injections and migraine surgery. The greater occipital nerve (GON) is a common trigger point. For optimal results, both injection and decompression require knowledge of GON anatomy, and the average depth of this nerve has not been previously described. The purpose of this study was to report the intraoperative location, including depth, of the GON in human subjects undergoing migraine surgery to optimize future nerve identification.

**METHODS:** We reviewed records of patients who underwent GON decompression by a single surgeon. Intraoperative measurement of the GON location in the x-, y-, and z-axes (e.g. distance, in millimeters (mm) lateral to midline, inferior to the occipital protuberance, and deep to the skin) was collected for two previously described positions: where the GON (a) exits (“point #3”) and (b) enters (“point #2”) the semispinalis muscle. Means were compared using independent t-tests. A p-value of < 0.05 was deemed statistically significant.

**RESULTS:** Thirty-four subjects (60 nerves) were included, with a mean age of 41 years (SD 10) and mean BMI of 29 (SD 7) at time of surgery. The mean depths of the GON were 20 mm (SD 4) where the nerve exits the semispinalis at point #3 and 30 mm (SD 6) at point #2. In 26 subjects who underwent bilateral surgery, there was no difference between right and left nerve depth at either point (p=0.720, p=0.534).
There was a difference between right and left nerve position lateral to midline at point #3 (p=0.008). Female gender (p=0.014) and BMI < 29 (p<0.001) were associated with a more superficial GON position.

CONCLUSION: The treatment of migraines requires a multidisciplinary, collaborative approach. The GON can be found approximately 20 mm deep to the skin where it exits the semispinalis muscle, an important consideration when performing targeted injection, diagnostic nerve blocks, and/or migraine surgery. Nerve position may be affected by BMI and gender, which should be considered prior to injection and/or dissection. When performing bilateral interventions, nerve position may differ between sides, particularly with respect to lateral distance from midline. Differences in this study compared to previous cadaver studies may reflect the inclusion of live subjects in prone position compared to cadaver specimens.

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Craniofacial Surgical Planning with Augmented Reality: Accuracy of Linear 3D Cephalometric Measurements on 3D Holograms

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INTRODUCTION: Conventional craniofacial surgical planning software lacks intuitive operator interaction and 3D navigation. Recently available augmented reality (AR) headsets have the potential for detailed 3D holographic projections of virtual 3D models, intuitive interaction and navigation, and accurate measurements.

OBJECTIVE: To evaluate the accuracy of linear measurements performed on HoloLens (Microsoft, Seattle, Wash.) in comparison with digital microcaliper towards assessing potential use for surgical planning.

METHODS: Seven adult dry human skulls were selected based on stable occlusion. Stereolithography files were generated from CT imaging data acquired with a default imaging protocol, loaded onto HoloLens. Two researchers performed two repeated linear measurements on 1) skulls with digital microcaliper as an anatomic physical measurement (gold standard) and 2) holograms by selecting two surface points. A subset of measurements that could be measured with digital microcaliper was used. We defined the limits of an agreement as 95% and the agreement between two methods was evaluated using the Bland and Altman analysis.

RESULTS: All HoloLens measurements were completed by easily “gazing” and navigating through complex 3D structures augmented to the virtual operating room. There was no significant bias between two methods used and 95% of the values were within the limits of the agreement.

CONCLUSION: Our results indicate that HoloLens has significant potential for surgical planning including sufficient accuracy for linear measurements. Future studies will include curvilinear measurements, formal usability evaluation and augmentation of 3D holographic planning results for intraoperative use.

Prospective Quality of Life Outcomes after Facial Feminization Surgery

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