Obtaining the Requisite Signals to Allow Independent Digital Control of a Myoelectric Prosthesis with the Starfish Procedure
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INTRODUCTION: The hypothesis of this study was that the Starfish procedure can provide viable signals to enable independent digital control of a myoelectric prosthesis.

METHODS: This was a retrospective review of prospectively collected data. It was approved by our Institutional Review Board (IRB). A query of our internal database was performed based on the CPT codes for Starfish procedure for partial hand amputation from 2010 - 2019. Clinic and hospital medical records were reviewed to determine if the Starfish procedure using dorsal interossei for partial hand amputation was performed. All patients who had a Starfish Procedure at our institution were seen for follow up for standard postoperative intervals of 6 weeks, 3 months, 6 months, 1 year, and annually for the life of the patient. Patients were included if they had been compliant with their routine follow up. At these routine follow-up visits, patients completed a standardized research outcome packet (including DASH, VAS scores, Satisfaction scores, and Common Functional Activity Ratings) and underwent clinical testing of the upper extremity that included activation of transferred muscles, evaluation of wound healing, and functional use of prosthesis.

RESULTS: There were 15 patients included in this series. Of these, 2 were female (13%) and 13 were male (87%), the mean age was 43 years old (range 22 – 66), 9 were Caucasian and 6 were other race/ethnicity, 12 patients had left sided surgery while 3 were right sided. The amputated digits included the Thumb in 3 (20%), Index in 11 (73%), Middle in 15 (100%), Ring in 15 (100%), and Small in 14 (93%). There were 2 patients (13%) with previous history of depression and 2 (13%) patients with depression postsurgery. Preinjury work status was reported for 11 patients, of these 1 patient (7%) was retired and 10 patients (67%) employed full time prior to their injury. Postinjury, the work status was reported for 12 patients and of these 1 was retired (7%), 2 employed full time (13%), 3 receiving disability payments (20%), and 6 were unemployed (40%). There were no reports of postsurgical neuroma in any of the patients during the study period. All patients had recordable signals with myoelectric testing and/or were actively using a myoelectric prosthesis. Patients reported an average wear rate of 5.5 hours per day and mean of 5.5 days per week. Patients reported the average common functional activity ratings (1-8 with 1 being the most common) grooming 5.5, dressing 2, eating 3, meal preparation 3, housework 2.5, yardwork 3, recreation 4, work 5. DASH scores presurgery and postsurgery were obtained with average presurgery DASH score of 52.1, postsurgery without prosthesis 58.3, and postsurgery with prosthesis of 40.4 (p=0.31). All had a decrease in DASH scores postsurgery with prosthesis except for 1 patient with average improvement in DASH score of 16 points. Patient reported VAS pain scores (0 – 10) postoperatively for residual pain were mean of 3.5 (0 – 7.5) and for phantom pain was 2.2 (0 – 6.3). Three patients reported prosthesis related issues including issues with fit, battery, and locking mechanism. Commonly reported challenging tasks included dressing, pinching, yardwork, bathing, and tying shoes.

DISCUSSION AND CONCLUSION: This is the first report of outcomes in patients undergoing Starfish procedure for partial hand amputations and acquiring and using a myoelectric prosthesis with independent digital control and all patients had viable myoelectric signals present at most recent follow up. Patients undergoing this procedure report adequate daily prosthetic use with improvements in DASH scores postoperatively with the use of a prosthesis. Although the procedure resulted in functional improvements, some residual pain and difficulty with certain daily tasks was observed.