A STUDY INVESTIGATING TARGETED MUSCLE REINNERVATION FOR INDIVIDUALS WITH TRANSRADIAL AMPUTATIONS

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Current strategies do not allow individuals with a transradial amputation to fully benefit from newly available multi-articulating hand prostheses. Targeted Muscle Reinnervation (TMR) surgery, where residual nerves are transferred to target muscle sites, has been successful in providing additional neural control information for higher-level amputees [1]. Additionally, pattern recognition (PR) of residual limb muscle signals has provided advanced control of multifunction prostheses. The objectives of this study were to quantify and compare PR control of a multi-articulating hand before and after TMR surgery in transradial amputees.

Previous myoelectric users with a unilateral transradial amputation were recruited and enrolled at the Shirley Ryan AbilityLab and Walter Reed National Military Medical Center. Subjects were fit with a custom socket with eight bipolar electromyography (EMG) channels, a passive wrist, modified Touch Bionics i-limb revolution hand, and a Coapt Complete Control System. The study was divided into three 8-week home trials: pre-TMR conventional control, pre-TMR PR control, and post-TMR PR control. Subjects participated in the pre-TMR home trials in a randomized order. For the TMR surgery, the median nerve was transferred to the flexor digitorum superficialis muscle and the ulnar nerve to the flexor carpi ulnaris muscle. Subjects participated in the post-TMR home trial at least 6 months post-surgery. Prior to starting each home trial, subjects were trained with an Occupational Therapist. While at home, they complete a daily log of their wear time, usage, and level of control of the device. At the end of each home trial, a variety of outcome measures were scored including the Southampton Hand Assessment Procedure and the Assessment of Capacity for Myoelectric Control.

Currently, three subjects are participating in home trials. The grips were selected with the help of the occupational therapist to include those most functional for a variety of daily activities. With pre-TMR conventional control, all subjects were able to select up to five grips using four triggers. With pre-TMR PR control, the two subjects who have begun home trials have selected four grips (Tripod, key, power, and precision pinch open). While the subjects have had 3-5 grips available, mainly two grips were used. Current use times reported for the home trials averaged 4.5 hours/day for subject one and 2.2 hours/day for subject two. Post-TMR PR home trial results will be discussed as well as any differences seen in the level of prosthesis control and/or performance compared to the pre-TMR PR home trial.

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REFERENCES

[1] T. A. Kuiken, et al., "Targeted Muscle Reinnervation for Real-time Myoelectric Control of Multifunction Artificial Arms," JAMA, vol. 301, pp. 619-628, February 11, 2009.