signs of neuroma with chaotic nerve regeneration (multidirectional axonal regrowth confirmed by histology) extending from the proximal stump as early as 4 weeks. At 5 weeks, axons grew through the entirety of the 0.5 cm ANAs, with neuroma formation extending beyond the grafts. In the 2.5 and 5.0 cm ANAs, robust axonal regeneration was demonstrated in the proximal portions of the grafts with a gradual tapering of regeneration as it moved distally, and axons failed to grow beyond the grafts. At 20 weeks, gross visualization of Thy1-GFP labeled axons demonstrates that regeneration dwindles and terminates within 5.0 cm ANAs without neuroma formation. Further histological analysis is ongoing, as are additional 20 week experiments to evaluate controlled termination with histology and IHC.

CONCLUSION: Following nerve transection, long ANA “caps” can be used to control disorganized axonal regrowth, and therefore prevent the formation of a neuroma. As such, the “capping” of a transected nerve with a long ANA is a potential surgical tool in the future of neuroma management. Based upon these results, further studies are underway in a swine model to evaluate the use of ANAs in neuroma prevention in a neuroma model more similar to the human.

RESULTS: Optimal corneal denervation was achieved by ablating V1 at the stereotactic coordinates (+ 1.5 mm, + 2.0 mm, 10 mm) with 3 W for 60s. Stereotactic electrocautery of V1 was well tolerated, however injury to the TG resulted in unacceptable morbidity. Corneal neurotisation using CP and sural nerve grafts was successful resulting in a significant increase in corneal axon density. Denervated corneas demonstrated minimal reinnervation after 4 weeks (2301 μm/mm² ± 1347) and reinnervation was restricted to the peripheral stroma. Neurotised corneas exhibited significantly greater corneal nerve density (62872 μm/mm² ± 12400; p < 0.0001), which extended to the central cornea and subbasal layer and was comparable to uninjured (normal) controls (46165 μm/mm² ± 3965). Histomorphometry demonstrated significant growth of myelinated axons across the grafts. Retrograde-labelling of uninjured cornea controls labeled 478 ± 16 neurons in the ipsilateral TG innervating the cornea with no labeled neurons in the contralateral TG. In contrast, labelling of neurotised corneas demonstrated no labeled neurons in the ipsilateral TG (0 ± 0) with a significant number of labelled sensory neurons in the contralateral TG (353 ± 215), suggesting axons reinnervating the cornea after neurotisation derived from the donor grafts and contralateral face.

CONCLUSION: The described animal model of corneal neurotisation is valuable to further investigate how reinnervation of the cornea using foreign donor nerves influences corneal epithelial health, including epithelial healing and protein expression.