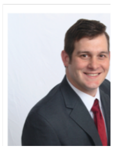
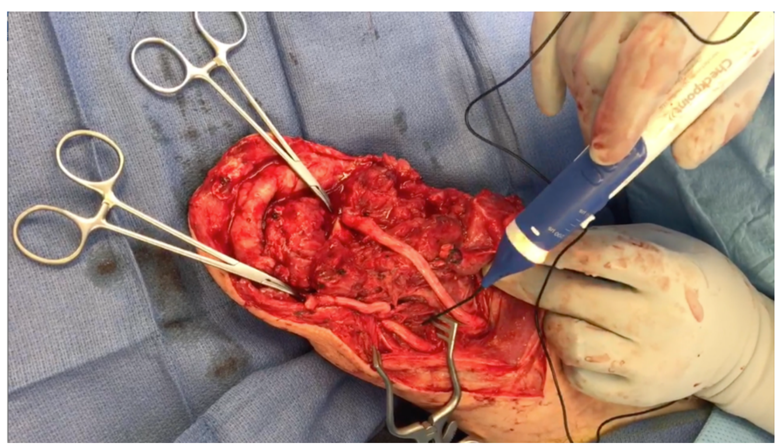
Case Report: Use of the Checkpoint Nerve Stimulator in Targeted Muscle Reinnervation in the Upper Extremity.



Steven A. Schulz, MD. Microsurgery Fellow, The Ohio State University Department of Plastic Surgery

Ian A. Valerio, MD. Associate Professor of Plastic Surgery, The Ohio State University Department of Plastic Surgery

Introduction:
Targeted muscle innervation (TMR) is a nerve transfer technique that is utilized in amputated upper and lower extremities to re-route the transected distal peripheral nerves into terminal muscular motor nerve targets.[1-4] This technique can allow for the utilization of more functional prosthetics for amputees, as well as significantly improved pain control due to reduced neuroma associated pain.[2,3,4,5] This technique was originally described as a secondary operation for upper extremity amputees to increase prosthetic functions.[4] More recently, TMR has shown benefits when performed in the acute setting, thus limiting the need for secondary procedures while still maintaining its contributions to prosthetic function and pain control. Locating the terminal nerve targets can be quite challenging as these structures are usually a few millimeters in diameter, and the typical nerve location and associated anatomical landmarks may be altered by the amputation. The Checkpoint Nerve Stimulator has been an important instrument in making this operation more predictable, facilitating easier location of these motor nerve targets.

Case Study:


The patient is a 26 year old right handed male who suffered a traumatic amputation of the upper extremity from an industrial accident. His initial care and definitive amputation was done at an outside hospital, and the patient was transferred to our institution approximately three days later for TMR. He presented with a transhumeral amputation through the distal third of the humerus with a closed wound. TMR was completed by extending the previous incision through the bicipital groove as a well as a secondary posterolateral incision. The medial approach give us access to the following nerve transfers: 1) ulnar nerve transfer and coaptation to a brachialis motor nerve target, 2) medial antebrachial cutaneous nerve transfer and coaptation to another brachialis motor target, 3) the median nerve transfer and coaptation to motor nerve branch of the short head of the biceps brachii, and 4) the musculocutaneous nerve transfer and coaptation to a motor nerve branch of the long head of the biceps brachii. An additional posterolateral approach permits access for nerve transfer of the radial nerve to a motor nerve branch of the lateral head of the triceps brachii. The Checkpoint Stimulator is used to selectively identify the location of the distal motor nerve targets in the selected muscles. Once the motor target is identified, the targeted distal motor nerve is transected, and the major peripheral nerve is transferred and then coapted to the previously identified distal motor nerve. The nerve coaptation can then be reinforced and protected by wrapping a deinnervated cuff of surrounding muscle around the coaptation site. Tenodesis and wound closure was then performed. This patient tolerated the procedure well. Pain scores, prosthetic tolerance, function, and usage rates are collected on an outpatient basis. Further assessment for cortical re-orientation and utilization of a functional prostheses are done 6 to 12 months post TMR to allow for healing as well as nerve regeneration.

Scan to view video

Conclusion:

Targeted muscle innervation (TMR) is a procedure that is gaining interest and adoption to treat amputee patient neuroma related pain as well as provide improved bioprosthetic function. It is beginning to be increasingly utilized in the acute setting (i.e. at the time of index amputation procedure) to favorably impact pain control as well as increasing the potential for functional prosthetic qualification. The Checkpoint Nerve Stimulator can improve operating efficiency as well as aid in quickly identifying the diminutive distal motor nerve targets necessary for the nerve transfers to achieve the objectives described above.

References:

1. Gart MS, Souza JM, Dumanian GA. Targeted Muscle Reinnervation in the Upper Extremity Amputee: A Technical Roadmap. J Hand Surg Am. 2015;40(9):1877-88.
2. Souza JM, Cheesborough JE, Ko JH, Cho MS, Kuiken TA, Dumanian GA. Targeted muscle reinnervation: a novel approach to postamputation neuroma pain. Clin Orthop Relat Res. 2014;472(10):2984-90.
3. Pet MA, Ko JH, Friedly JL, Mourad PD, Smith DG. Does targeted nerve implantation reduce neuroma pain in amputees?. Clin Orthop Relat Res. 2014;472(10):2991-3001.
4. Kuiken TA, Li G, Lock BA, et al. Targeted muscle reinnervation for real-time myoelectric control of multifunction artificial arms. JAMA. 2009;301(6):619-28.
5. Bowen JB, Wee CE, Kalik J, Valerio IL. Targeted muscle reinnervation to improve pain, prosthetic tolerance, and bioprosthetic outcomes in the amputee. Adv Wound Care (New Rochelle). 2017;6(8):261-267.

The Checkpoint Stimulator is a single-use, sterile device intended to provide electrical stimulation of exposed motor nerves or muscle tissue to locate and identify nerves and to test nerve and muscle excitability. Do not use the Checkpoint Stimulator when paralyzing anesthetic agents are in effect, as an absent or inconsistent response to stimulation may result in inaccurate assessment of nerve and muscle function. For a complete list of warnings and precautions regarding the use of the stimulator please see www.checkpointsurgical.com.

Note: White Papers are Company funded and not peer reviewed.