

**Table 2**

Rates of change between major time points for patient population and surgical groups

Outcome Variable	Δ baseline to 12 weeks	Δ from baseline to poorest rating	Δ from poorest rating to return to baseline level	Δ poorest rating to 3 months
<b>DASH</b>				
All Patients	1.22	7.86	16.23	5.76
Nerve	1.26	10.54	21.89	7.16
Decompression				
Nerve	0.96	6.20	17.59	3.34
Reconstruction				
<b>SF-8 PCS</b>				
All Patients	0.51	3.66	5.32	1.91
Nerve	0.40	2.35	8.50	1.77
Decompression				
Nerve	0.67	6.75	10.47	3.14
Reconstruction				
<b>SF-8 MCS</b>				
All Patients	0.18	4.60	5.28	1.14
Nerve	1.06	7.12	10.65	2.69
Decompression				
Nerve	0.57	9.30	5.60	0.22
Reconstruction				
<b>Pain</b>				
All Patients	1.85	11.17	5.05	3.04
Nerve	2.26	8.97	8.63	3.28
Decompression				
Nerve	1.15	15.46	41.97	2.66
Reconstruction				

## 23

### Early Implementation of Sensorimotor Retraining for Cortical Reintegration in Postoperative Rehabilitation in an Bilateral Above Elbow Allotransplantation

*L.L. FILIPPI*

*Physical Medicine and Rehabilitation, Johns Hopkins Hospital, Baltimore, MD, United States*

**Purpose:** The goal of postoperative rehabilitation after hand transplantation is to enhance the quality of life, improve arm and hand function and raise an individual's level of self-esteem. Despite the lack of established protocol for this population, literature is in agreement that cortical reintegration is imperative in achieving optimal functional outcomes for those with a transplanted limb. Published case studies on transplant patients by Dubernard and Geatz demonstrated changes in cortical maps were reversed with restoration of motor and tactile sensation. This case study describes the implementation of early phase sensorimotor retraining for a patient having undergone the first bilateral above elbow arm transplantation.

**Methods:** The patient is a 35 year old male who sustained bilateral above elbow traumatic amputation in May 2012. He successfully received bilateral arm transplantation in November 2017. Hand therapy was provided daily beginning the day after surgery with focus on passive ROM for both hands, positioning, edema management and fabrication of custom molded bilateral arm and hand orthoses modified periodically as determined by changes in arm girth. Adaptation and environmental modifications were implemented to enhance independence in basic self-care tasks. Graded exercises for the trunk and arms were introduced based on strength, motor control gains and tissue healing. Frequency of therapy was changed to 5 days a week under outpatient setting after discharge from acute care.

Sensorimotor training was initiated 10 days after surgery with graded motor imagery focusing on left/ right discrimination, visualization techniques and imagined movements. The use of mirror therapy was not applicable but to aid lateralization training, a computer program was downloaded to his iPad which he could

access using his right foot. At 4 weeks, NMES (VMS FR) at sensory threshold was introduced to create “noise” on both long hand flexors and extensors. At 8 weeks after surgery, surface EMG was added to his sensorimotor retraining program targeting his biceps and triceps. This added another level of feedback as he worked towards meeting target muscle contraction. Using a BTE Primus, shoulder eccentric strengthening following controlled contraction for internal and external rotation was initiated 10 weeks after surgery. At week 14, gaming devices were added to his sensorimotor retraining program with alternating use of the Xbox Kinect for active shoulder motions, Boba exercise board device while weight bearing on his elbows and the Hocoma Armeo Spring device for supported arm movements. The gaming devices provided kinesthetic and proprioceptive feedback of his transplanted arms. Alternating between the gaming devices, use of EMG and BTE allowed multiple sensorimotor facilitation and feedback until his discharge to another facility at week 19.

**Results:** At six weeks after surgery and discharge from acute care, the patient was able to perceive manual deep pressure at approximately 2 inches past his bilateral upper arm volar incision lines. At 8 weeks, it improved approximately to 3 inches and using a 6.65 mm SW monofilament, he perceived sensation 1 cm below his right upper volar arm incision and 2.5 cm for his left. Note that he had significant post-surgical edema that could affect response. With the introduction of EMG, measurements using average work were taken on his biceps and triceps at 8 and 12 weeks with gains of 20-48 uV for the right and 28-48uV for the left. At 19 weeks and discharge from this facility, MMT for right elbow flexion and extension was 2+/5 with trace forearm supination and left elbow flexion and extension was 2/5 with trace forearm supination. He could also perceive a 6.65 mm SW monofilament 5 inches distal his right volar incision line and 6 inches for the left. He reported that his phantom limb sensation still persisted but improved as it is “tied” to an actual limb and that all the sensorimotor retraining has helped him know where his arms are in space. Monthly assessments have since been completed to determine progress and return in function as he continued his therapy in another facility. At 10 months, he demonstrated left index finger active mobility and at 1 year, emerging bilateral middle finger active mobility.

**Conclusion:** There are common themes in rehabilitation protocols and data collection in the different centers that provide hand transplantation procedures. However, every patient will require their own unique treatment plan [1]. This case study shows the successful implementation of early phase sensorimotor training using various rehab techniques and modalities. Due to the nature of this case study, no conclusion can be reached regarding its efficacy, however, positive gains in sensation and motor control were objectively established. Future studies investigating the rehabilitation procedures for this patient population should consider early phase sensorimotor training as part of the rehabilitation protocol.

## 24

### Upper Extremity Pain in Breastfeeding Mothers: A Narrative Review of the Literature

*A. WAGNER*

*Physical Therapy, University of the Incarnate Word, San Antonio, TX, United States*

**Purpose:** Breastfeeding is an occupational activity that requires repetitive use of the upper extremities. Some women may experience upper quarter pain with this activity. The purpose of this narrative review of the literature is to summarize the scientific literature regarding upper extremity or neck pain that mothers may experience with breastfeeding, in order to understand the problem and inform hand therapy examination and interventions for this population.