Table
Long Arm Orthosis Wear

Subject	Wrist Cock-Up Used Prior	Length of LAO Wear (days)
1	NO	N/A
2	NO	47
3	NO	45
4	YES	19
5	YES	21
6	NO	35
7	NO	34

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The Effects of Kinesio Tape® and No Tape for Muscle Facilitation and Inhibition, for Collegiate Athletes With Self-Reported Shoulder Pain

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Purpose: The use of Kinesio Tape® as a therapeutic modality is a common intervention used in occupational therapy. However, there is a lack of research on the benefit of using Kinesio Tape®, especially during the occupation of sports. The purpose of this research was to determine if Kinesio Tape® causes a difference in muscle facilitation, inhibition, and pain, between Kinesio Tape® and no tape for collegiate athletes with self-reported shoulder pain.
Methods: This quantitative non-randomized design used a convenience sampling method. There were eleven participants with self-reported shoulder pain who were athletes on the men's and women's lacrosse and tennis teams from a division III university. Each participant attended one 30-45 minute session for data collection. During this session, each participant received all three taping conditions and performed four repetitions of 120 degrees of active shoulder flexion for the three separate trials (no tape, Kinesio Tape® inhibition, and Kinesio Tape® facilitation). Surface electromyography (sEMG) electrodes were placed on the anterior deltoid, supraspinatus, and lower trapezius to measure muscle facilitation and inhibition. Each participant completed the visual analogue scale (VAS) before and after each trial to measure pain. A one-way analysis of variance (ANOVA) with a Tukey post hoc test was utilized.
Results: No statistical significance was found for pain scores on the VAS between the taping methods of facilitation, inhibition, and no tape ($p = .118$). No statistical significance was found for the percentage of change in muscle function for each taping method; Anterior deltoid ($p = .993$), supraspinatus ($p = .997$) and lower trapezius ($p = .922$).
Conclusion: Based on the results Kinesio Tape® appears to not have an effect on muscle function or pain when utilizing the facilitation or inhibition taping method when compared to no tape.

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Collaborative Curriculum - Advancing Ergonomics Education by Incorporating the Expertise of a Certified Hand Therapist

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Purpose: Dental professions are at a high risk of experiencing musculoskeletal disorders (MSDs), with estimates indicating that between 60% and 96% of the workplace is impacted. [1] The dental hygiene studies (DHS) program at Pacific University previously included standardized ergonomics education in their curriculum, however these principles were reinforced predominantly through passive techniques (posters and brochures). In 2017, Pacific adopted a plan for ergonomics curricular revision that incorporated the expertise of a faculty member in Pacific's Physical Therapy (PT) program; this involved introducing the Core Four activity set to incoming DHS student cohorts by a PT who is a Certified Hand Therapist.
Methods: This study was approved as 'exempt' by the Pacific University IRB. First year DHS students at Pacific received the standard ergonomic curriculum in both the 2018 and 2019 (n = 32 each) graduating cohorts. Starting with the 2020 cohort, students received curriculum from experienced DHS and PT faculty members through a collaborative revision. As part of this enhanced model, the 2020 cohort received instruction in daily performance of the Core Four routine after every clinical-based course. Data from the 2018 and 2019 cohorts will be used as control data; the 2020 and 2021 data will serve as the experimental group. Each group of students was assessed using a set of standardized outcome measures, including the Neck Disability Index, the Upper Extremity QuickDASH, the Visual Analog Scale and a scale of self-efficacy for management of MSDs. Data collection for the control group will be complete in the spring of 2019 and the experimental group data will be available by the spring of 2021.
Results: The results of this investigation are pending; preliminary data for our control group will be ready for analysis by April 2019 and results will be disseminated at the meeting.
Conclusion: Ergonomic-based education through a collaborative model incorporates additional evidence, structure and strategies that may alleviate the potential for MSDs and promote corrective habit formation. In order to promote best practice, including input from both DHS and PT faculty to disseminate optimal instruction may advance ergonomic curriculum for first-year DHS students. Recommendations will be formally established once data analysis is complete.

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Outcome Trajectories for Pain, Disability, and Health Following Surgical Intervention for Peripheral Nerve Disorders

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Purpose: This research examines trajectories of pain, disability and health pre-surgery to 12 weeks post-op (PO) for patients diagnosed with an upper extremity peripheral nerve disorder (UE-PND) to describe overall recovery as well as compare trajectories between patients undergoing nerve decompression (ND) versus nerve reconstruction (NR).
Methods: Adult patients (n=149) undergoing 1 surgery by 1 surgeon for UE PND over a 3-year period participated in this study. Our sample included 60.4% males (n=90) with a mean age of 50.8 (range 18-85). Outcome data included pain on a 100-point visual analogue scale (VAS), self-rated disability with the Disabilities of the Arm, Shoulder and Hand (DASH), and self-reported health with the Short-Form 8 (SF-8) producing mental (MH) and physical (PH) component scores. Scores were converted to a 100-point scale with higher scores denoting better PH and MH and lower scores less disability and pain.

Ninety-seven patients had ND and 52 had NR. Example procedures for ND include carpal tunnel release or ulnar nerve transposition. NR includes nerve transfers and nerve grafting, or patients undergoing both ND and NR. Number of days PO for each visit was calculated and categorized into 1-week intervals to 12 weeks. The week with the poorest rating, return to baseline level, and 12-week PO as well as rates of change (ROC) between each time-point were computed for total sample population and each surgical group. Results from available outcome measures were placed in appropriate time categories to create trajectory graphs for total sample population and surgical groups.
Results: While rates and timing varied among outcome measures, all measures demonstrated similar trends following surgery with poorest rating occurring a few weeks PO, return to baseline, and

scores peaking by 12-weeks PO. Baseline scores for total sample population indicated mid-level disability (43.98), PH and MH within population norms, and mid- level pain (51.03). Pain ratings peaked the earliest at 1 week PO with DASH being the last to peak at 4 weeks PO. DASH and VAS had the greatest ROC between baseline and poorest ratings. All patients demonstrated decreased disability (10.83) that met meaningful clinical difference (MCID) from baseline to 12 weeks PO after experiencing MCID increases in disability pre-operative to poorest rating PO. Return to baseline for all measures occurred 2 weeks after poorest rating except for SF-8 MCS, which occurred 3 weeks after. SF-8 PCS and MCS ratings trended up and down, but remained within population norms at all times.

Surgical groups trended similarly to the total sample trajectory with variations as noted. Baseline ratings for disability, PH and MH were within 10 points between groups with a difference of 11.3 points in pain (lower in NR). ND overall had the poorest DASH and NR had the poorest SF-8 PCS scores. NR experienced poorer ratings 1 week earlier on both DASH and SF-8 than ND. Return to baseline for all measures occurred at the same time for both groups, except for disability. NR returned to baseline disability rating by week 4, whereas ND did not return until week 6. ND experienced the greatest ROC in both disability increase and improvement while NR experienced the greatest ROC in pain increase/improvement. ND demonstrated MCID changes in VAS (18) from baseline to 12 weeks. Both groups demonstrated MCID from poorest VAS to 12 weeks PO. Final ratings yielded similar disability, physical health and pain for both groups; however, MH remained significantly lower for NR.

Conclusion: This research shows that patients following surgery for PND demonstrate improvements in disability, PH and pain from baseline to 12-weeks PO; however, scores worsen before improving. This trend of function worsening in earlier weeks before returning to pre-operative levels following surgery has important implications for the clinician.

Key variations in recovery trajectory between groups including earlier increases in disability and decreases in PH/MH in NR, but higher levels of disability longer in ND, may be explained by patients' perception of PO recovery. Patients with ND may hope for symptom relief quickly following surgery, whereas patients with NR may have already been living with limited hand function due to denervated nerves. This may also explain why NR experiences decreased MH longer than ND. Both groups had similar trajectories for pain, with NR demonstrating more variance. Pain scores overall worsened earlier than disability and PH with the most pronounced ROC, potentially attributed to patients' expectations of improved pain not being achieved until further along in recovery.

These findings endorse a multi-disciplinary approach to patient education on course of recovery. Surgeons an set realistic patient expectations pre-surgery, as well as refer to hand therapists immediately PO to teach patients how to modify activities and manage pain, which can ultimately help decrease high disability levels and improve long-term outcomes.

Figure 1. *Total patient population pain, disability, and health trajectory following surgery*

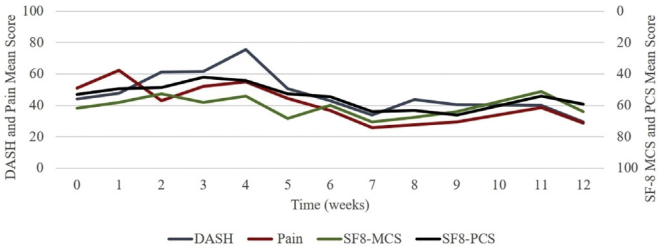

Figure 2. *Surgical group pain, disability, and health trajectory comparisons following surgery*

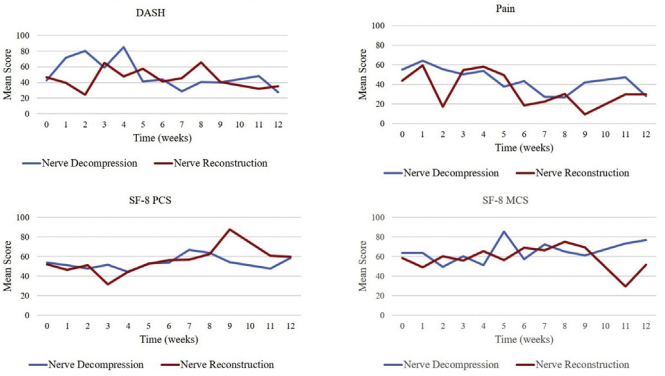

Table 1
Outcomes at major Time points for total patient population and surgical groups

Outcome Measure	Baseline (pre-surgery)	Poorest Rating		Return to Baseline		12 Weeks Post-op
DASH	**Score**	**Score**	**Week**	**Score**	**Week**	**Score**
All Patients	43.98 ± 23.15	75.40 ± 21.55	4	42.94 ± 25.43	6	29.29 ±32.81
Nerve Decompression	42.54 ± 23.50	84.69 ± 13.33	4	40.92 ± 14.80	6	27.38 ± 39.91
Nerve Reconstruction	46.48 ± 22.55	65.09 ± 21.06	3	47.50	4	35.00 ±0.0
SF-8 PCS	**Score**	**Score**	**Week**	**Score**	**Week**	**Score**
All Patients	52.89 ± 19.19	41.90 ± 16.71	3	52.54 ± 18.02	5	59.06 ± 18.51
Nerve Decompression	53.52 ± 19.65	44.14 ± 12.38	4	52.64 ± 24.19	5	58.28 ± 28.14
Nerve Reconstruction	51.81 ± 18.49	31.55 ±7.46	3	52.48 ± 13.22	5	59.85 ± 7.95
SF 8 MCS	**Score**	**Score**	**Week**	**Score**	**Week**	**Score**
All Patients	61.78 ± 25.17	52.58 ± 32.19	2	68.43 ± 21.54	5	63.98 ± 32.67
Nerve Decompression	63.77 ± 22.35	49.53 ± 30.52	2	60.18 ± 22.65	3	76.47 ± 8.85
Nerve Reconstruction	58.31 ±29.37	49.01 ± 21.70	1	60.21 ± 48.25	3	51.48 ± 46.05
Pain	**Score**	**Score**	**Week**	**Score**	**Week**	**Score**
All Patients	51.03 ± 29.88	62.20 ± 27.42	1	52.11 ± 25.63	3	28.80 ± 23.18
Nerve Decompression	55.16 ± 29.52	64.13 ± 28.72	1	55.50 ± 21.75	2	28.00 ± 31.75
Nerve Reconstruction	43.84 ± 29.43	59.30 ± 26.58	1	17.33 ± 15.56	2	30.00 ± 11.31

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
DASH				
All Patients	1.22	7.86	16.23	5.76
Nerve Decompression	1.26	10.54	21.89	7.16
Nerve Reconstruction	0.96	6.20	17.59	3.34
SF-8 PCS				
All Patients	0.51	3.66	5.32	1.91
Nerve Decompression	0.40	2.35	8.50	1.77
Nerve Reconstruction	0.67	6.75	10.47	3.14
SF-8 MCS				
All Patients	0.18	4.60	5.28	1.14
Nerve Decompression	1.06	7.12	10.65	2.69
Nerve Reconstruction	0.57	9.30	5.60	0.22
Pain				
All Patients	1.85	11.17	5.05	3.04
Nerve Decompression	2.26	8.97	8.63	3.28
Nerve Reconstruction	1.15	15.46	41.97	2.66

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

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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 approximatelt to 3 inches and using a 6.65 mm SW monofilamnet, 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.

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

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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.