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Thoracic outlet Syndrome Decompression and the Effect of Physical Therapy in the Outpatient Setting: A Case Study

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THORACIC OUTLET SYNDROME DECOMPRESSION AND THE EFFECTS OF PHYSICAL THERAPY IN THE OUTPATIENT SETTING: A CASE STUDY

by

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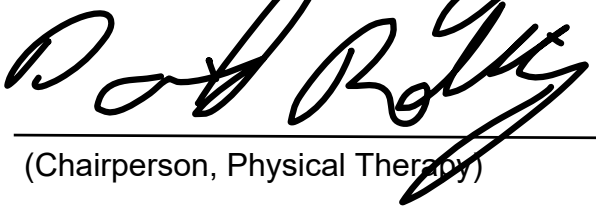

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ABSTRACT

Background and Purpose: Thoracic outlet syndrome (TOS) includes the signs and symptoms in the upper extremity caused by a compression of the brachial plexus, subclavian vein and/or subclavian artery at the thoracic outlet. The thoracic outlet symptoms may present as pain, weakness, numbness, tingling, and early fatigue or heaviness of the arm. Severe and unrelenting symptoms may lead to individuals considering surgical treatment. The purpose of this case report is to present an evidence-based strengthening and stretching program for the post-operative care of TOS.

Case Description: This article describes the 10 - week outpatient physical therapy treatment of a 41-year-old female who underwent a thoracic outlet decompression of the left shoulder. The patient presented to therapy with decreased strength, decreased ROM, muscle imbalance, numbness of forearm on radial and ulnar sides anteriorly and in the hand.

Intervention: The interventions included therapeutic exercise for stretching and strengthening, range of motion, soft tissue mobilizations, and Kinesiotape.

Outcomes: With physical therapy intervention, the patient achieved increased active range of motion, increased strength, decreased pain, and improved postural awareness and alignment. The patient reported elimination of numbness in the fingers following surgery and numbness ceased in the forearm throughout physical therapy treatment. The patient's Shoulder Pain and Disability Index (SPADI) score improved by 20% throughout her time in physical therapy.

Discussion: Rationale for treatment was based on recent studies for biomechanical and exercise considerations for shoulder dysfunction to help improve the patient's presenting symptoms upon evaluation. Treatment changes were based on how the patient tolerated and responded to the treatment.

Key Words: thoracic outlet syndrome, thoracic outlet decompression, neurogenic, treatment, rehabilitation, therapeutic exercise

CHAPTER I

BACKGROUND AND PURPOSE

In 1956, the term thoracic outlet syndrome (TOS) was first used to describe the signs and symptoms in the upper extremity caused by a compression of the brachial plexus, subclavian vein and/or subclavian artery at the thoracic outlet.[1] The thoracic outlet symptoms may present as pain, weakness, numbness, tingling, and early fatigue or heaviness of the arm. The thoracic outlet is composed of tissues between the clavicle superiorly, and first rib inferiorly, along with the lateral neck musculature including the middle and anterior scalenes (See Figure 1). The three structures that are commonly compressed either together or individually are the subclavian artery, subclavian vein, and the brachial plexus nerve roots. These neurovascular bundles enter the thoracic outlet between the anterior and middle scalenes and extend laterally towards the shoulder. Encroachment on the thoracic outlet may be brought on by various causes such as poor posture, acute trauma, anatomical abnormalities, repetitive overhead stress, pressure on the joint, and pregnancy. Compression of the subclavian artery and/or vein is referred to as vascular TOS, and compression of the brachial plexus by any anatomical structure anomalies is neurogenic TOS. Some common risk factors include a higher incidence in females than males and between the ages of 20 – 50 years old.[2, 3] Additional risk factors include anatomical anomalies including cervical ribs, prominent C7 transverse process, or anomalous ligaments; acute trauma such as a motor vehicle accident; and repetitive motion or stress injuries.[3]

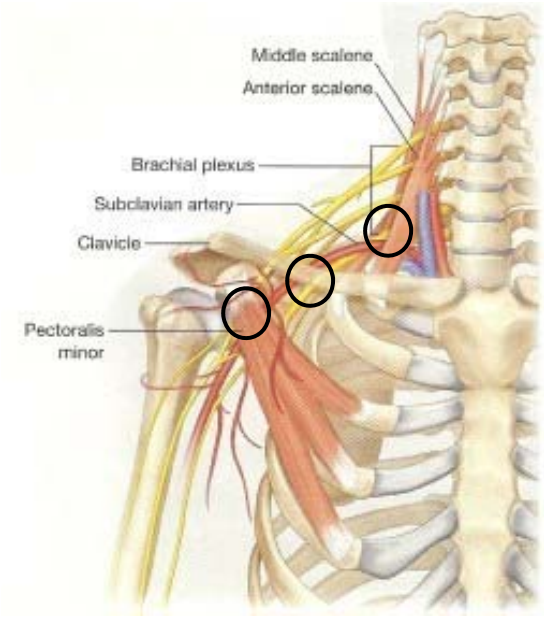


Figure 1. Common points of compression for onset of TOS symptoms.[2]
Adapted from: https://www.unionpt.com/physical-therapy-for-thoracic-outlet-syndrome/

Even though many patients have success with conservative treatment, surgical decompression is available when other treatments are ineffective. The surgical option is utilized more with vascular (venous or arterial) TOS than with neurogenic TOS. There are three approaches for TOS decompression surgery including trans-axillary, supraclavicular, and posterior.[4, 5] The most common approaches with neurogenic TOS are trans axillary and supraclavicular. The thoracic outlet decompression surgery involves the removal of the first rib, scar tissue, extra cervical rib, scalene muscles, and/or pectoralis minor. This is an inpatient procedure and requires physical therapy following surgical efforts. Arm restrictions are in place following the surgery that limit the patient's upper extremity movement until pain subsides.

The prognosis for post-surgical outcomes are generally positive in about 80% of patients if properly selected.[6] However, it is possible that surgery may not relieve symptoms for some individuals including those who have unresolved symptoms following treatment, older clients, active smokers with increased frequency of comorbid

pain syndromes, clients with neck/shoulder disease, and clients with prolonged periods of symptoms.[7] It is advised to screen for these risk factors of poor outcomes prior to surgical candidacy to increase optimal outcomes. The TOS surgery is normally an effective treatment option for clients with TOS, but there are some surgical complications that may arise. Surgical complications may include pneumothorax, injury to the subclavian vein or artery, brachial plexus, or thoracic duct, and failure to decompress the thoracic outlet.[1] As with most procedures, the healthcare team monitors the patient for any signs of acute post-operation bleeding and incision site infection. Following the acute phase, a comprehensive rehabilitation plan was implemented to achieve maximal functional outcomes.

Physical therapy is an integral component of the comprehensive rehabilitation program following TOS surgery. A physical therapy intervention plan is utilized to help regain strength, improve range of motion, and decrease pain with movement and everyday tasks. Most of the current literature focuses primarily on physical therapy for thoracic outlet syndrome as a conservative treatment. Evidence is lacking in post-surgical guidance for physical therapy intervention following a thoracic outlet decompression. Hanif et al found that therapeutic exercises prior to surgery were beneficial to strengthen the paraspinal, scapular and trapezius musculature; as well as, stretch the sternocleidomastoid, anterior scalenes, and pectoralis major muscles to relieve symptoms.[8, 9] Post-surgical treatment's main precautionary guideline is to limit upper extremity movement until pain subsides. Kinesiotape has shown effects with minimizing pain with shoulder movement in non-surgical patients as shown in a study conducted by Thelen et al.[10] Another treatment method that was briefly explored was functional dry

needling. De Meulemeester et al did find success in treating myofascial neck and shoulder pain with dry needling when in comparison to manual pressure techniques.[11] Current research is lacking guidance on physical therapy intervention techniques involving the benefits of therapeutic exercise and postural correction for enhancing outcomes post-TOS decompression surgery.

The purpose of this case report is to present an evidence-based strengthening and stretching program for the post-operative care of TOS. The case report describes the evidence-based interventions for a 41-year-old female who underwent a scalenectomy, excision of the first rib, and removal of the left pectoralis major muscle for relief of neurogenic TOS symptoms. The interventions for this client post TOS will provide intervention options for other physical therapists treating patients post thoracic outlet syndrome surgery.

CHAPTER II

CASE DESCRIPTION

This patient is a 41-year-old female who underwent a left anterior and middle scalenectomy, excision of the first rib, and removal of the left pectoralis major muscle for relief of her neurogenic TOS symptoms. Her symptoms originated as severe scapular pain and gradually progressed over the last two years prior to therapy. The patient stated there was no known mechanism of injury to the left shoulder. Her chief complaints were pain and numbness in the left upper extremity, muscle strength imbalances on the left, and tightness to the anterior and posterior neck and shoulders. The numbness spanned the radial and ulnar sides of the forearm, wrist, and into the fourth and fifth digits. The patient had difficulty with lifting objects overhead, grooming, repositioning in bed, and holding prolonged positions at work. She works as a certified registered nurse anesthetist and has the most difficulty when working with arms overhead or having her arm fall asleep when holding prolonged positions. She was chosen for this case study based on the lack of evidence-based research for a course of rehabilitation treatment following a TOS decompression surgery.

The patient sought a few different treatments while seeking relief from her symptoms. The original severe scapular pain led to a subsequent cervical fusion at C5-7. Since her symptoms persisted, she trialed six weeks of physical therapy which included exercise, stretching, nerve glides and dry needling without relief from her symptoms. The patient also had Botox injections to the left anterior scalene and pectoralis minor twice

within a four-month time period. The injections gave her temporary relief from her symptoms and full range of motion of the left shoulder lasting less than 24 hours. Ultimately, she did receive the TOS decompression surgery and her symptoms began to recede. Her numbness was limited to her left forearm and the surgical incision sites.

Her risk factors for the development of thoracic outlet syndrome included repetitive overhead motions for work, being female, and within the age range of 20 – 50 years old. The patient's past medical history was as follows: attention deficit hyperactivity disorder, baker's cyst, dysthymia, purging disorder, kyphosis, osteoarthritis, and sinusitis. Her past surgical history included left knee arthroscopy, bilateral augmentation mammoplasty, cervical fusion C5-7, keratomileusis (LASIK), septorhinoplasty with three cartilage grafts from the left side of her rib cage., and left knee ACL reconstruction. The patient reported taking aspirin every six hours for pain management at the time of the examination.

Her initial visit was four weeks after her surgery date. Physical therapy orders given by her surgeon were to evaluate and treat. The patient was to progress as tolerated with no set guidelines provided for post operation rehabilitation. To add more background to her history, the patient was not currently working as a CRNA due to inability to complete work duties at that time. She had difficulty with lifting and overhead movements at home and at work. The patient lived at home with her spouse and children who assisted her as needed. She attended the gym and workout classes regularly prior to her TOS surgery, but was not currently able to complete. Her primary goal was to return to full strength in order to handle work and home responsibilities without limitations.

A brief systems review was completed throughout the history and into the examination. There were deficits noted in the integumentary, neurological, and musculoskeletal systems. The integumentary and neuromuscular systems were affected at the incision sites. The patient had numbness at the incision sites, and there were also some slight adhesions and tightness around the surgical scarring. Numbness along the ulnar distribution of the forearm was also present following surgery, however the patient stated that she was pleased that the numbness no longer affected her hand and wrist. There were no existing signs or symptoms systemically or locally at the incision site. The musculoskeletal system was affected by the left anterior and middle scalenectomy, excision of the first rib, and removal of the left pectoralis major muscle. Her range of motion and strength of the left upper extremity and scapular movements had deficits when compared to the contralateral side (see Table 1 and Table 2). There were no complications to the cardiovascular system.

The patient was deemed a fit candidate to receive physical therapy intervention, since she had no red flags for discontinuing treatment or referral, good family support, and was eager to achieve her goals of returning to her prior function. Verbal and tactile cueing were necessary to help aid her in proper movement patterns, but she learned quickly with direction. An examination plan to evaluate the patient's musculoskeletal system included range of motion (ROM), strength, and posture assessment. The findings from her examination plan were used to complete a safe and progressive intervention plan without exacerbating pain or adverse symptoms for the patient.

Examination

The patient was sitting upright in a chair prior to starting the examination. She did not favor her left arm when seated, standing, or with ambulation. The patient was asked to provide a ranking of her current pain based off a numerical pain rating scale. She stated that her pain is more of an ache and ranked it as a 1 on a scale from 0 – 10 (0 = no pain, 10 = worst pain ever experienced). She was taking aspirin every six hours to manage pain around the left lateral neck. The client reported increased concern with her lack of scapular stability on the left as well as the inability to relax her upper trapezius and required chest support when moving her arm. It was discussed with the patient that there will be some upper trapezius contraction with shoulder elevation.

Following the subjective history, the patient was grossly screened for cervical spine, shoulder, wrist, and hand strength and ROM in a seated position. Her cervical spine ROM was decreased by 40-50% in flexion, extension, right rotation, and left rotation. Her right shoulder, wrist, and hand demonstrated full range of motion and were graded a 4/5 for strength. Her left wrist and hand ROM were within normal limits but had comparable strength with the contralateral side with a grade of 4/5. Her left shoulder ROM was lacking significantly in abduction and flexion (see Table 1). All left shoulder motions were graded for strength at a 4-/5, except for abduction which was graded a 3/5 (see Table 2). The patient was placed in supine for measuring the range of motion of left upper extremities in the motions of flexion, abduction, internal rotation, and external rotation. The ROM measurements were completed in supine with a handheld goniometer and MMT measurements were performed in a standardized manner as described in *Cram Session: Goniometry and Manual Muscle Testing*.[12]

Table 1. Initial Shoulder Active Range of Motion Measurements

	Right Shoulder	Left Shoulder
Flexion ROM	180°	160°
Abduction ROM	180°	80°
Internal Rotation ROM	70°	70°
External Rotation ROM	90°	85°

Table 2. Initial Shoulder Strength Measurements

	Right Shoulder	Left Shoulder
Flexion	4/5	4-/5
Extension	4/5	4-/5
Abduction	4/5	3/5 (painful)
Adduction	4/5	4/5
Internal Rotation	4/5	4-/5
External Rotation	4/5	4-/5

The patient's posture was assessed while standing in the anatomical position. She had rounded shoulders with protracted scapulae bilaterally – the left a little more than the right. The left scapula was slightly more downwardly rotated. Her cervical spine was very upright lacking the natural lordosis – due to her cervical fusion from C5-7. Her left upper trapezius appeared to be hypertrophied when compared to the right side.

The functional assessment utilized during the initial evaluation was the shoulder pain and disability index (SPADI) for its reliability and validity for shoulder specific measures.[13, 14] Her disability was scored at a 44/80.

Evaluation, Diagnosis, Prognosis, and Plan of Care

After reviewing the information from the initial examination, the International Classification of Functioning, Disability, and Health (ICF) best demonstrates how the patient's abilities and disabilities relate to her health condition (See Appendix 1). The patient's ICD-10 Diagnosis Code is G54.0 Brachial Plexus Disorders – neurogenic thoracic outlet syndrome.[15]

The initial examination revealed several problems for the patient. Her primary deficits involved decreased ROM and strength. She was still experiencing minimal pain, but had difficulty performing her activities of daily living in the home and at work. A full problem list was created after identifying any difficulties the patient was having with her movement (See Table 3). Using the *Guide to Physical Therapy Practice*, she was placed in the Pattern 4I: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Bony or Soft Tissue Surgery and Pattern 7D: Impaired Integumentary Integrity Associated with Full-Thickness Skin Involvement and Scar Formation.[16]

Table 3. Problem List

Problems
1. Decreased Left Shoulder ROM into Abduction and Flexion 2. Decreased Upper Extremity Strength Bilaterally 3. Altered Scapulohumeral Rhythm on Left 4. Decreased cervical ROM 5. Pain 6. Adhesions at Surgical Sites 7. Difficulty with overhead and sustained movements while grooming, lifting, and working 8. Numbness at surgical sites and along anterior forearm 9. Reduced core stability with upper extremity movement

Her physical therapy treatment plan was expected to last 12 weeks – two therapy sessions per week. Short term goals for the patient included active shoulder abduction ROM measurements to 120° for functional motion, maintenance of pain levels below 2/10 to show good pain management after medication ceases and improving her shoulder pain and disability index (SPADI) from a 44/80 to a 60/80. Long term goals were set to improve her SPADI score to 70/80, active left shoulder flexion and abduction with proper scapulohumeral rhythm to 160°, able to tolerate overhead activity for 3 sets of 20 to show an increase in functional endurance for returning to work, and able to return to work without limitations. The SPADI outcome assessment was chosen due to its validity, ease of use, and responsiveness to change.[13, 14, 17] Paul et al found this outcome measure to be the preferred shoulder questionnaire for assessing shoulder dysfunction for those reasons as well when compared to three other shoulder outcome questionnaires.[17] However this study was completed on patients with nonsurgical shoulder dysfunction.[17] A separate study was completed on 40 patients following a surgical neck dissection to test the validity of three different shoulder outcome measures including the SPADI.[14] Marchese et al translated the English versions to Italian for their study and found the SPADI instrument to be valid for assessing shoulder dysfunction after a surgical neck dissection.[14]

The patient's prognosis for recovery was very good due to her age, motivation to return to work, physical fitness, access to gym resources, and family support. There are restraining forces to full recovery such as anxiety and fear of symptom onset that may have led to a slower progression during post-operation physical therapy intervention. All these factors as well as examination and evaluation results were taken into consideration

when developing the patient's plan of care and intervention plan. The intervention plan included therapeutic exercise for stretching and strengthening the left upper extremity and cervical musculature to improve ROM; exercises to improve scapular stability to recover proper scapulohumeral rhythm; and manual therapy techniques to decrease soft tissue adhesions along scars and reduce pain.

CHAPTER III

INTERVENTION

The interventions chosen for this patient targeted the patients' deficiencies in movement. A short list to summarize interventions utilized during treatment is as follows: ROM, stretches, strength exercises, manual therapy, functional dry needling, and Kinesiotape. De Meulemeester et al performed functional dry needling on 42 female office workers with myofascial neck/shoulder pain and demonstrated improvements in pain pressure threshold, muscle elasticity, and stiffness.[11] Interestingly, the patient in this case study did not respond to the dry needling intervention and the treatment route was discontinued.

Soft tissue mobilization was used at incision sites to work on adhered tissue to promote better healing during scar formation.[18] Passive range of motion of the shoulder was completed at the start of therapy sessions following a 5-minute warm up on the upper extremity ergometer. Passive motions consisted of shoulder abduction, flexion, internal rotation, external rotation, D1 and D2 flexion/extension patterns. These motions were done passively to help relax the patient and to gain motion into limited ranges. This was paired with passive stretching done by the physical therapist to the upper trapezius, pectoralis major, and sternocleidomastoid. These muscles were frequently identified as being tight by the patient. The patient was resting in supine on an adjustable plinth so the physical therapist could maneuver at the head and side of the table.

Strengthening exercises focused on improving shoulder mobility, scapular stabilizers, and core and hip strength. Hip and core strengthening were included to reduce biomechanical deficits in lower extremity and core stability to aid in improvements in shoulder strength and mobility.[19] Due to difficulties with symptom onset during early treatment sessions, the patient became much more cautious with her movement. It was decided to progress slower from gravity eliminated positions to active assistive range of motion (AAROM) with a dowel, to seated and standing positions for active movement. Her initial home exercise program involved gravity eliminated positions for external rotation and flexion as well as cervical unloading with chin tucks. Her exercises were progressed gradually from gravity eliminated positions to against gravity positioning. The main focus for gravity eliminated positioning with abduction and flexion was to improve the patient's scapulohumeral rhythm. Initially, she required tactile cueing to aid with proper movement, but she had excellent carryover with against gravity movements.

Kinesiotape was added to facilitate proper upper trapezius activation with overhead movements. The patient felt more stable and aware of her movements when reaching overhead which had been a concern for her. She thought she was over activating her upper trapezius but was unaware that there would need to be activation of the upper trapezius with shoulder elevation. The discussion of when it is acceptable to have upper trapezius activation was discussed with the patient. Thelen et al completed a study on 42 subjects and found that using Kinesiotape in a Y position covering the supraspinatus and upper trapezius, an I-strip applied to the coracoid process extending around to the posterior deltoid, and another Y strip applied to the deltoid helped to improve pain-free, active shoulder ROM after tape application.[10] The tape was applied in line with the

muscle fibers running from insertion to origin. During this study the patients wore the Kinesiotape application for 2-3 days.[10] The application given to this patient was similar to the positioning mentioned above including the Y strip along the supraspinatus and upper trapezius and around the coracoid process to the posterior deltoid. The patient did appreciate the cueing that tape gave her and how she felt more in control of her movements.

Patient education throughout treatment sessions involved proper form for exercises, proper lifting mechanics for when she returns to work, upper trapezius activation with shoulder elevation, clarification of important exercises, and checking skin for breakdown with Kinesiotape application/removal. Due to the patient's concerns of being overwhelmed with a build-up of home exercises and gym workouts. Her home exercise program was reviewed. She had been adding each exercise that was trialed in physical therapy sessions to her home program without the knowledge of the physical therapist. The amount of exercises in her home program was reduced, and it was discussed that even though a new exercise is introduced in her physical therapy session it doesn't mean the exercise is added to her home program. A review of proper lifting form and explanation to the patient about the safety of proper lifting mechanics when lifting objects to and from low to high settings was completed. She was grateful for the cues since she had not realized she had been lifting in a way that could cause her more pain in the future.

The patient was seen for a total of 10 out of the 12 weeks with two sessions per week. Re-examination and evaluation were set to be completed on the last visit prior to her check up with her medical doctor. A review of goal progression was to occur at this

time as well. The patient was provided with a more advanced home program following Thrower's Ten exercises a couple weeks prior to discharge to ensure time to check if the patient had fully grasped understanding and was able to do the exercises. The Thrower's Ten exercises provide more exercise variations that incorporate overhead movements and a sustained hold at the end of each movement to improve muscular strength and endurance in preparation for returning to work.[20] (See Appendix 2). Consideration as to the readiness to return to work was dependent on progress with overhead muscular endurance, reduced pain, avoiding symptom onset, and patient readiness and safety.

CHAPTER IV

OUTCOMES

The patient was not ready for discharge at the end of the 10-week treatment period and had two weeks of physical therapy remaining. She was able to partially meet her own personal goals of going to the gym and starting to return to work. Returning to her job duties was increasing each week starting at her eighth week. She was currently working only three days per week with lifting limitations. The patient had reported being pain free with activity with some occasional soreness after workouts. She had rated her pain at a 0-1/10 (0 = no pain, 10 = worst pain ever experienced) after workouts, but it subsides after a few hours. With her home exercises, the patient was able to incorporate her Thrower's Ten exercise program into her gym routine three times a week without complications.

The patient's SPADI score was initially at a 55% disability and improved to only a 16% disability at week seven. Her initial abduction ROM was limited to 80°. The patient had made strength and range of motion improvements. Following active ROM exercises, the patient was able to go through 160° into abduction and flexion with a proper scapulohumeral rhythm and without having to prepare herself for the motion.

The patient had not yet returned to work full time since she continued to have difficulty with prolonged overhead motions. Since the patient was not set to discharge yet

the patient's care continued under the clinical instructor for the remainder of her treatment sessions. She required more time with physical therapy to work on muscle activation to help with stabilization at the shoulder, since she was unable to resume full work duties due to strength deficits with lifting while using proper body mechanics.

CHAPTER V

DISCUSSION

This patient was a 41-year-old female who underwent a scalenectomy, excision of the first rib, and removal of the left pectoralis major muscle for relief of neurogenic TOS symptom. Her symptoms originated as severe scapular pain and gradually progressed over the last two years prior to therapy. She began having increased pain in her shoulder and neck as well as numbness spanning down into her hand. After evaluation, the patient was found to have reduced left shoulder strength, reduced left shoulder and cervical ROM, increased pain, numbness at surgical sites and in her forearm, an altered scapulohumeral rhythm, adhesions at surgical sites, difficulty with overhead and sustained movements, and reduced core stability with upper extremity movement.

Rationale for treatment was based on recent studies for biomechanical and exercise considerations, Kinesiotape application for reducing pain with movement, and an attempt with dry needling for reducing pain and muscle stiffness in the neck and shoulder to help improve the patient's presenting symptoms upon evaluation. Treatment changes were based on how the patient tolerated and responded to the treatment. The interventions included therapeutic exercise for stretching and strengthening, range of motion, soft tissue mobilizations, dry needling and Kinesiotaping. The patient achieved increased active range of motion, increased strength, decreased pain, and improved postural awareness and alignment. The patient reported elimination of numbness in the

fingers following surgery and remaining numbness of the forearm subsided after a few weeks.

The patient was compliant with completing home exercises and very involved in her recovery. She continued to have difficulty simultaneously activating her core, left glutes and left scapular stabilizers while standing or half kneeling, and completing shoulder movements. Early on, treatment interventions were more focused on stretching, passive range of motion, and gradually advanced to strengthening activities.

Hanif et al. and Levine et al. found that pre- TOS surgical patients benefited from therapeutic exercise for strengthening the paraspinal, scapular and trapezius musculature; as well as, stretch the sternocleidomastoid, anterior scalenes, and pectoralis major muscles to relieve symptoms in conservative treatment of TOS.[8, 9] These same targeted areas were incorporated well for post-surgical rehabilitation. The anterior scalenes or pectoralis minor being stretched were not included since they had been removed. Gradual, graded exposure to against gravity motions were necessary as not to aggravate the patient's symptoms. Stretching of sternocleidomastoid and pectoralis major aided in relief of muscle tightness for the patient. Range of motion increased as the patient's confidence in her movements increased as well as her shoulder strength and scapular control improved. Kinesiotaping for proper upper trapezius activation was helpful for cueing the patient for proper scapular mobility. She felt more in control of her movement and gave her sense of external stability and reported no neck or shoulder pain with movement. The positioning of the tape was similar to that described by Thelen et al including placement over the supraspinatus, upper trapezius, and around the coracoid process to the posterior deltoid to help reduce pain with abduction movements.[10] The

study completed by Thelen et al applied the Kinesiotape along the upper trapezius, supraspinatus, and the deltoid in line with the muscle fibers running from insertion to origin on 42 patients.[10] The patients reported having pain free active shoulder ROM after tape application and were able to keep the same application for up to 2-3 days after.

Kinesiotaping has several benefits including reducing pressure on an injured area, alignment assistance, pain alleviation, bruise and swelling reduction, and for preventative measures in athletic training including patellar tracking issues or rolled ankles. Effectiveness isn't well researched yet, but a drawback can include skin breakdown, rashes or infection if an open wound develops.[21] Some contraindications to the use of Kinesiotape include the following: deep vein thrombosis, kidney problems, congestive heart failure, skin injections/rashes, diabetes, lymph node removal, allergy, and cancer.[21]

Another treatment attempted with this patient was dry needling; however, she did not respond to the intervention and it was discontinued. Despite this patient not having success with the treatment, dry needling has demonstrated short-term effectiveness with reducing pain, increasing pressure pain threshold, and improving function in patients being treated with musculoskeletal pain.[22] Similarly, De Meulemeester et al performed functional dry needling on 42 female office workers with myofascial neck/shoulder pain and demonstrated improvements in pain pressure threshold, muscle elasticity, and stiffness.[11]

Reflective Practice

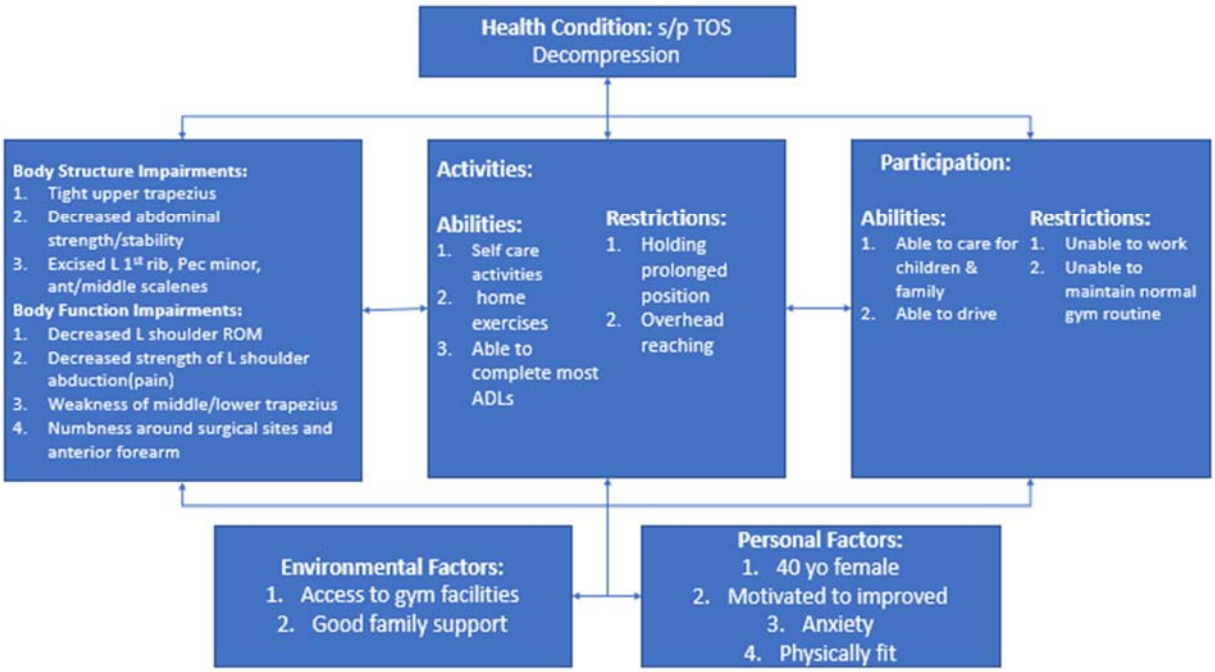
In hindsight, it would have been more beneficial to have checked more frequently on progress towards goals; as well as, addressing all problems in the goals to show improvements or changes over time. MMT was not completed after the initial session

when checking for progress in strength measurements. Strength improvements should have been addressed in goals for left shoulder abduction to track progress. Overall outcome measurements as a whole should have been documented more sufficiently and timely when rechecking progress towards her goals.

An aim for future research could gear more insight into supporting structures such as core and hip stabilization to benefit upper extremity movement. With better core stability it could provide a strong base for mobility at the shoulder to improve. Another option for increasing evaluation techniques would be using Selective Functional Movement Assessment techniques and breakouts for processing of compensatory movement dysfunctions that may be present following a TOS decompression surgery. Above all, there is a gross lack of research supporting physical therapy treatment following a TOS decompression surgery which leads to insufficient guidance for post-surgical management.

APPENDIX

Appendix 1. ICF Taxonomy



Appendix 2. Thrower's Ten Exercise Home Program

Thrower's Ten Exercise Home Program
Perform 2 sets of 12 reps with 3 second hold at end range; 3-4 days per week
1A. Diagonal pattern D2 Extension
1B. Diagonal pattern D2 Flexion
2A. External Rotation at 15° Abduction
2B. Internal Rotation at 15° Abduction
2C. External Rotation at 90° Abduction
2D. Internal Rotation at 90° Abduction
3. Shoulder abduction to 90°
4. Scaption with External Rotation to shoulder height (90°)
5. Side lying External Rotation
6A. Prone Horizontal Abduction (T's)
6B. Prone Horizontal Scaption (Y's)
6C. Prone Rowing
6D. Prone Rowing into External Rotation
7. Press-ups (seated)
8. Push up
9A. Elbow Flexion
9B. Elbow Extension (abduction)
10A. Wrist Flexion
10B. Wrist Extension
10C. Supination
10D. Pronation

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