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Physical Therapy Management in a Patient with a Left Scapular Fracture, Left Three-Through-Eight Rib Fracture and Left Sternoclavicular Ligament Sprain

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Physical Therapy Management in a Patient with a Left Scapular Fracture, Left Three-Through-Eight Rib Fracture and Left Sternoclavicular Ligament Sprain

by

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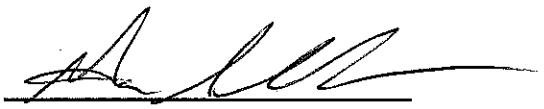
This Scholarly Project, submitted by Morgan Bicker in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.



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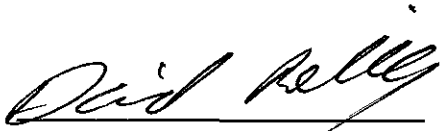

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ABSTRACT

Background and Purpose. The case study describes the outpatient physical therapy management used for a patient with a left scapular fracture, left three-through-eight rib fracture, and left sternoclavicular ligament sprain following a motorcycle accident. **Case Description**. A 43-year-old man with decreased left shoulder range of motion, decreased left shoulder strength, increased left upper extremity pain, and impaired functional mobility. He received ten sessions over a 13-week period. **Intervention.** Interventions that were documented into the patient's plan of care included: evaluation, ASTYM, electrical stimulation, home exercise program, manual therapy, neuromuscular re-education, therapeutic activity, therapeutic exercise, and ultrasound. There were ten sessions consisted of the interventions listed above. **Outcomes.** Following physical therapy intervention, the patient improved in left shoulder range of motion, left shoulder strength, decreased pain, and improved functional mobility. The patient was able to return to work and complete ADLs independently. **Discussion**. Therapeutic exercise and manual therapy may be a beneficial combination of interventions for scapular fractures. Additional research is needed regarding the creation of an effective protocol for scapular fractures.

CHAPTER I

BACKGROUND AND PURPOSE

The shoulder joint is a complex joint to examine because of the multiple structures that contribute to the joint, which produces a large range of motion (ROM) within a small area.[1] The shoulder girdle consists of the glenohumeral joint, sternoclavicular joint, acromioclavicular joint, and scapulothoracic joint. Scapular motion is necessary for shoulder function, as it contributes 60˚ of shoulder flexion and abduction when functioning properly.[1,2] Scapular fractures usually occur from high force trauma.[3] Sprains, fractures, or other damage can occur to additional areas with scapular fractures including the clavicle and the ribs, typically due to the mechanism of the injury.[4] With involvement of multiple bones and joints, this can cause malalignment or shifting of the shoulder girdle, including the clavicle and ribs. Scapular fractures can heal well with conservative treatment and patient compliance to the plan of care. Physical therapy usually begins with passive range of motion (PROM) and progresses to active range of motion (AROM) with strengthening slowly progressing throughout the episode of care to healing of bone and other soft tissue structures involved.[5]

Scapular fractures make up about 1% of all fractures and are most common among men from 25-45 years old.[6] Individuals with a scapular fracture are predicted to have additional injuries 80-95% of the time.[7] These injuries can include rib fractures, a collapsed lung, a bruised lung, a brachial plexus injury, a clavicle fracture and/or head and spine injuries. According to Cole et al[8], rib fractures are present 52.9% of the time and clavicle injuries are present 25.2% of the

time. Harris[9] identified rib and clavicle fractures along with pulmonary and brachial plexus injuries occurred in 50% of 53 patients with scapular fractures. Common signs and symptoms indicating a scapular fracture include bruising, swelling, weakness, tingling in the upper extremity (UE), and immediate severe pain that is localized and increased with movement of the UE.[6] The figure below models the shoulder girdle and muscles which assist in scapula and arm positioning, which help visualize the area that can be affected with scapular fractures (see Figure 1).

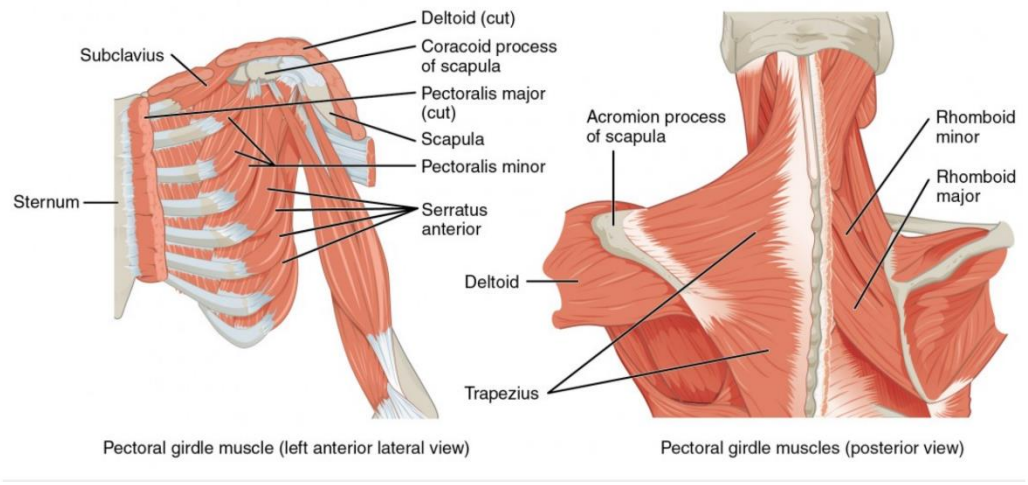


Figure 1. Muscles That Position the Pectoral Girdle.[10]

Cole et al[8] identified indications for surgical intervention for intraarticular and extraarticular glenoid fractures. Intraarticular glenoid fracture indications for surgery include greater than four millimeters of articular step-off with more than 20% of glenoid involvement, instability of the glenohumeral joint, subluxation secondary to fracture, anterior rim fractures involving greater than 25 % of the articular surface, and posterior rim fractures larger than 33 % of the articular glenoid surface.[8] Extraarticular glenoid fracture indications for surgical management include angular deformity of at least 45ºon a scapular Y shoulder radiograph, lateral boarder offset of at least 15 millimeters plus angular deformity greater than 35°, clavicle or scapula displacement of

at least ten millimeters, and a complete acromioclavicular joint dislocation and scapula fracture with displacement greater than ten millimeters.[8] A surgeon will also consider age, activity level, and job requirements.

The current case study represents a patient whose injuries occurred due to a motorcycle accident. As most scapular fractures are treated conservatively, the physician and patient agreed to progress with conservative treatment with the physician monitoring the healing process before opting for surgical intervention. The patient presented to physical therapy three weeks following the accident with a physician referral to evaluate and treat following the left scapular fracture, left three-through-eight rib fractures and left sternoclavicular ligament sprain. No previous injuries had occurred to the left upper extremity. There was decreased left shoulder ROM, decreased left shoulder strength, increased pain in the UE, scapula, and ribs, and impaired function mobility. Even with these impairments, the patient was motivated to achieve his goals of returning to full-time employment and hobbies and re-gaining independence with ADLs. The patient's problem list can be broken into the International Classification of Functioning, Disability and Health (ICF) model to better visualize how injuries impact a patient's daily life (see Appendix 1). The ICF has five categories, which include body function and structure, activity, participation, environmental factors, and personal factors. The completed ICF helps create and meet goals, individualize therapy, and deliver holistic patient-centered care. His expected prognosis was to return to work without restrictions and prior level of function following physical therapy interventions.

The patient's perceived impairments can be measured using a variety of functional outcome measures that are specific the affected area. For this current case, the *Quick* Disability of Arm, Shoulder and Hand (DASH) was utilized. The *Quick*DASH score is a way to measure physical

function and symptoms in the UE. Higher scores indicate increased symptoms and impaired physical function on the affected side. The QuickDASH is a short, easy questionnaire consisting of 11 items that have been taken from the original DASH.

The purpose of the case study is to outline the physical therapy management protocol for the left scapular fracture, left three-through-eight rib fracture, and left sprained sternoclavicular ligament. The present research is lacking due to the variety of fractures that can occur to the scapula and to the low incidence rate of scapular fractures occurring.

Rajfer[11] identified long-term outcomes for scapular fractures with conservative treatment have high patient satisfaction and pleasing long-term functional outcomes with minimal complications. Further research investigated conservative treatment versus surgical treatment to highlight any differences between the two approaches. Jones[12] identified similarities with the healing process, return-to-work timeframe and reported pain levels with recommendations of conservative treatment for scapular fractures smaller than 20 millimeters.

This case study will outline the rehabilitation process for a patient with a left scapular fracture, left three-through eight rib fracture and left sternoclavicular ligament sprain. Current research is used to discuss and evaluate the role of physical therapy following the rehabilitative process for this patient.

CHAPTER II

CASE DESCRIPTION

In July of 2019 a 42-year-old male was injured in a motorcycle accident. He was admitted to the hospital following the accident. X-ray and CT scan were completed, which showed the posterior one-third of ribs three-through-eight fractured, comminuted left glenoid and left scapular fracture, and left sprained sternoclavicular ligament. The physician and patient agreed to proceed with conservative treatment and monitored healing process. The physician referred the patient to physical therapy, and he was evaluated for a left scapular fracture, left three-through-eight rib fractures, and left sternoclavicular ligament sprain on August 12, 2019, three weeks post-accident.

The patient reported no previous injuries to left UE. His chief complaint was left UE weakness as well as left shoulder, scapular, and rib pain during left UE movement. He described the pain to be pinching, achy, and stabbing in nature surrounding the left scapula and left lateral side of ribs. He had increased pain with sleeping, back and left side lying, and active movement of left UE with decreased pain while in an upright position. Following the accident, the patient utilized a left shoulder sling at all times up to six-weeks post-injury while having needed assistance with donning and doffing of socks and shoes. He was independent for all activities of daily living (ADLs), transfers, and bed mobility prior to the accident. He stated being married and having lived with his family in a single-level house with no stairs. Prior to injury, he worked full-time at AmeriPride, where he was expected to lift and deliver supplies. He did not work

following the injury due to restrictions placed on him by the physician, which included wearing a sling for six weeks post-injury, and no lifting, reaching, or pushing/pulling with the left arm. The patient stated his goals with physical therapy were to return to full-time employment and return to hunting.

Examination, Evaluation and Diagnosis

Prior to the initial evaluation, a comprehensive patient chart review was completed on the patient. The patient's past medical history consisted of chronic sinusitis, dyslipidemia, gastroesophageal reflux disease, heart murmur, and pneumonia. The patient had a surgical history which included left ankle arthroscopy and colonoscopy. The patient consumed a daily vitamin and was taking pain medication as prescribed by the physician. The use of a left shoulder sling for six weeks was the only precaution instituted by the physician upon the physical therapy referral. Understanding the timing of medication consumption was important to allow the patient to better tolerate physical therapy sessions.

The physical therapy evaluation was based on Magee's *Orthopedic Physical Assessment Chapter 5 Shoulder*.[1] Prior to the evaluation and examination, the patient completed the *Quick*DASH outcome measurement tool (64%), (see Appendix 2). Examples of items assessed by the *Quick*DASH include: opening a jar, completing heavy household chores, washing your back, and arm or hand pain.[13] When calculating the validity and reliability of the QuickDASH to the DASH the questionnaire identified similar precision in measuring symptom severity for a variety of UE conditions.[14]

A gait assessment was completed, and patient had decreased arm swing on the left but had no other gait deviations present. The patient presented to physical therapy wearing a sling on

his left UE and ambulated with reciprocal gait pattern with no balance deficits. Forward head and rounded shoulders were noted during the posture assessment.

Palpation of the left acromioclavicular joint, supraspinatus, sternoclavicular joint, scapula, and infraspinatus were painful to the touch with muscle soreness noted along his left upper trapezius muscle. Scapular fractures can affect multiple areas, making it important to understand the location of the injury and how it may affect another area.

Cervical spine and bilateral elbow AROM was pain-free and within normal limits clearing the peripheral joint scan. Right UE AROM and PROM were measured bilaterally and were reported within functional limits. Left shoulder AROM was not measured due to increased pain. Bilateral shoulder PROM was measured with a goniometer as listed in Table 1.

Table 1.
Initial Shoulder Passive Range of Motion

	Right	**Left**
Flexion	160˚ PROM/ 160˚ AROM	90˚ PROM (sore)
Extension	20˚ PROM/ 20˚ AROM	0˚ PROM (sore)
Abduction	160˚ PROM/ 160˚ AROM	90˚ PROM (sore)
Internal Rotation	70˚ PROM/ 70˚ AROM	45˚ PROM (sore)
External Rotation	90˚ PROM/ 90˚ AROM	30˚ PROM (sore)

Shoulder strength was assessed on the right UE; however, not the left due to increased pain and bone fractures. Right shoulder strength equaled 5/5 with manual muscle testing (MMT) with all shoulder movements. Special tests were not completed due to recent accident, increased pain, and bone fractures. A CT scan and X-rays were completed and used to assist in the physical therapy diagnosis. The CT scan and X-ray reduced the need to complete special tests during the physical therapy evaluation. Anavian[15] investigated the interobserver reliability of radiographs and three-dimensional CT and the diagnosis of scapular fractures. The results showed interclass correlation coefficients to be 0.36 to 0.76 for radiographs and from 0.48 to 0.87 for three-

dimensional CT, showing the three-dimensional CT is more reliable with scapular fracture diagnosis.[15]

Following the physical therapy evaluation, data indicated the patient had a left scapular fracture, left three-through-eight rib fractures and left sternoclavicular ligament sprain. No other disorders were ruled in or out due to recent imaging and physician visit. A tuning fork test could have been utilized during the physical therapy evaluation to confirm the presence of a fracture. Mugunthan[16] included a variety of settings and ages and compared the results to a magnetic resonance image (MRI). Research identified the use of a tuning-fork may have some value in ruling out fractures but not with ruling in a fracture due to the heterogenous results.[16] After a diagnosis was established, early interventions focus on maintaining shoulder ROM and decreasing pain while the fractures healed. Goals for the patient included increasing shoulder and scapular PROM and AROM, increasing shoulder and scapular strength, and decreasing pain. Goals established would be directly related to the patient's return to full-time employment, completion of ADLs, decrease of pain, and increased functional ability.

The patient's impairments found included impaired posture, decreased left UE ROM and strength, and increased left UE pain. The problem list included decreased left shoulder AROM and PROM (all planes of motion), decreased left upper UE strength (unable to test due to pain), increased left UE pain (6/10; 0 = no pain, 10 = unbearable pain), impaired posture (forward head), tenderness in palpation of AC joint, supraspinatus, sternoclavicular joint, scapula, infraspinatus and upper trapezius, impaired perceived function (*Quick*DASH 64% impaired), unable to participate in occupation, and unable to sleep on back.

According to the *Guide to Physical Therapist Practice*, the ICD-10 code for fracture of unspecified part of scapula, left shoulder, initial encounter for closed fracture is S42.102A.[17] The

practice pattern for this patient, according to the American Physical Therapy Association, is pattern 4G: Impaired joint mobility, muscle performance, and ROM associated with fracture.[18]

Prognosis and Plan of Care

Following a scapular fracture, research suggests that satisfactory functional outcome measures can be achieved following conservative treatment, but the presence of rib fractures were associated with less favorable outcomes.[19] Based on this patient's situation, he is expected to make a full recovery and return to prior level of function.

Following the initial evaluation, short-term and long-term goals were developed based on the patient's overall goals and impairments noted during the evaluation. Short-term goals were set to be met in ten visits and are detailed in Table 2. Long-term goals, which were to be met in 20 visits, are listed in Table 3.

Table 2.
Initial Short-term goals

		Visit goal was met
Goal 1	The patient will report a decrease in pain from 6/10 to 3/10 so he can sleep with less pain lying flat or on his side.	5th visit
Goal 2	The patient will demonstrate an improvement in left shoulder flexion AROM from 0 degrees to 90 degrees so he can wash his hair.	5th visit
Goal 3	The patient will understand the importance of proper posture and body mechanics to decrease compressive loads and decrease risk of additional injury or symptoms so patient can advance through PT.	3rd visit
Goal 4	The patient will be independent with short-term HEP and compliant with PT to assist in reaching personal goals.	1st visit

Table 3.
Initial Long-term goals

		Visit goal was met
Goal 1	The patient will report a decrease in pain from 6/10 to 1/10 so he can perform light duty chores at home with less pain.	Discharge visit
Goal 2	The patient will demonstrate an improvement in left shoulder IR/ER AROM arc to within 20 degrees of opposite arm so he can reach behind his head and back with increased ease.	Discharge visit
Goal 3	The patient will demonstrate an improvement in left shoulder flexion and abduction strength to within 90% of opposite arm so he can return to work with no restrictions.	Still in progress
Goal 4	The patient will be independent with long-term HEP and compliant with PT to assist in reaching personal goals.	1st visit
Goal 5	The patient will demonstrate an improvement in QuickDASH score to <40% to show decreased perceived disability and increased function.	Not assessed at discharge

Many long-term goals were still in progress at the time the student physical therapist's (SPT) nine-week clinical experience came to an end. The stated goals assisted the patient's return to full-time employment, completion of ADLs, while having promoted decreased pain, improved strength and increased functional ability. By meeting these goals, the patient was able to return to prior level of function.

The patient was care planned for 20 total visits in 12 weeks and expected to return to prior level of function. The plan of care for this patient consisted of evaluation, assisted soft-tissue mobilization (ASTYM), electrical stimulation, home exercise program, manual therapy, neuromuscular re-education, therapeutic activity, therapeutic exercise and ultrasound. A case study from 2012 reported the plan of care including: ROM, strengthening exercises, manual therapy (soft tissue mobilization, scapular and shoulder mobs, and TENs is the most beneficial

for a patient completing rehabilitation for floating shoulder and related fracture.[20] Outcomes were long but favorable for this patient noting improvements in strength, pain, and function.[20]

CHAPTER III

INTERVENTION

A recent study investigated a combination of strengthening exercise and dry needling, which found clinically meaningful improvements in disability and pain in the short term and upon long-term follow up were demonstrated for each patient.[21] This combination of interventions was trialed one to two times per week for eight weeks. The target patients were those with chronic rotator cuff pathology. This is not a direct link but can be applied due to the area affected with the scapular fracture.

In addition, Brudvig et al[22] investigated the combination of therapeutic exercise and mobilization compared to therapeutic exercise alone in patients with shoulder dysfunction. They found that after five weeks 70% of the group with the combination of interventions had less pain compared to 10% of the group with therapeutic exercise alone having less pain. However, after 11 weeks neither group's interventions were shown to be more superior for pain reduction and decreased disability.[22]

The initial evaluation began with patient education. Physical therapy reviewed shoulder precautions with the patient. These precautions included not reaching behind the back, no pushing or pulling of objects on left side, no pushing off with left side during transfers, no AROM, no aggressive painful PROM or stretching that promotes muscle activity or spasms on left side. In addition, patient education consisted of posture education in order to place the least amount of strain on your body in any given position or movement. Imagama et al[23] discussed how spinal alignment influenced shoulder ROM since the scapula is a part of the shoulder joint,

which is connected to the rib cage and spine by muscles. Their findings identified shoulder and scapular kinematics ROM as being restricted when in a slouched position.[23] Finally, physical therapy discussed phases of treatment and expectations, along with the goals to be achieve.

Following the initial evaluation therapeutic intervention began with the physical therapist having performed PROM into shoulder abduction and shoulder flexion in a modified supine position. In addition, HEP was developed. The HEP included a modified passive pendulum within a small circle, passive external rotation with a stick in sitting, scapular circles (shoulder rolls), and wrist AROM. A handout was provided in which the patient expressed understanding. The patient completed ten repetitions of each exercise twice a day. Emphasis of HEP was placed on left UE ROM.

During the second physical therapy session the patient presented wearing a shoulder sling with HEP being reviewed. Physical therapy continued with PROM into left shoulder flexion and abduction while the patient was positioned in a modified supine position with pillows for support. The patient performed scapular retractions, in a small pain-free ROM, upper trapezius stretching and countertop shoulder flexion.abduction stretching with 30 second holds. The physical therapist demonstrated, and the patient performed seated pulleys into shoulder flexion. Shoulder flexion measured 100˚ while performing the assisted active range of motion (AAROM) with the pulleys. The neck stretch, counter-top stretch and pulleys into shoulder flexion were added to the HEP and was able to be completed once daily.

During the third session (six-weeks post-injury), physical therapy performed manual therapy and therapeutic exercise. The sessions started on the upper body ergometer (UBE) arm bike in forward motion with no resistance for four minutes. The UBE arm bike was used in the following sessions as a way for the patient to warm up prior to each session. A vertebral artery

test was performed and had negative findings. Physical therapy performed manual therapy for 15 minutes to cervical spine, due to increased neck and muscular pain on the left side. With the patient positioned in a modified supine position with 20˚ of cervical flexion the physical therapist performed mobilizations at C1 and C2 and unilateral side glides to C2-C7. Mobilizations consisted of 2 sets, 10 at levels C2-C7. Following manual therapy, the patient performed seated pulleys into shoulder flexion, scaption, and abduction. In addition, treatment included thoracic spine AROM which consisted of thoracic flexion, extension, side-bending to left and right, and rotation to left and right in sitting for 10 repetitions each. The session ended with left shoulder flexion, external rotation, and internal rotation PROM in modified supine position, with pillows in an "L" shape to reduce pain.

During session four the patient discontinued the use of the shoulder sling per physician orders. Physical therapy continued to work on the previous exercises to improve the patient ROM as the patient's pain continued to decrease. During this session the patient perform isometric strengthening of elbow flexion and extension in standing. The patient continued PROM and progressed to AAROM. PROM consisted of shoulder flexion, abduction, internal rotation, external rotation, and scaption. AAROM, with the use of a want, was performed into flexion and abduction in a supine position and external rotation while in side-lying. Each motion was completed ten times. Elbow flexion and extension isometric strengthening in standing and AAROM into shoulder flexion, abduction, and external rotation using a stick were added to the patient's home exercise program. Patient was given visual and verbal directions.

Session five of physical therapy consisted of exercise review and progression. Physical therapy demonstrated and had the patient perform all new exercises. All stretches were held for 30 seconds and added to the home exercise program. Pictures and instructions were sent home

with the patient. Patient expressed understanding. Patient reviewed wand AAROM on left side into shoulder external rotation, flexion, and abduction for ten repetitions with each motion.

At session six new exercise were performed, which continued to progress the patient's left UE ROM and strength. These exercises included scapular push-ups, AROM into shoulder flexion in supine, and abduction and external rotation with a towel between the humerus and the ribs while side-lying. The patient completed ten repetitions of each of these motions. The physical therapist performed rhythmic stabilization for two sets, 30 seconds while the patient was supine with shoulder flexed to 90˚ and light pressure applied in all shoulder motions. Scapular push-ups and shoulder AROM into flexion, abduction, and external rotation were added to the home exercise program.

Twelve days elapsed between the sixth and the seventh session, due to the patient being on vacation. Strengthening progressed, including the use of resistance bands and weights. The seventh session included performing fifteen standing left shoulder external rotation with towel under arm and yellow resistance band, fifteen standing left shoulder internal rotation with towel under arm and red resistance band, and fifteen standing low rows with scapular retraction with red resistance band. Further exercises performed included fifteen standing shoulder flexion and abduction to 90˚ with one-pound weight along with specific core exercises. Core exercises included five supine double-leg lifts with ten second holds and quadruped alternating arm lift on right for five seconds while weight shifting on left side due to sharp shooting pain on left side along ribs. The SPT and patient discussed doing more activities around home. Shoulder ROM was measured and recorded. Refer to Table 4 for progress of left shoulder AROM.

Table 4.
Progress note for Shoulder Active Range of Motion

	Right	**Left**
Flexion	160˚	133˚ (sore with eccentric lowering in posterior cuff region)
Extension	20˚	20˚
Abduction	160˚	123˚
Internal Rotation	70˚, T7	60˚, T12 (sore)
External Rotation	90˚	49˚ (sore)

Strengthening exercises continued to progress, by increasing weight and repetitions. During the eighth and ninth sessions instrument assisted soft tissue mobilization was performed to left rotator cuff and paraspinals for pain management. Following these two sessions, the patient reported minimal pain with a rating of 2/10.

CHAPTER IV

OUTCOMES

At the patient's discharge the patient rated his pain 1/10 located along left lateral boarder of ribs. Strengthening performed included ten D1 and D2 proprioceptive Neuromuscular Facilitation (PNF) pattern with a cable machine with 13.5 pounds on left side, ten kettle bell swings with a ten-pound weight and ten single arm kettle bell swings on left side with a seven-pound weight. The physical therapist discussed continuation of home exercise program and strengthening at a local gym. The patient has returned to work with light duty restrictions from the physician. He felt ready to transition from skilled physical therapy to an independent home exercise program and gym routine to continue strengthening and rehabilitation. The patient reported improved ability to compete household activities, such as carrying objects into and out of the house and reaching overhead with improved left UE ROM, and left UE strength. In addition, the patient was able to dress independently, don and doff socks and shoes, and reach behind his head and back to wash. Shoulder strength was assessed bilaterally via MMT. All right shoulder motions graded as 5/5 and with no pain. All left shoulder motions (flexion, external rotation, abduction, and internal rotation) graded as 4/5 with no pain. Refer to Table 5 for shoulder AROM at discharge:

Table 5.
Last treatment Shoulder Active Range of Motion (degrees = ˚)

	Right	**Left**
Flexion	160˚	148˚
Extension	20˚	20˚
Abduction	160˚	153˚
Internal Rotation	70˚, T7	65˚, T9
External Rotation	90˚	77˚

The patient's shoulder motion progressed from therapist controlled PROM to the patient being able to perform shoulder AROM in all planes. Shoulder flexion improved from 90˚ PROM to 148˚ AROM. Shoulder abduction improved from 90˚ PROM to 153˚ AROM. Shoulder IR improved from 45˚ PROM to 65˚ AROM and shoulder ER improved from 30˚ PROM to 77˚ AROM. Short-term goal two was met at the fifth visit and long-term goal two was met at the discharge session.

Left UE pain continued to decrease from session to session. Pain rating at initial session as rated 6/10 and rated 1/10 at the discharge session. Short-term goal one was met at the fifth visit and long-term goal one was met the discharge session.

The patient did positively respond to physical therapy and continued to progress throughout treatment sessions. The patient met all short-term and long-term goals except one, which was the strength for the left UE to within 90% of the opposite limb. The patient was motivated to progress throughout therapy and remained compliant while treatment was carried out.

CHAPTER V

DISCUSSION

The patient demonstrated progress throughout therapy for conservative treatment of left scapular fracture, left three-through-eight rib fracture and left sternoclavicular sprain. At the initial treatment session, the patient presented with decreased left UE ROM, decreased left UE strength, increased left UE pain, and impaired functional mobility. The combination of interventions completed helped the patient return to work and hobbies, independently complete ADLs, and achieve goals.

Left UE strength also improved over the course of therapy. Manual muscle testing was not completed on the left upper extremity during the initial evaluation due to increased pain and fractures present. At the discharge session MMT was completed bilaterally. The right UE rated 5/5 with no pain for flexion, abduction, external rotation, and internal rotation. The left UE rated 4/5 with no pain for flexion, abduction, external rotation and internal rotation. This improvement was significant, even though the long-term goal five was still in progress at the discharge session. The patient was able to return to work with light duty restrictions set by the physician.

Outcome measures are used to show progress throughout therapy and measure and meet goals. The book *Muscle and Sensory Testing* compared MMT to a handheld dynamometer while providing images and instructions on how to standardize the handheld dynamometer technique. It was noted that MMT showed unreliable values with higher manual muscle grades.[24] In addition, handheld dynamometers were found to be able to detect weakness and changes at a higher sensitivity than MMT.[24] Therefore, implementing handheld dynamometers into strength

may be beneficial in assessing patient outcomes secondary to handheld dynamometers potentially being more reliable in detecting strength changes.

Overall, the patient's goals of returning to work and hobbies was achieved through physical therapy. The patient was also able to wash hair, reach behind back and complete all ADLs around the house independently. The patient reported decreased pain, which may be attributed to healing of fractures and soft tissues affected along with compliance with physical therapy and home exercise program. Outcomes from physical therapy greatly outweigh the cost of physical therapy for this patient.

Some limitations that occurred at discharge included: not completing the *Quick*DASH outcome measure to compare perceived impairment throughout therapy and not meeting the long-term goal of left shoulder strength to with 90% of opposite limb. The patient may have been less compliant with session participation as well following the transfer of care. The patient also did not meet the long-term strength goal the left UE but was able to return to work with light duty restrictions.

Greiwe[7] identified conservative treatment of scapular body and neck fractures having had shown good patient satisfaction and long-term function outcomes that had minimal complications. However, currently there is minimal research on scapular fractures for both surgical and conservative treatment options.

Future research is needed on effective interventions and outcomes for conservative treatment of scapular fractures. It may be beneficial to have a standardized protocol for scapular fractures that defines the common precautions, restrictions, and the physical therapy role for progressing treatment safely. It may be beneficial to have a follow up session with patients for any concerns and to better understand the patient's full outcomes of therapy.

Reflective Practice

As a patient presents to physical therapy for an initial evaluation, it would be important to recognize the signs of a fracture and the following steps you would take. Questions are available that can assist with differential diagnoses and tests we can perform to further use clinical judgement and decision making. The use of a tuning fork is another inexpensive, easy to use test that can be performed. However, Mugunthan et al[16] concluded the tuning fork may be able to rule out fractures but is overall not statistically accurate in the diagnosis of a fracture. This is beneficial due to some physical therapists not having the ability to order imaging or perform imaging in our scope of practice.

Plan of care modifications that may have assisted in improved outcomes with the incorporation of dry needling as an intervention to help with pain relief. Saylor[25] paired strengthening exercises with dry needling and found clinically meaningful improvements in disability and pain in the short term and upon long-term follow up. Additional physical therapy referrals for conservative care of scapular fracture may be more cost effective and beneficial for patients' long-term care.

This patient was seen for ten visits over 13 weeks. Some of the direct cost included the therapy sessions and physician sessions. The total cost of ten physical therapy sessions for this patient was $718.64.[26] The total out of pocket cost for the patient for ten sessions of physical therapy was $179.60.[26] Indirect costs that were noted for this patient included: gas, driving to appointments, and daily needs from the patient's family. The patient also couldn't work for many weeks due to restrictions and functional limitation. An estimated $20.81 per hour for ten weeks was lost due to this injury resulting in a total loss of $6,600 due to being unable to work.[27]

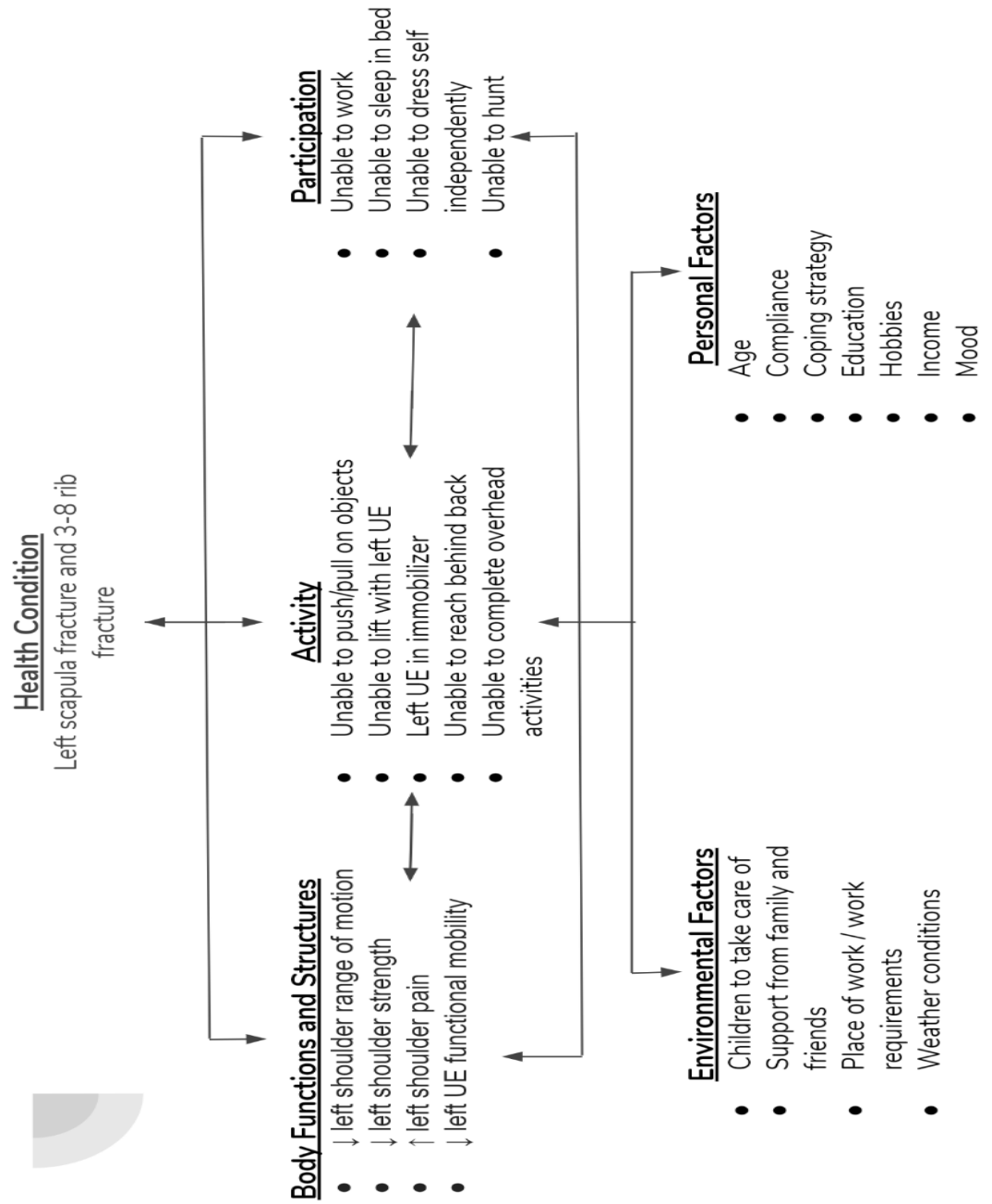
However, the patient was able to collect short-term disability. Therapy outcomes seem to show greater benefits and outweigh the cost of physical therapy.

Physical therapy benefits included that the patient had decreased left UE pain, improved left UE ROM, improved left UE strength, and improved functional mobility. The role of the physical therapist was to be a teacher, educator, and listener. Teaching, educating, and listening were included throughout this episode of care and evident in many areas. These areas include explanation of the diagnosis, appropriate exercise progression, diagnosis, healing process, anatomy involved, motions and actions to avoid, sling use, physician restrictions, use and purpose of modalities, proper exercise technique, HEP, pain, and time frame to return to prior level of function. Another component of education could also include ways to adapt while healing.

This case has influenced professional development by continuing to expand knowledge of shoulder and scapular evaluation and treatment. The learning experience allowed the opportunity to practice finding relevant research and resources when working with a patient population where knowledge is limited. Research was found which discussed the pairing of specific interventions for better outcomes and give more information on ways to improve my UE assessment, including MMT versus hand dynamometry. This case study identified how self-reflection and specific literature review can aide in the improvement of future patients with a similar scenario, as well as treating patient populations of less familiarity more efficiently and effectively.

APPENDIX I

ICF Model – Scapular Fracture



APPENDIX II

*Quick*DASH Outcome Measure[28]

THE QuickDASH

OUTCOME MEASURE

INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer every *question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* of which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

QuickDASH

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	(5)
2. Do heavy household chores (e.g., wash walls, floors)	1	2	3	4	(5)
3. Carry a shopping bag or briefcase.	1	2	3	4	(5)
4. Wash your back.	1	2	3	(4)	5
5. Use a knife to cut food.	1	(2)	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	(4)	5

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, to what *extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	(2)	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	(5)

Please rate the severity of the following symptoms in the last week. *(circle number)*	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	1	(2)	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand.	1	(2)	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	(3)	4	5

QuickDASH DISABILITY/SYMPTOM SCORE = $\left(\frac{\text{sum of } n \text{ responses}}{n} - 1\right) \times 25$, *where* n is equal to the number of completed responses.

A QuickDASH score may not be calculated if there is greater than 1 missing item.

([35/ 11] - 1) x 25 = 63.6% or 64% impaired

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