# Transplants and Grafts

## A Nerve Cuff Delivery System Enables Rapid Recovery of Limited Function after Peripheral Nerve Injury

Peripheral nerve injuries are common and often devastating as they frequently lead to poor recovery of sensory and motor function in the affected extremity. Extremity amputations resulting from blast injuries or otherwise, are one of the most debilitating combat injuries for our active military personnel, and one of the key factors for upper and lower extremity amputations is concomitant nerve injury. Additionally, chronic pain syndromes are associated with neuromas resulting from unrepaired or ineffectively repaired nerve injuries.

In animal studies, Polyethylene Glycol (PEG) improves the healing of nerve injury sites by immediate fusion of the cut nerve ends while methylene blue lessens the spread of oxidative injury (*Bamba et al. 2017, Bamba et al. 2016, Riley et al. 2017*; Figure 1). The optimal treatment is a single dose that is easily applied during the surgical repair.

Researchers at Vanderbilt Medical Center (Nashville, Tennessee) and AxoGen, Inc., (Alachua, Florida), conducted a study to develop a prototype nerve cuff delivery system that will both bring the cut nerve ends together and allow for the fusion solutions to be applied. This strategy has been shown to rapidly restore nerve function in rodents, even when the nerves are completely cut or when segments have been cut away.

In conclusion, the nerve cuff delivery system enables peripheral nerve repair with a PEG-based method. It will allow rapid recovery of some function and increases the ultimate recovery by preventing target tissue atrophy.

*This study was funded by Peer Reviewed Orthopedic Research Program, and is strategically aligned with Combat Casualty Care Research Program. The award (W81XWH-13-1-0447) was managed by Congressionally Directed Medical Research Programs.*

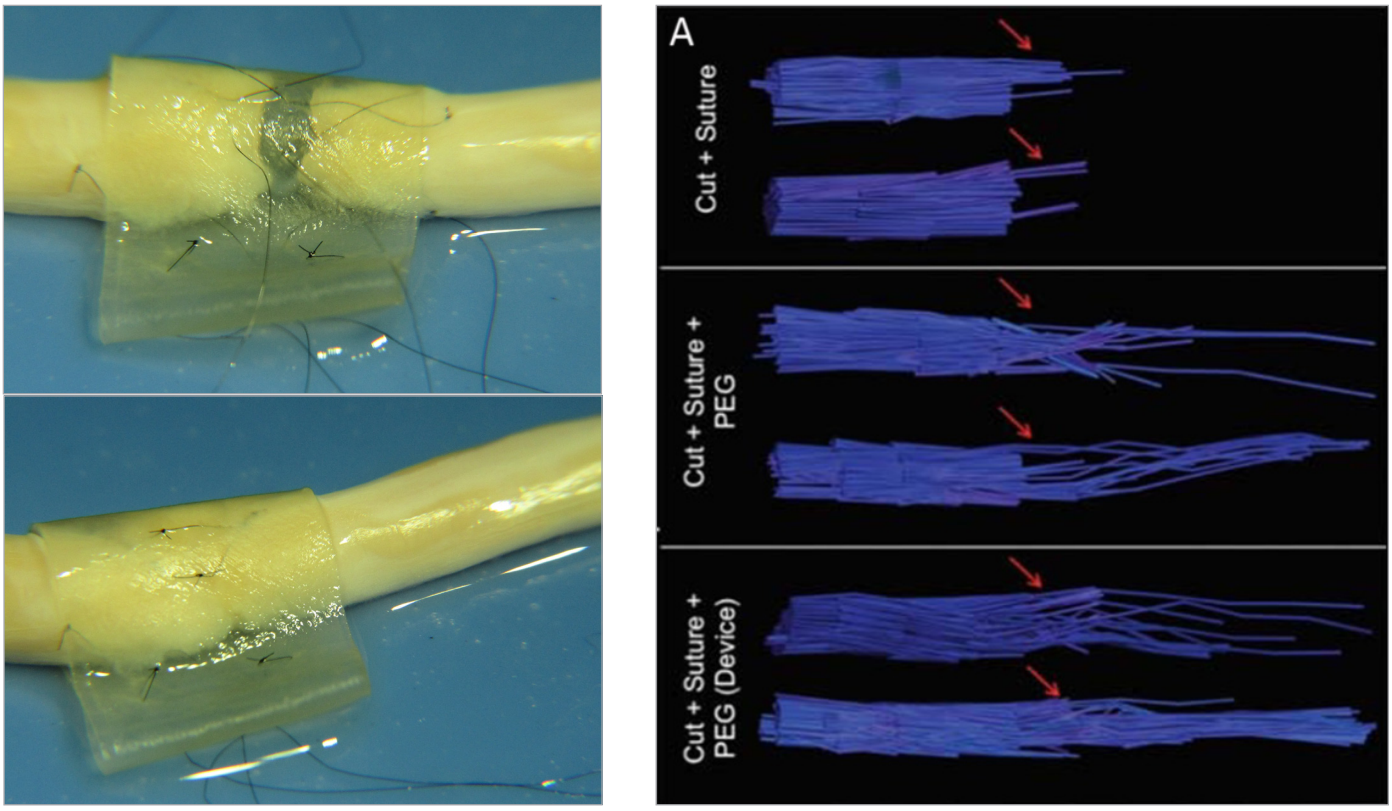


**FIGURE 1:** Examples of Prototype and PEG-fusion tractography. The top left image demonstrates the cut nerve endings with the device sutured into position. Two sutures are placed on each nerve that are 180 degrees apart. The nerve is then drawn into the tube, with PEG applied, to the ends touch and secured. The diameter and circumferential fit can be adjusted with a pre-placed "cinch" suture (bottom left image). The right panels show magnetic resonance tractography immediately after treatment with or without PEG using an earlier prototype. The tracts indicate axonal continuity after fusion by the treatment, thereby resulting in partial but immediate recovery of function in the nerve. (Figure from Riley et al. (2017) used with permission from the authors).

## REFERENCES:

Bamba, R., Riley, D. C., Kelm, N. D., Cardwell, N., Pollins, A. C., Afshari, A., Nguyen, L., Dortch, R. D., and Thayer, W. P. 2017. "A Novel Conduit-Based Coaptation Device for Primary Nerve Repair." Int J Neurosci (Epub):1-7. doi: 10.1080/00207454.2017.1398157.

Bamba, R., Riley, D. C., Kelm, N. D., Does, M. D., Dortch, R. D., and Thayer, W. P. 2016. "A Novel Technique Using Hydrophilic Polymers to Promote Axonal Fusion." Neural Regen Res 11 (4):525-8. doi: 10.4103/1673-5374.180724.

Riley, D. C., Boyer, R. B., Deister, C. A., Pollins, A. C., Cardwell, N. L., Kelm, N. D., Does, M. D., Dortch, R. D., Bamba, R., Shack, R. B., and Thayer, W. P. 2017. "Immediate Enhancement of Nerve Function Using a Novel Axonal Fusion Device after Neurotmesis." Ann Plast Surg 79 (6):590-599. doi: 10.1097/SAP.0000000000001242.