such patients, the loss of fat between the highlight areas of the malar and gonial regions may be better treated by injections directly into the buccal fat pad. Herein, we describe the methods and results of transoral buccal fat augmentation during facelift surgery.

**METHODS:** Fat is harvested using disposable Caraway harvest cannula; processed with a bi-laminar filtration system and injected with disposable 18 gauge cannula. Intravenous clindamycin is given 1 hour before surgery and the intraoral mucosa at the site of injection is re-prepped with betadine. The upper lip is retracted and approximately 1–1.5 cm above and medial to the Stensen’s duct, the injection cannula is threaded carefully through the mucosa and guided by palpation/ultrasound into the buccal fat pad. The cannula is then moved radially and clockwise from 12:00 to 6:00 and counterclockwise from 12:00 to 6:00 filling the buccal space with 2–5 ml of fat, depending on physical findings.

**RESULTS:** As part of a prospective IRB study on fat grafting, 8 female patients aged 52 to 78 (mean=64) underwent buccal fat injection using the transoral approach (total injection = 4ml to 10ml). No intraoperative or perioperative complications of nerve injury or infections occurred. Based on physical findings, patients had anywhere from a 20% to 80% improvement in buccal fat fullness at a mean follow up of eighteen months. Aesthetic improvement was observed in all patients. A fresh cadaver dissection was performed to demonstrate the relationship between buccal fat pad to Stensen’s duct, the marginal mandibular nerve and to map out the anatomy defining the buccal fat pad.

**CONCLUSIONS:** Buccal fat injection is a powerful technique that restores the deep fat compartment between the zygoma and mandible, anterior to the masseter. Loss of subcutaneous fat is variable and in part based on the skeletal anatomy, patient age, and facial muscle activity. Restoration of the buccal fat pad volume can help reestablish harmony and balance to the face.

**New Insights for Botulinum Neuromodulator Targets for Correction of the Nasolabial Fold and Midface Rhytids: An Anatomic Study and Introduction of the Malar Levator Muscle**

**Chelsea Snider, MD; Ashley Amalfi, MD; Lauren Hutchinson, MD; Nicole Sommer, MD**

**BACKGROUND:** An acute nasolabial angle and prominent medial nasolabial fold are features of the aging midface. The medial nasolabial fold is a difficult area to correct and is not easily addressed by current facelift procedures. As minimally invasive procedures are becoming mainstay in aesthetic surgery, botulinum toxin has become a preferred method for treating dynamic facial rhytides. We therefore sought to identify relevant nasolabial fold and midfacial musculature anatomy to determine the ideal location of neurotoxin injection for patients with prominent nasolabial folds and midface rhytids.

**METHODS:** Twelve hemifacial cadaveric dissections were performed to expose the midfacial muscles and identify their origin, points of insertion, relationship to surrounding musculature, greatest width, and vector of pull. Particular attention focused on the levator labii superiorior alaeque nasi (LLSAN), levator labii superiorior (LLS), nasalis, and orbicularis oris. Measurements were obtained based on palpable surface landmarks, including the medial canthus, for future neurotoxin injection.

**RESULTS:** The central portion of the LLSAN was located 8.4 (+/- 0.9) mm inferior and 4.6 (+/- 0.8) mm medial to the medial canthus. Insertion sites included the medial nasolabial fold and alar base. The LLS has a broad insertion into the middle third of the nasolabial fold before extending to meet the obicularis oris at a point 4.5 (+/- 0.4) cm inferior and 5.9 (+/- 0.8) mm lateral to the medial canthus. We also uncovered a tubular muscle, obliquely oriented between the orbital obicularis oculi and the LLSAN, separated by adipose tissue, with its cephalad origin in continuity with the LLSAN and its insertion into the malar fat pad. This so-called “malar levator” was found in all twelve specimens and diverges from the LLSAN 8.7 (+/- 2.1) mm inferior and 2.8 (+/- 0.5) mm lateral to the medial canthus. The effects of this muscle on medial periorbital rhytids and the tear trough deformity were observed in the live patient.

**CONCLUSION:** This cadaveric study further defines the muscular anatomy of the midface and medial nasolabial fold and provides new insights into the use of neuromodulators for midfacial rhytids, tear trough deformity, and the medial nasolabial fold, all of which are challenging areas to correct with current surgical techniques. Neuromodulators may be sufficient to provide a youthful midface and soften the snarl appearance that comes with age, without affecting the upper lip.

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HAND SESSION 1

Validation of Regenerative Peripheral Nerve Interfaces for Control of a Myoelectric Hand by Macaques and Human

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INTRODUCTION: Regenerative Peripheral Nerve Interfaces (RPNIs) are promising for interfacing human intentions to myoelectric prostheses. Rat studies led to proof of internal RPNI long-term function and high signal to noise ratio with no adverse biological effects. Validation of voluntary and independent RPNI function has also been determined. However, true voluntary fine control of fingers and hand myoelectric prostheses requires RPNI real time validation with voluntary control. Our purpose was to validate voluntary RPNI control of a myoelectric hand in both macaque and human models.

METHODS: The RPNI consists of a free muscle graft implanted on the end of a transected nerve fascicle. RPNIs were implanted in the forearms of two macaques (n=3/macque). Intramuscular electromyography (EMG) electrodes were also implanted in each macaque RPNI. Macaques were trained to perform index finger movements to acquire virtual targets on a computer screen. The human RPNIs were implanted to treat neuroma pain. The human had fine wire electrodes temporarily placed in the RPNIs. Voluntary RPNI EMG that represented control was recorded.

RESULTS: With continuous EMG decode using 10-fold cross-validation, the resulting predicted finger position had a, correlation coefficient \( \rho = 0.82 \) between predicted and true finger positions for Macaques. The EMG decode correctly classified 97.7% of movements. The human ulnar nerve RPNIs were able to control thumb key pinch to first finger and thumb to little finger. Thumb abduction trials were 96% correct. At harvest macaque RPNIs were well vascularized; RPNI muscle fibers continued to regeneration after 1 year.

CONCLUSIONS: Macaques voluntarily controlled virtual finger movements with nerve signals transferred through implanted RPNIs. The human controlled an advanced myoelectric prosthetic thumb with RPNIs implanted in the ulnar nerve RPNI. Voluntary RPNI control of a myoelectric hand was validated by both macaque and human models.

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Muscle-Derived Stem Cells Are Capable of Transformation into Cells with Schwann Cell-Like Phenotypes

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PURPOSE: Muscle-derived stem cells (MDSCs) are a distinct population of immature progenitors cells with pronounced pluripotent potential. Previous findings from our laboratory have demonstrated that MDSCs have special

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