Manual physical therapy and therapeutic exercise using the NEUBIE for management of complications related to spinal cord injury- a case report

2021

November 24, 2021

MATRX Health & Fitness
Authored by: Krystina Miller, PT, DPT, ATP

Case Study Title: Manual Physical Therapy and Therapeutic Exercise Using the NEUBIE for Management of Complications Related to Spinal Cord Injury- a case report

Therapist Name & Treatment Location: Krystina Miller, PT, DPT, ATP; MATRX Health & Fitness, Macomb, Michigan

Key Words: spinal cord injury, paraplegia, shoulder overuse pain, hetertrophic ossification, frequency specific microcurrents, muscle activation, neuromuscular re-education, functional training

Summary of Treatment and Outcome: The patient's shoulder pain and range of motion have improved significantly using a various neuromuscular techniques combined with electrical stimulation. The patient's bilateral hip range of motion (ROM) has shown significant improvement allowing for increased independence with floor recovery transfers and functional mobility using manual therapy and frequency specific microcurrents (FSM) with the NEUBIE. He is making regular progress with functional reaching and lifting activities, reactive postural strength, and sitting balance with ongoing sessions twice a week.

Patient Information/Diagnosis: 54-year-old male who sustained a T4/5 ASIA A(American Spinal Injury Association) spinal cord injury (complete) in 2014. He underwent spinal fixation and extensive rehabilitation post-injury and he presented to therapy in June 2020 with complete paraplegia; abdominal and back spasms causing daily pain; limitations in hip mobility due to heterotrophic ossification; and bilateral shoulder pain from prolonged wheelchair use and regular adaptive mobility.

Clinical Findings:

Process: Manual Muscle Testing (MMT) & scan, sensation testing, AROM and PROM assessment, functional mobility assessment, standing tolerance

Findings:

Weaknesses: patient lacks voluntary motor activation and sensation throughout lower trunk (below T8) and in bilateral lower extremities. Weakness was noted throughout rotator cuff, lower and middle trapezius, and latissimus dorsi bilaterally. This upper extremity motor imbalance is contributing to poor scapulothoracic rhythm; that combined with adaptive shortening of the latissimus dorsi contributes to reduced shoulder AROM into flexion and abduction.

Scan: No hot spots were noted in lower extremities but note reactive withdrawal (spasticity) when scanning tibialis anterior and plantar surface of foot bilaterally. Hot spots were identified in bilateral biceps tendon, middle trapezius, upper trapezius, and teres complex.

Additional Findings: Passive movement of lower extremities and transitions short sitting to/from supine result in reactive spasticity in abdominals and lumbar spine. Limitations in hip flexion ROM have limited patient positioning for floor recovery transfers (required moderate assistance to perform). He required moderate assistance to achieve and maintain tall kneeling with BUE support; demonstrates significant anterior pelvic tilt in this position due to limited hip extension ROM. When initiating para-gait training prior to starting with MATRX, the patient required bracing to maintain ankle and knee stability, 2-person assist to maintain hip extension and advance BLE, and BUE support in parallel bars (endurance limited to 10-12 ft).

Assessment: Patient presents with complete T8/10 functional paraplegia. His balance and functional mobility are affected by resulting trunk spasticity and concomitant weakness. ROM restriction in B shoulders limits overhead reaching and hip ROM limitations due to heterotrophic ossification were limiting his balance and independence with gait and floor transfers. The scan revealed reactive

spasticity in BLE indicating impaired neural pathways interrupted due to the spinal cord injury. It also identified hot spots in his back and scapular muscles indicating faulty firing and coordination of various muscle groups responsible for scapular stabilization and proper arthro-kinematics of the glenohumeral joint. This has led to impingement and is likely responsible for supraspinatus and biceps tendonitis. The resulting limitation in ROM has affected his independence with overhead reaching and reduced his tolerance during athletic performance (handcycling and weight-lifting) due to pain. The primary goals of skilled physical therapy include neuro-re-education of scapular motor patterns, spasticity management, trunk flexor/extensor strengthening, manual therapy for UE and LE, and functional training (floor transfers, mat mobility, sitting and standing balance, and gait training.

UPPER EXTREMITIES STRENGTH (MMT) and ROM (in degrees)**:**

	Right	ROM	**Left**	ROM
SHOULDER				
Flexion (supine)	**3-/5**	**-6.5”**	**3-/5**	**-10”** **(measured initially as distance of thumb from table)**
Abduction (supine)	**3-/5**	**110**	**3-/5**	**110**
Latissimus Dorsi	**4/5**		**4-/5**	
Pectoralis	**4/5**		**4/5**	
Lower Trapezius	**3-/5**		**3-/5**	
Supraspinatus	**4-/5**		**4-/5**	

LOWER EXTREMITIES:		
HIP		
Flexion	100	90
Extension	10	5
Internal Rotation	10	20
External Rotation	WNL	5

Treatment: manual therapy for release of overactive muscles with “electric fingers” and muscle activations to weak muscles in the UEs, PAILS and RAILS for improvement in shoulder flexion ROM, followed by NEUBIE stimulation at hot spots (teres complex and upper trap) with AROM in supine and prone. AAROM for ankle DF with NEUBIE on hot spots for LE (plantar surface of foot and spinal just below level of injury). Manual joint mobilization/glides with NEUBIE for FSM for hip mobility.
Patient report after initial evaluation: Patient states he could feel the muscles release during manual therapy with the “electric fingers” technique. He was shocked at home much shoulder range of motion he gained in a single session.

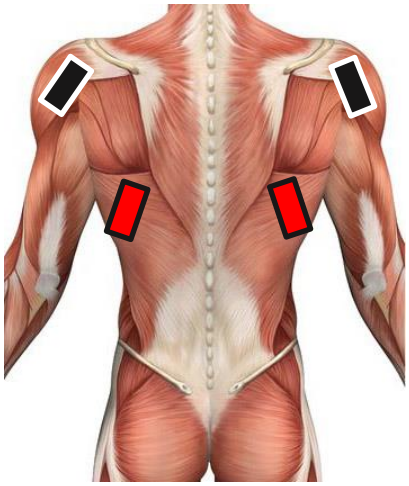
Detailed Treatment, Timeline, and Outcome:

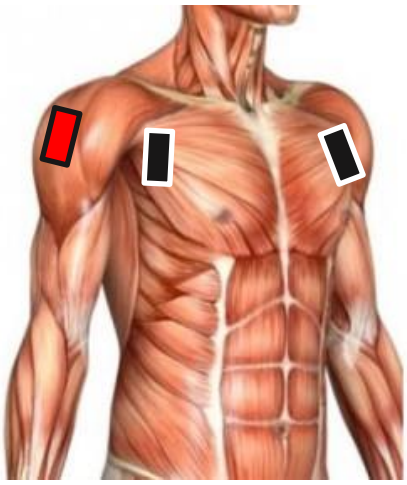
Frequency: 2x/ week for 16 months consistently, except for two 10-day breaks due to illness (treatment ongoing)
Techniques used in follow up sessions: Treatment focuses have shifted as the patient has progressed. Initially, attempts were made to focus on LE strengthening with the NEUBIE for neuro-motor repair, but no progress was made. Due to insurance constraints, sessions shifted to areas of progress. Heavy emphasis was placed on shoulder ROM and pain management. A regular sequence of manual therapy and activations (500 Hz), PAILS/RAILs (500 Hz on antagonist muscle groups with 55 Hz used on agonist muscle groups for shoulder flexion), and AROM with NEUBIE on hot spots (500 Hz) was repeated for several weeks. This progressed to isolated latissimus and lower trapezius strengthening (varied frequencies between 500, 250, 160 Hz continuously as well as 100 and 55 Hz pulsed at 5 sec on/10 sec off) followed by functional carryover during transfers or reaching/lifting activities. When shoulder pain and mechanics were consistently managed, treatment focus shifted to hip mobility, transfers, and gait training. This involved the use of FSM targeting the pelvis and hips during manual therapy prior to

standing tolerance using custom B knee-ankle-foot orthoses (KAFOs) and a gait harness system (GHS). Vestibular training was attempted to aid in management of early orthostatic hypotension and proprioceptive awareness deficits with standing. This did not appear to generate any improvement and was discontinued. Manual trigger point release and spinal joint mobilization was added during FSM to assist with trunk spasticity management and back pain. Postural strengthening was addressed using the NEUBIE for core activation (100 and 160 Hz) during various isolated, functional, and balance-related activities. We have recently increased focus on isolated back extension strengthening at various frequencies (500-250-160 Hz and 55-100-250Hz combinations) followed by a functional application.

Pad Placement for PAILs and RAILs:

Channel 1: 500 Hz
(Red) latissimus dorsi
(Black) pectoralis major and minor
Channel 2: 55 Hz
(Red) lateral deltoid
(Black) posterior deltoid





Pad Placement for FSM:

Channel 1: (Red) Left paraspinals at T10-12
(Black) Right proximal hamstrings
Channel 2: (Red) Right paraspinals at T10-12
(Black) Left proximal hamstrings

Results: Treatment is ongoing. Major milestones noted: August 18, 2020, patient reports that he experiences 2-3 days of relief from abdominal and back extension spasticity following sessions. August 20, 2020, patient received custom-molded KAFOs to progress to gait training. He was limited initially by orthostatic hypotension. In late October 2020 a progress note revealed several significant improvements: he had progressed to para-gait x 9 ft with a GHS and B KAFOs and minimal assist of only one person. Also in that month, shoulder ROM was measured with goniometry at 100º R (also measured at -3.5" from table in supine) and 105 º L (-3" from table in supine); digital dynamometry had been previously initiated for UE strength, and he improved B latissimus dorsi strength by 5 lbs, lower trapezius by 4 lbs on the L, and rhomboids by 10 lbs L and 20 lbs R; hip ROM improved to flexion of 110 º R and 102 º L which allowed us to progress floor transfer training. February 19, 2021, he achieved shoulder ROM of 155-160 º for flexion and abduction B without pain, and he was able to maintain this range between sessions due to improvement in strength in this new range. On June 11, 2021, patient had progressed to 50 ft bouts during gait training using GHS and B KAFOs with only incidental assist to steer GHS. October 26, 2021, he was able to maintain tall kneeling using BUE without assistance due to improvements in his hip extension ROM. On December 1, 2021, he was able to complete a floor recovery transfer with standby assist due to further improvements in hip flexion ROM, shoulder pain management (no longer experiences with functional mobility), and latissimus dorsi strength.

Left: Early treatment: tall kneeling and standing were limited due to UE fatigue. The patient used his arms excessively for support because he was unable to achieve adequate hip extension to utilize ligamentus support to maintain extension. He presents with significant anterior pelvic tilt and excessive lumbar lordosis. Middle: With improvements in hip extension, he was able to progress to upright standing and began working on stability and balance over his pelvis for progression with gait. You can see the reduction in his anterior pelvic tilt and lumbar lordosis. Right: He has progressed from requiring two people to assist with gait in the parallel bars, to gait over 50 ft with minimal assistance of one person due, in large part, to increases in hip ROM, balance, core strength, and UE strength.

Left: shoulder flexion ROM improved from less than 100º to near normal range. Right: Comparison of hip flexion ROM improved from 100º R and 90º L to functional range necessary for floor recovery transfer positioning.

Discussion: Patient's recent course of treatment began several years after his spinal cord injury. Prior to starting with our clinic, he received regular neurologic physical therapy (2x/week) since his hospital discharge in 2015. He had been treated by his current physical therapist in the past, including outpatient in 2017 specifically for assistance addressing hip mobility and floor recovery transfers. During that time, no progress was made with respect to hip flexion ROM, and patient was unable to achieve positioning for floor to wheelchair transfers without moderate assistance. Since working with the NEUBIE, the patient began making improvements in range and resulting strides with transfer independence. Similarly, FSM and manual therapy have helped to unlock hip extension ROM. Within months of focused treatment to the hips, the patient was able to achieve positional and functional goals that he had been unable to make progress with during previous therapy. He made consistent progress with shoulder ROM, and each new range milestone resulted in end range weakness. Strengthening with the NEUBIE and improvements in shoulder kinematics have contributed significantly to the carryover seen with this progress as well as the translation to improvement in functional reach and lifting. The patients previous therapy experience provides a good comparison to demonstrate to power of the NEUBIE to unlock potential that traditional therapy has been unable to tap. The treatment methods used had been applied to this patient in the past, but the addition of the NEUBIE allowed for rapid progress in function.

Patient Perspective: The patient continues to express fascination with "the ability of the machine to find the tight muscles and painful spots" when we use the NEUBIE for manual release techniques and activations. He enjoys capturing videos and pictures for comparison to the same activities at his previous therapy clinic. During his most recent progress assessment, he was shocked that he was able to complete a floor transfer, directly from the floor, without assistance, and with significant ease and efficiency. He immediately said, "It's the strengthening!"

Links to videos:

Floor transfer:
https://fb.watch/9F8cW2F0HI/
Standing activity, gait training, and overhead lifting:
https://instagram.com/p/CXAEN8iJLZk/