vs. 50.5 +/- 9.9% collagen density, Beige, \( p = 0.0321 \), and delayed epithelialization (94.6 +/- 17.1% epithelialized, C57Bl/6 vs. 58.5 +/- 30.0% epithelialized, Beige, \( p = 0.0044 \)) in Beige wounds. No differences were observed for macrophage infiltration, phenotype or neo-vascularization. Next, we evaluated protein secretion profiles from primary dermal fibroblasts from Beige and C57Bl/6 mice. Beige fibroblasts demonstrated decreased ability to secrete monocyte chemoattractant protein-1 (MCP-1) (17294 +/- 563 relative optical density (OD), C57Bl/6 vs. 10519 +/- 2348 relative OD, Beige, \( p = 0.0083 \)) and members of the insulin-like growth factor regulatory axis, IGF-1 and IGFBP2 (IGF-1; 473.8 +/- 40.6 relative OD, C57Bl/6 vs. 149.8 +/- 133.7 relative OD, Beige, \( p = 0.0159 \) and IGFBP2; 17918 +/- 664 relative OD, C57Bl/6 vs. 15451 +/- 690 relative OD, Beige, \( p = 0.0111 \)). While these are known mediators for normal wound healing, specifically, for wound epithelialization and ECM deposition [3-5], the role of LYST in their intracellular protein trafficking and exocytosis has not been previously described. Interestingly, IGF-1 does rely on well-established exocytic pathways reliant on the synaptotagmin family of proteins [6]. These findings, therefore, provide new insight into the intracellular mechanism of action of the LYST protein, which has previously remained elusive.

Conclusions: LYST is important for the secretion of chemokines and growth factors that play an important role in regulating normal wound healing. The expansion of knowledge towards a fundamental understanding of diverse cellular processes involved in normal wound healing, such as endolysosomal trafficking, is important because it provides new lines of investigation for therapeutic strategies to address problem wounds.

**TUESDAY, JUNE 8, 2021: NERVE/HAND TOP SCORED ABSTRACTS**

1

**Eye Tracking Analysis as a Means of Evaluating Aesthetic Result Following Toe to Thumb Transfers: A Pilot Study**

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Purpose: Exceptional functional results can be obtained with toe to thumb transfers; however objective measures to evaluate the aesthetic outcome of a toe to thumb transfers remains elusive. Aesthetic evaluation of a reconstruction when performed by external raters or the patient, may be influenced by expert knowledge, emotional antecedent, or ethnic or regional bias. In this study, we were interested in determining the observers’ instantaneous, reflexive responses to the toe to thumb transfer as determined by eye-tracking analysis.

Methods: 13 patients with unilateral great toe to thumb transfers were photographed using a standardized technique. None had undergone secondary procedures that changed the appearance of the transferred toe. Both hands were photographed side by side in each image. A dorsal and palmar image was taken, producing 26 photos in total. 40 observers (Average age 41.39, 14-65 yo, 18 males, 22 females), blinded to the procedure, were asked to evaluate each image for symmetry between the hands. An infrared eye-tracking camera continuously recorded their eye movements. Participants were allowed to evaluate each image for 6 seconds. Data was evaluated to determine the percent of time that was devoted to evaluating each portion of the photograph. The percent time spent in each of the lookzones was recorded.

Results: i) Observers spent an average of 17.7% of their time evaluating the reconstructed thumb compared to the entire bilateral hand. This was on average 63% more time looking at the reconstructed thumb compared to the normal control thumb. (p value<0.01) ii) Observers spent 43.9% of the time looking at the reconstructed thumb compared to the entire hand of the same side. They spent 31.6% of the time looking at the normal control thumb compared to the entire hand of the same side (p value<0.01, mean 0.36 seconds on the abnormal thumb (SD 0.439)), vs. mean 0.22 seconds on normal control thumb (SD 0.305); mean 0.82 seconds on abnormal hand (SD 0.45), mean 0.69 seconds on entirely normal bilateral hand (SD 0.41)). iii) Areas of significant attention as visualized by heatmaps representing where observers focus their attention include abnormal nailbed and scar tissue at the junction between the toe and native hand skin.

Conclusion: The technique described above may represent a novel and objective technique for quantifying observers’ gaze with respect to toe to thumb reconstructions and the un-altered contralateral thumb. It could be applied to other areas of hand reconstruction to help
determine aesthetic outcomes. The present pilot suggests that symmetric nail size may be an area of importance for creating the sense of aesthetic success. Incorporation of this data into surgical counseling may assist the patient and medical team focus on surgical-decision making priorities.

2

Sensorimotor Myoelectric Control Using Surface Based Regenerative Peripheral Nerve Interface (RPNI)

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Purpose: Although advanced prosthetic devices have the potential to allow fine-motor movements and extract somatosensory signals via sensitive pressure sensors, an ideal interface to integrate the human nervous system with the prosthetic doesn’t exist. Furthermore, the requirement for the implantation of indwelling electrodes and prohibitive costs limits the application of current technologies. The Regenerative Peripheral Nerve Interface (RPNI) was developed as a stable biologic interface on the notion of providing physiologic end-organ targets for regenerating axons by implantation of a residual nerve into an autogenous free muscle graft. Despite providing intuitive motor control, RPNI sensory feedback is limited and also relies on implantable electrodes for myoelectric signal transmission. To address these challenges, we investigated the placement of RPNIs underneath the defatted skin in rats to capture myoelectric signals using surface electrodes. This strategy simultaneously provides sensory feedback through the sensory reinnervation of the overlying skin.

Methods: Utilizing six male F344 rats, the right tibial nerve was transected distally in the thigh before entering the leg’s posterior compartment. Subsequently, the left side extensor digitorum longus (EDL) muscle was harvested and co-apted with the proximal segment of the tibial nerve for RPNI fabrication. The RPNI was placed and secured in between the biceps femoris muscle near the skin while the side opposite to the nerve coaptation was facing the dermis. The overlying skin was defatted and fixed on top of the superficial RPNI (S-RPNI). At two months post-surgery, functional motor reinnervation was evaluated by electrical stimulation of the tibial nerve and compound muscle action potentials (CMAPs) were recorded using surface electrodes. Sensory feedback was assessed by electrical and mechanical stimulation of the skin to respectively record sensory nerve action potentials (SNAPs) and sensory afferent signals. The S-RPNI construct and its overlying skin were subsequently harvested and processed for immunohistochemistry and whole-mount immunostaining.

Results: Recording muscle CMAPs from the skin was readily feasible in all animals, showing robust signals with minimal noise distortion (366 µV ± 86.3). Electrical stimulation of the skin on the lateral thigh, which is not innervated by the tibial nerve normally, resulted in classic tri-phasic SNAP generation in this nerve. Brushing the overlying skin using a cotton swab generated synchronized monomorphic afferent signals. Sensory reinnervation of the skin was shown using IHC. Whole-mount staining of the muscle component showed regenerated muscle with new neuromuscular junctions (NMJs) and spatial segregation of sensory fibers toward their end-target organ.

Conclusion: Superficially placed RPNI is a viable and an alternate methodology that is simple to implicate and has the potential to transmit simultaneous, real-time, and independent sensory and motor signals between the residual nerve and the prostheses.

3

IGF-1 Hydrogel-based Nanofiber Drug Delivery System to Improve Nerve Regeneration and Functional Recovery After Peripheral Nerve Repair

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