



Novel Bioengineered Tapered Conduit Reduces Neuroma Formation After Targeted Muscle Reinnervation



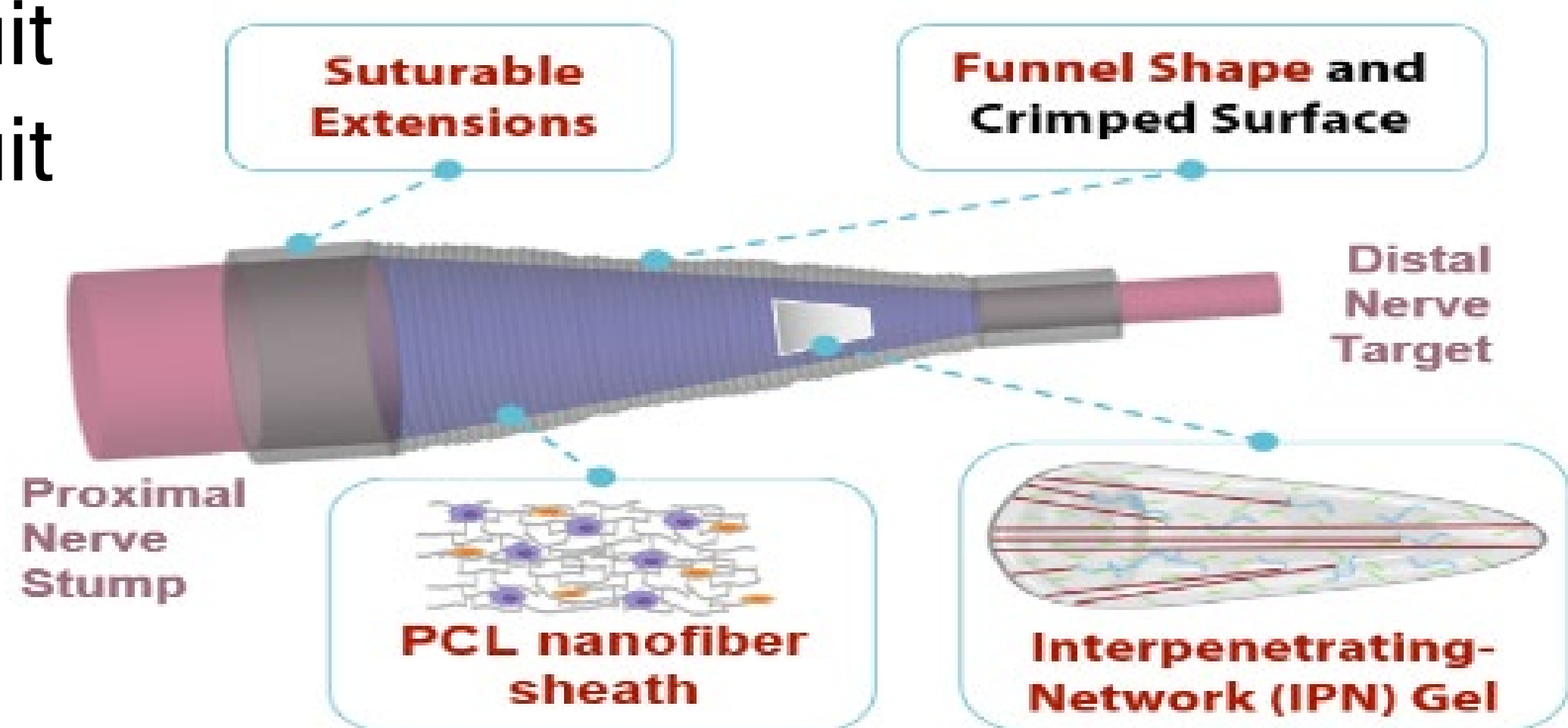
Purpose

Targeted muscle reinnervation (TMR) outcomes may be limited by axonal escape and consequential neuroma formation at the often size-mismatched coaptation. To overcome this concern, we developed a bioengineered funnel-shaped conduit to mechanically guide regenerating axons across the coaptation site as well as inhibit a proportion of the regenerating axons through the use of chondroitin sulfate proteoglycans (CSPGs) to reduce the size mismatch between nerves.

Methods

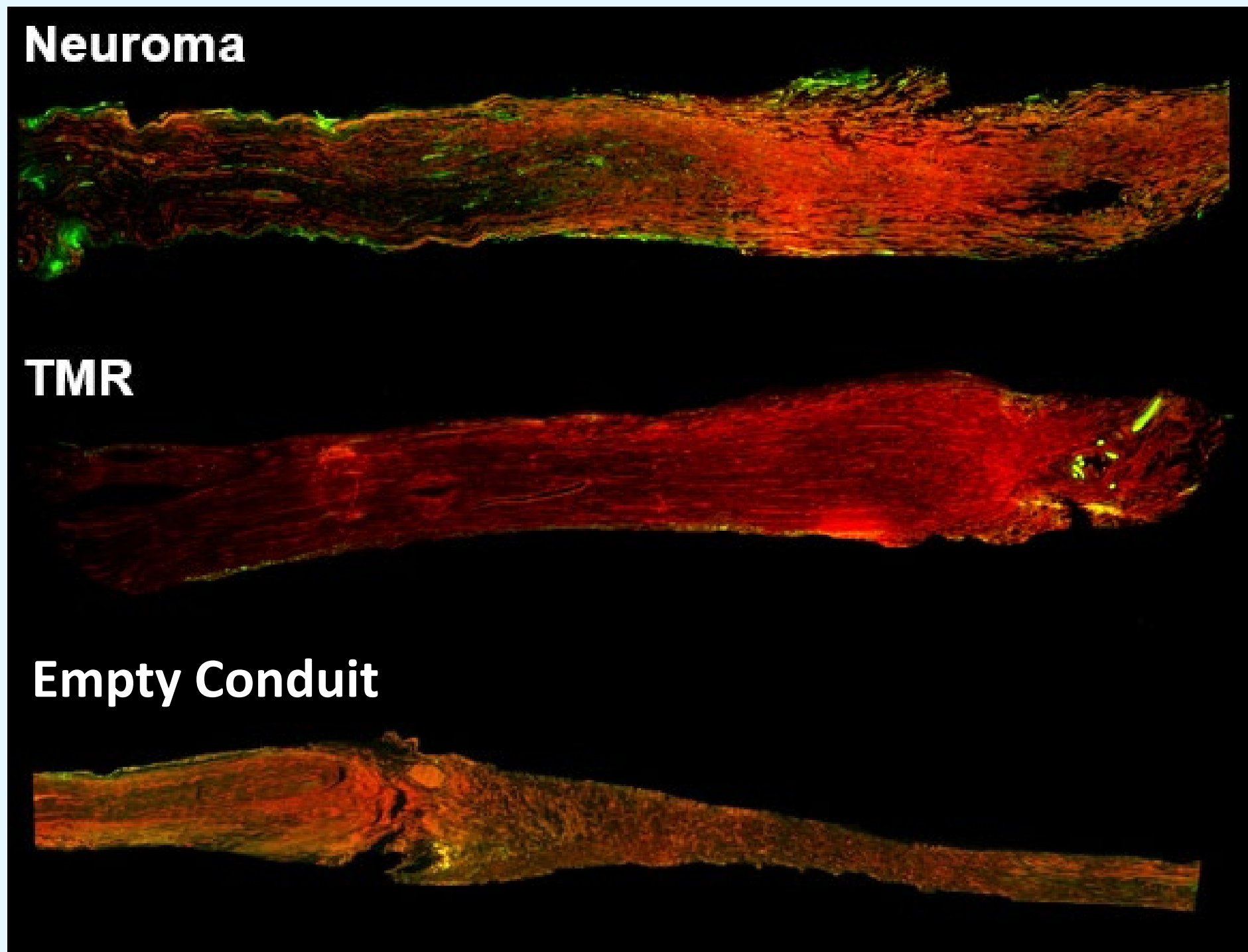
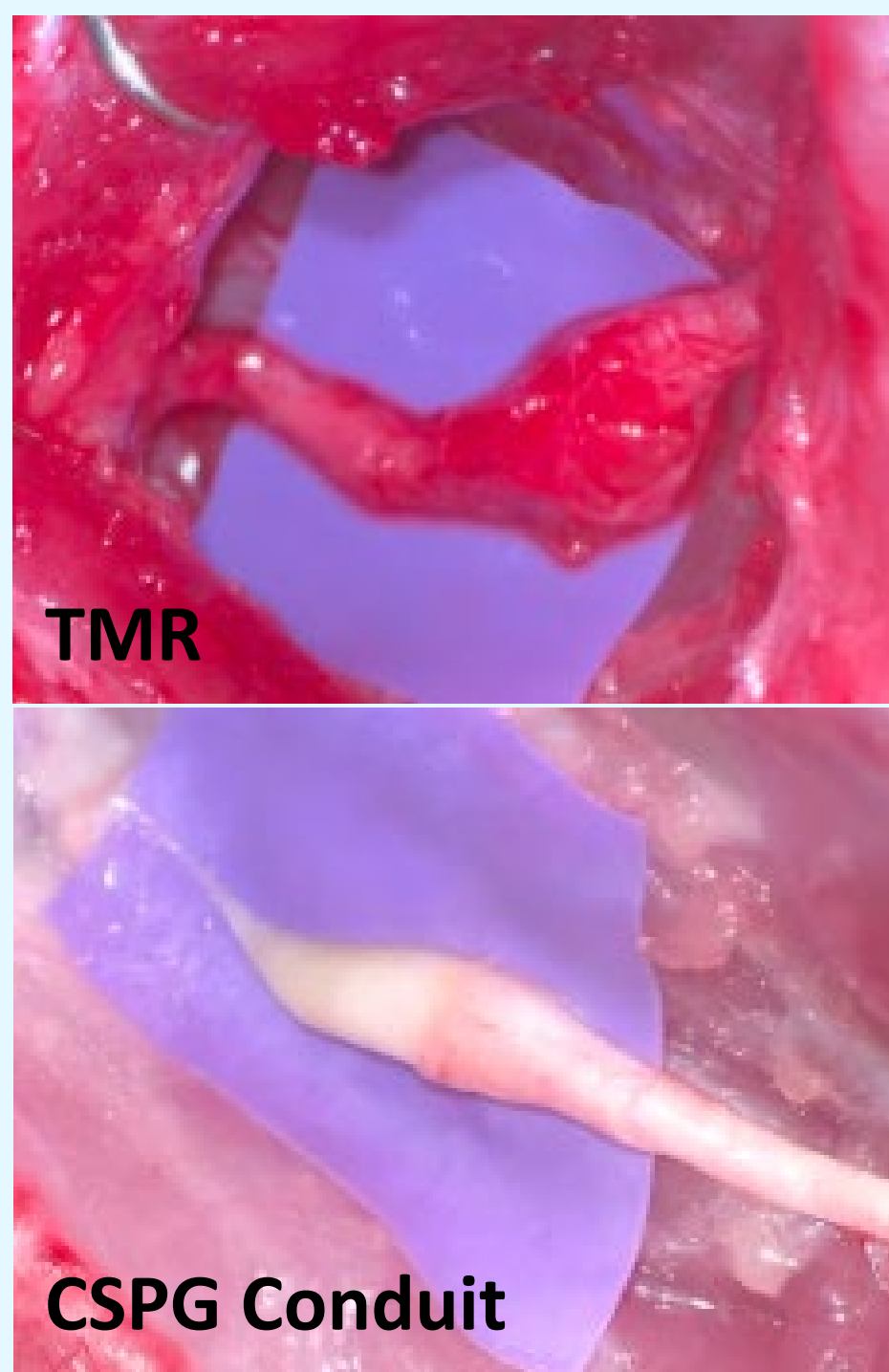
- Nonwoven poly-ε-caprolactone was electrospun into a funnel shaped conduit
- Within the conduit, CSPGs incorporated into a nanofiber hydrogel form an interpenetrating network
- Using a TMR rodent hindlimb model, we tested the effects of this device with and without CSPGs on neuroma formation in the following groups:

- CSPG Conduit
- Empty Conduit
- TMR
- Neuroma
- Sham

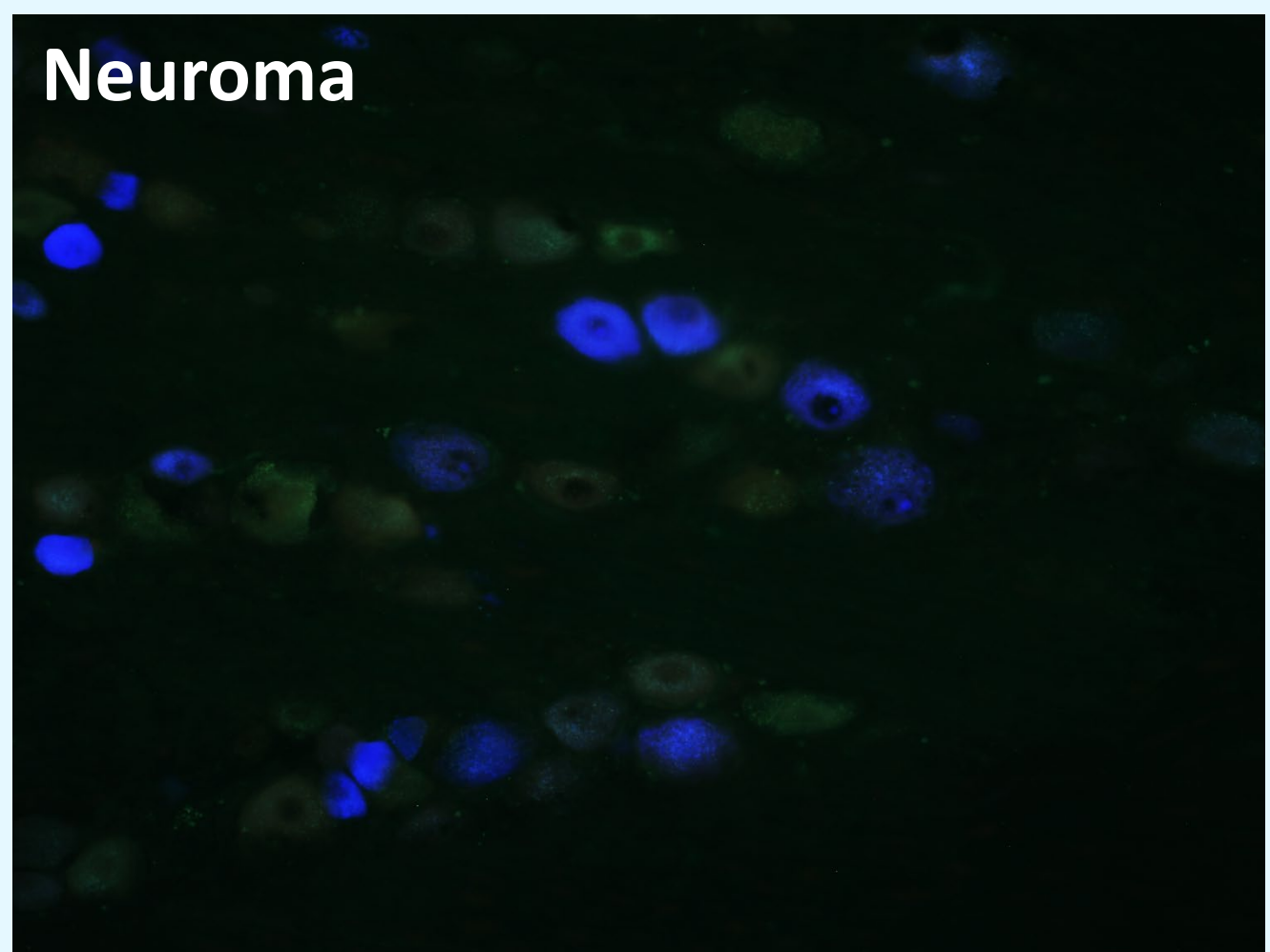
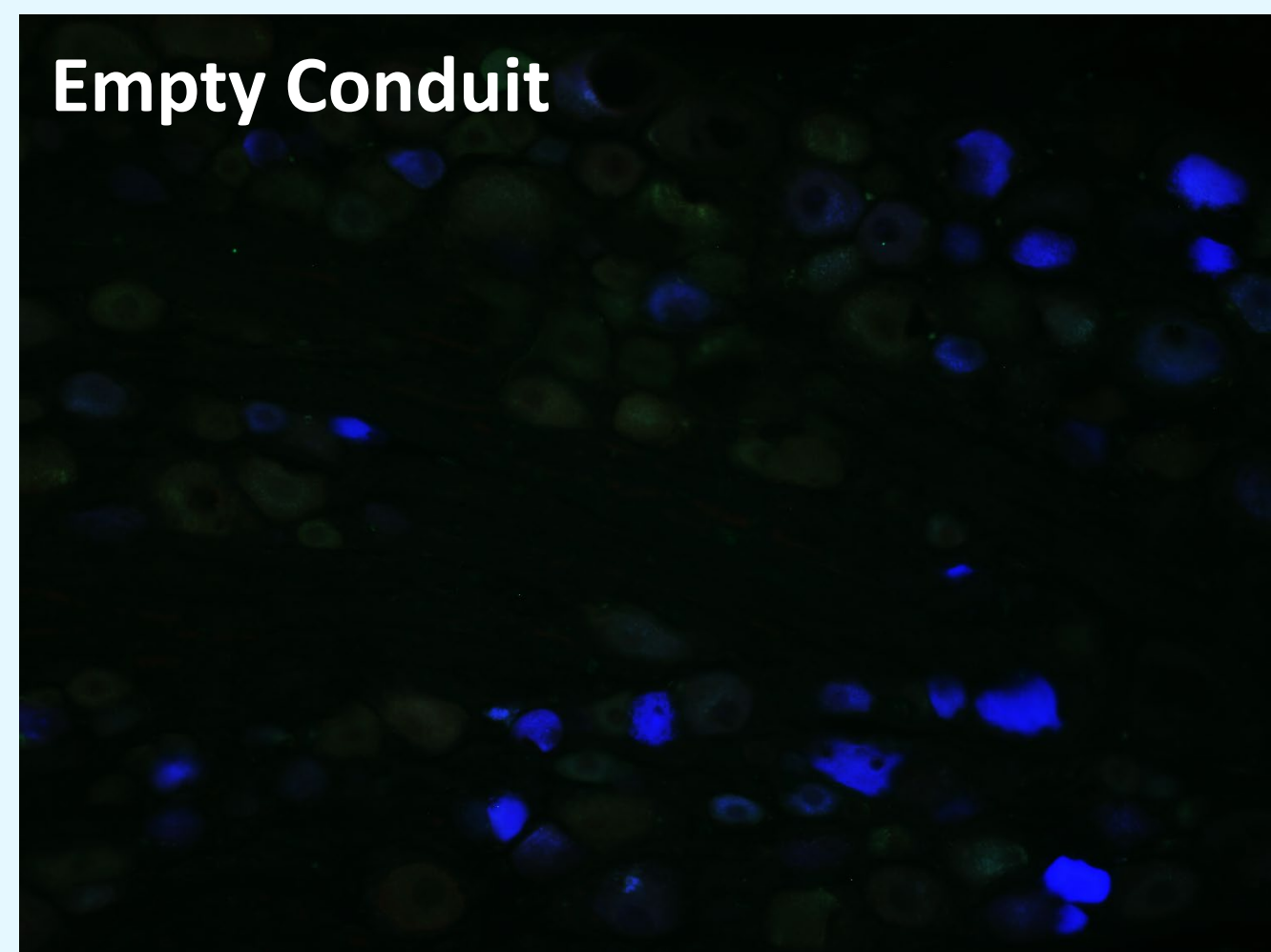


Results

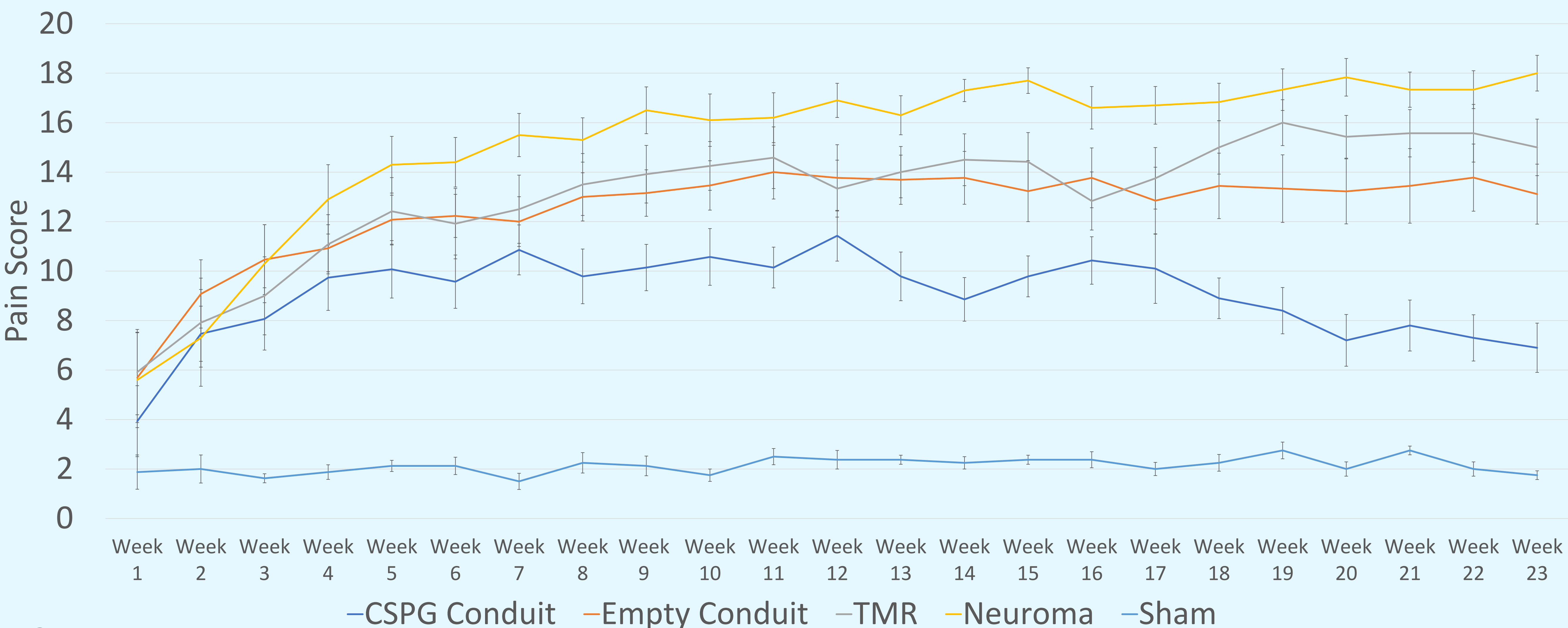
Conduits resulted in tapered reinnervation of the lateral gastrocnemius nerve and muscle by the sciatic nerve as seen on both gross appearance and **SCG10** immunofluorescence for regenerating sensory axons.



Conduits **facilitated axonal regeneration into muscle** as shown by retrograde labelling (blue) and expressed **less Substance P** in the L3-L6 dorsal root ganglion (green)



CSPG Conduit Animals Demonstrated Significantly Lower Pain Behaviors



Conclusions

This tapered conduit presents a biologically compatible, non-invasive means by which we could optimize TMR postoperative outcomes.

