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Whiplash and Post-Concussion Syndrome following MVA

Tyler Wegscheid
University of North Dakota

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WHIPLASH AND POST-CONCUSSION SYNDROME FOLLOWING MVA

by

TYLER WEGSCHEID

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

University of North Dakota

in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota
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This Scholarly Project, submitted by Tyler Wegscheid 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.

(Graduate School Advisor)

(Chairperson, Physical Therapy)

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Title Whiplash and post-concussion syndrome following MVA

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ABSTRACT

Background and Purpose: Neck pain is one of the most prevalent musculoskeletal conditions in today's world affecting individuals of all ages. More specifically, Whiplash Associated Disorders (WAD) is a major classification of neck pain that is often caused by motor vehicle accidents (MVA). The purpose of this case report is to reflect and examine the available evidence relevant to the examination, evaluation, and treatment procedures that were used for a patient following a MVA.

Case Description: The patient was a 52 year old female with COPD that presented with whiplash, post-concussion syndrome, and various soft tissue injuries following a motor vehicle accident.

Intervention: The individual was seen by physical therapy for six days in the inpatient hospital setting followed by an additional 10 days in the transitional care unit (TCU). She received several physical therapy services including ice packs, interferential current (IFC) electrical stimulation, range of motion (ROM) activities, stretching and strengthening exercises, gait training, therapeutic ultrasound (US), and manual therapy.

Outcomes: Ambulation distance increased from 15 feet using a front wheeled walker (FWW) on the initial evaluation to over 800 feet using a single point cane at discharge. Pain decreased from 10/10 on an ordinal scale on the first visit to

an average of 4-7/10 throughout her final week at the facility. Strength was increased to functional levels as well as normal range of motion attained throughout all extremities

Discussion: Active exercise, electrical stimulation, ultrasound, and manual therapy may be effective methods for improving pain and decreasing function.

CHAPTER I

BACKGROUND AND PURPOSE

Neck pain is one of the most prevalent musculoskeletal conditions in today's world affecting individuals of all ages, causing it to be one of the most burdensome socioeconomic medical complications in the United States (US). In fact, approximately 50% of the overall population will experience neck pain at some point in his or her life.¹ The cost of treatment for neck pain ranks second to low back pain in annual worker's compensation costs in the U.S.² Therefore, it has been a high priority among researchers over the last few decades to identify the most effective treatment strategies for such diagnoses. Considering that hundreds to thousands of studies have been conducted regarding neck pain, there still remains no gold standard for treatment. Part of the reason for this is because the etiology of neck pain is so variable, therefore, yielding different types of neck pain. One common form of cervical discomfort is mechanical neck pain, which is defined as "any neck pain brought on by purely anatomical issues, such as spinal abnormalities, poor posture, injury, or degenerative change."³ It is generally accepted that to be considered mechanical neck pain, the pain level must change with movement. Another major classification of cervical pain is Whiplash Associated Disorders (WAD), which will be the focus of this study.

Whiplash is defined as "an acceleration-deceleration mechanism of energy transfer to the neck."⁴ Roughly 4 out of 1,000 individuals are estimated to

experience such injuries. These types of conditions are often the result of a motor vehicle accident (MVA) in which the vehicle is struck from behind or from the side; this type of injury can occur from an accident in which the vehicle is moving as slow as 7 miles-per-hour.² This type of force can cause bony and/or soft tissue injuries typical of WAD. WAD can be categorized by the severity of signs and symptoms, ranging from Grade 0 to Grade 4, with a grade zero being the smallest degree of WAD, where the patient would not experience any complaints or physical symptoms. Grade 1 indicates neck pain or tenderness, and Grade 2 indicates the same as the previous grade plus musculoskeletal signs such as decreased strength and range of motion (ROM). The most severe degrees of WAD include Grades 3 and 4, which entail a fracture or dislocation in the cervical area along with neurological signs.⁴

Individuals who have experienced a whiplash injury or concussion often experience a common set of symptoms including neck pain, cephalgia (headache), cervicogenic headache, muscle spasm in neck and shoulder musculature, and neck stiffness. Cervicogenic headaches are secondary headaches that may result from inflammation and head or neck injuries and often will present with neck pain and stiffness.^{5, 6} These types of headaches are usually unilateral and start in the posterior regions of the neck or head and travel to the front of the head, as well as produce pain or discomfort in the ipsilateral shoulder and arm. Although the etiology is not well understood, evidence of cervical dysfunction is an important factor in determining or diagnosing this disorder. Depending on the severity, many other symptoms may be present

including arm pain, weakness, nausea, vomiting, dizziness, vision and hearing problems, and difficulty swallowing.⁴ Various factors including how fast the vehicles were going when the accident occurred, size of the involved vehicles, whether or not the head was rotated when the incident happened, and the position or presence of headrests will greatly affect the severity of injury and overall outcome.² Other conditions that may be associated with WAD include paravertebral muscle injury, cervical radiculopathy, vertebral fracture, concussion, depression, chronic pain syndrome, post-traumatic stress disorder (PTSD), and rotator cuff impingement.

Recovery rates for WAD are variable and there have been many inconsistencies regarding rehab potential amongst research publications; however, a general consensus among studies states that the majority of symptom improvement will occur within the first six weeks following the incident, with symptom plateau after three months. Further evidence supports that nearly 50% of those that have experienced a Whiplash Associated Disorder will experience symptoms of neck pain after one year following the date of injury.² Physical therapy (PT) is frequently one of the first treatment approaches utilized for patients with neck pain, and as a result neck pain accounts for roughly 25% of all outpatient PT visits.⁷ Therefore, this case report will focus on PT interventions for the treatment and management of Whiplash Associated Disorders.

Conservative forms of treatment have been common methods for treating this condition, yet the effectiveness of such strategies has been under debate for over a decade. Conservative treatment may consist of a variety of approaches

including neck collar immobilization, localized heat, cryotherapy, electrical stimulation, ultrasound (US), traction, massage, mobilization, and therapeutic exercise. A moderate amount of evidence supports that active forms of treatment have shown to decrease recovery time and increase function better than passive, or inactive, approaches to treatment. However, when looking at the global realm of evidence on this topic, there remain considerable inconsistencies between studies as to which intervention strategies are the most effective for treating this condition. Various medications including nonsteroidal anti-inflammatory drugs (NSAIDs) have been studied and are found to be minimally effective. Various cases have shown that individuals who rely on such drugs to a great extent actually have an extended recovery time before they return to functional activities.²

A new body of evidence supports the use of thoracic spine manipulation for the management of patients with neck pain. This has become an increasingly popular intervention strategy for neck pain, and several randomly controlled trials (RCTs) support its effectiveness for decreasing pain, improving range of motion, and maximizing overall function. A positive feature for using this method is that it has the potential to offer significant improvements in neck function while avoiding the possibility of causing harm to the delicate structures of the cervical spine. The downfall of this newly available realm of research is that most studies have chosen to exclude whiplash and focus on other forms of this condition such as mechanical neck pain. Prospective reasons that WADs have been left out from these studies is because the prognosis and recovery rate have proven to be

highly variable which may pose negative effects on the overall results of these studies.³

Another commonly utilized approach for treating various forms of acute neck pain is electrical stimulation. This technique has been used for many years and was specifically employed to a much greater extent in prior decades for the management of various causes of pain. Even though the technique's use is widely accepted, there is no conclusive evidence showing true effectiveness when applied to painful areas of the body. This holds specifically true when carried out for pain management following Whiplash Associated Disorders, as there is insufficient evidence supporting its practicality.

Considering the inconsistency in research results and overall lack of evidence, intervention strategies for the treatment of WAD such as conservative treatment approaches, exercise-based therapy, thoracic manipulation, and electrical stimulation may be effective methods for managing and improving the various impairments accompanying cervical strain issues. The purpose of this case report is to: (1) describe the physical therapy care activity of a unique patient with severe comorbidities following whiplash which is in itself a difficult to treat injury (2) explore the active, exercise-based treatment approach used for WADs (3) identify the efficacy of thoracic spine manipulation for improving pain and function in individuals with WADs (4) look into the research of whether or not electrotherapy has an effect in pain reduction with WADs (4) identify other intervention methods that may yield positive results for treating WADs.

CHAPTER II

CASE DESCRIPTION

The patient in this case report was a 52-year-old female who was involved in a motor vehicle accident, in which her automobile was struck on the passenger side by a moving vehicle causing her car to rollover multiple times. She lost consciousness for several minutes and was transported to the hospital via ambulance immediately. Once she arrived at the hospital she was seen by PT the afternoon of that same day as her admission. The patient experienced severe stomach, back, neck, and left hip and groin pain. Over the left iliopsoas and adductor muscle regions, the client was extremely tender and a palpable muscle spasm was present. The patient experienced whiplash to the cervical area where she was extremely tender upon palpation and had notable muscle spasms. X-ray, computed tomography (CT) scan, and other medical tests were performed and no evidence of bony injury, fracture, internal bleeding, or major derangements was found. There was a great deal of soft tissue injury including numerous abrasions and facial contusions that were found upon visual assessment. Pain with palpation was present and bony injuries were ruled out. The patient was found to have had a severe concussion form of a mild traumatic brain injury as a result of the accident. She suffered from several symptoms associated with post-concussion syndrome including headaches, nausea,

vomiting, and pain for several days to weeks following the accident. The client's past medical history consisted of end-stage chronic obstructive pulmonary disease and she was currently on a waiting list to receive a lung transplant. A partial resection of one of her lung lobes was performed several years ago due to the severity of the disease. As a result, the patient had been on supplemental oxygen for over a year. Furthermore, the patient also had a history of hypertension, depression, was a former smoker of many years, and underwent left eye enucleation due to melanoma. Enucleation of the eye is the surgical removal of the entire eyeball which is often performed when a malignancy is present in the eye.⁸ A prosthetic eyeball is then positioned in the eye socket and held in place by reattaching muscles from the original eye to give it support and the ability for eye movement. She was on disability and had not held a job for several years.

Examination, Evaluation and Diagnosis

The initial physical therapy evaluation was very limited due to the acuteness of the injury and the severe pain she was experiencing. On a 0-10 pain scale she reported 10/10 pain with movement in her low back, neck, and left groin region, which means that she reported feeling the worse pain imaginable; this level of pain was present with movement in any direction of the stated injured areas. This client was independent with all transfers and activities of daily living (ADLs) prior to the accident. She lived with her boyfriend in a multi-level home, with one step to enter and six to reach the upper level of the house; there were bilateral railings present in both of these locations. Her vitals were as follows:

heart rate (HR)=82, pulse oximeter oxygen saturation (SpO₂) =98% while on 3 liters of oxygen (O₂). Left knee flexion was approximately 105°, and active range of motion for all other lower extremity movements were limited approximately 50% in all directions, by visual assessment. All strength testing was deferred on the initial visit due to severe pain. Her transfers were as follows: supine to sit stand-by-assist (SBA) with head of bed raised, sit to supine required moderate assist, and sit to stand contact-guard-assist (CGA). When transferring to and from the supine position, the patient used one hand to support her cervical spine and the other arm to assist in moving her left lower extremity as she got in and out of bed; without providing this support, she stated that the pain elevated to near unbearable levels. She ambulated 15 feet within the room using a front-wheeled-walker (FWW) with contact-guard-assist. Her standing balance was noted to be fair, but the patient was uneasy on her feet at this time and was not willing to maintain an upright posture for a great deal of time; however, no formal balance testing was done at this time. The initial goals set for the patient to be achieved within three to five days were that she would be able to ambulate 150 feet using a front wheeled-walker with stand-by-assist, and to be independent with all transfers.

On the sixth day following the accident, the patient was transferred to a transitional-care rehabilitation (rehab) unit located in the same facility where she carried out a prolonged stay in order to receive therapy services two times per day for the purpose of decreasing pain, regaining strength, and improving her current deconditioned state. Subsequently, another formal evaluation was done

after this transfer was made. All upper extremity active range of motion (ROM) was found to be within normal limits (WNL) and upper extremity strength was 4/5. Active cervical spine flexion ROM was full, extension was 28°, right rotation 52°, and left rotation 57°. Left active hip flexion was 90° with pain and spasm in the groin and hip flexor muscle area, and active knee extension of the same extremity was 15° from full extension before pain became the limiting factor. The right side was WNL for active hip flexion and knee extension. Quadriceps and hamstring strength were 4/5 on the left, hip flexion 2/5, adduction 2/5, abduction 3/5, and ankle dorsiflexion 5/5. Right lower extremity strength was found to be WNL. Manual muscle testing (MMT) has been found to be both reliable and valid by many researchers.⁹ Authors of a large study conducted several years ago found that clinicians were in complete agreement in assigning the same MMT grade in 60%-66% of cases. Furthermore, agreement within plus or minus 1 full MMT grade occurred 91%-95% of the time. Its' validity is found to be strongest for reporting MMT grades below 4, as this method loses much of its ability to discriminate muscle grading that exceed grade 4.⁹ This is significant because other methods of strength testing such as isokinetic dynamometry and handheld dynamometry (HHD) have a limited ability to distinguish between lower grades of muscle strength.

The patient experienced increased pain with trunk extension and left rotation, which limited her range of motion. She required stand-by-assist for all transfers, but was still using her hands to lift and support her cervical spine and left lower extremity. Her Lower Extremity Functional Scale (LEFS) score at this

time was 6/80. The test-retest reliability of the LEFS has been found to be between .88 and .98 among different studies which is a great outcome.^{10, 11} The cross-sectional validity was reported to be .51 when compared with the time up and go (TUG) test. However, a study published in 2009 states that further research is need needed to determine the construct validity of the LEFS.¹⁰ There were no significant findings with dermatomes or myotomes, and the patient was able to ambulate 150 feet at this time. The patient's skin color and integrity was noted to be normal with no irregular findings. Medical doctors and a respiratory therapist (RT) were both working with this client to address any respiratory and pulmonary issues that were present. Cardiovascular findings were found to be normal as the patient's heart rate and blood pressure were monitored daily and were of no concern. Other than this client's COPD, she had no significant past medical history or family history of any major diseases or health concerns. After gathering all of the examination findings it was evident that the patient would not have a rapid recovery due to her complex medical condition. The patient's COPD was a chronic disease in the end stages that limited her PT performance in many ways. First, her pulmonary function was significantly decreased due to her respiratory diagnosis of COPD and the fact that she required supplemental oxygen at all times. With lower level physical activity the patient became fatigued quickly and her SpO₂ declined. These factors were revealing of the deconditioned situation that this individual was in. Furthermore, strength testing revealed below functional grades in many motions of the lower extremities which contributed to her weakness and difficulty with performing

transfers. The pain that the patient was experiencing was at very high levels and was likely a contributing factor in her diminished ability to carry out daily functional activities. Her ambulation distance upon hospital admission of 15 feet using a FWW and after being transferred to the TCU of 150 feet were not functional distances for returning to the community; therefore it was easy to determine that this patient would require an extended stay at a rehab facility before returning home. Looking at her admission test and measure values, she would not be able to complete the stair ambulation required within her home and it would be unsafe for her to carry out the transfers necessary for independent daily living. Considering all of these factors, PT expected that she may progress at a slower pace than a patient with a healthy cardiopulmonary system because the intensity of therapy would need to be at a lower level. Frequent rest breaks would be necessary throughout therapy sessions due to fatigue and in order to maintain safe SpO₂ levels of around 90% or greater. It was also understood that the high pain levels were likely contributing to her low-functioning presentation and as it began to resolve, function would be regained at a measurable pace.

Prognosis and Plan of Care

According to the Guide to Physical Therapy Practice, the physical therapy diagnosis was practice pattern 4D, Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Connective Tissue Dysfunction.¹² Her prognosis was good to get back to her level of functioning prior to the accident since she did not sustain any major injuries, though she was in a deconditioned state preceding the car accident due to medical problems.

The plan of care for this patient consisted of electrical stimulation, ultrasound, and ice for pain control and muscle spasms. In addition, therapeutic exercise and activities were initiated to promote range of motion and strengthening. Continuous supplemental oxygen was also given during all therapy sessions as oxygen saturation levels are recommended to be 90% or greater as this can reduce symptoms of dyspnea.¹³ Continuous supplemental oxygen given long term has been shown to increase the survival rates in patients with severe hypoxemia and chronic respiratory failure.¹³ Manual therapy was also listed as an option to help with range of motion and pain relief. Other interventions associated with the plan of care were transfer training, gait training, and soft tissue mobilizations.

Her goals to be achieved within two weeks were:

1. Patient will be able to independently transfer her lower extremities in and out of bed without the assistance of her upper extremities.
2. Patient will be independent in her room using a front-wheeled walker in order to be able to return home safely and ambulate throughout her home.
3. Patient will decrease her neck pain and back pain from 8/10 to 4/10 in order to be able to tolerate returning to ADLs at home.

The long-term goals to be achieved in four weeks were:

1. Patient will be able to independently ambulate throughout the facility at a distance of 600 feet using a single point cane so she can return to community living and be able to walk functional distances for completing tasks such as grocery shopping and meeting her basic needs.

2. Patient will be able to ascend/descend six steps with a railing and single point cane to allow her to enter her home and get to her bedroom.
3. Patient will be able to return home in this period of time with average pain levels within the last 24-48 hours of 2-3/10 to be comfortable to return home without medical supervision needed for pain control.

CHAPTER III

INTERVENTION

During the patient's five-day hospital stay, the amount of PT interventions that could be administered was minimal due to the severe, acute pain; therefore, the aim of treatment was to decrease the pain which would provide the patient with comfort. Electrical stimulation, specifically interferential current (IFC), was administered to the cervical musculature and low back musculature on both sides. During the 15 minute treatment time, a total of eight electrodes were used four over the cervical area and four in the lower back region. Ice packs were used in combination with the electrical stimulation as they were placed over the electrodes in these areas. The effectiveness of IFC for the management of musculoskeletal pain control has been debatable, as some research studies have shown results of pain improvement while others have yielded inconclusive evidence. In a systematic review published in 2010, a comparison was done with IFC as a supplement to other treatments versus a control group. Eight studies in this comparison significantly supported the use of IFC in combination with other treatments for pain reduction as it reduced pain to a much greater extent when compared to the control.¹⁴ Two other studies examined in this review compared IFC alone to other forms of treatment such as manual therapy, massage, and

traction; the electrical stimulation show no significant improvements over the other 3 forms of treatment when comparisons were done at discharge.

To directly address the left iliopsoas region, ultrasound was administered with 100% duty cycle, 1 MHZ, and 1 W/cm² for 8 minutes. This was done with the hope of decreasing pain, muscle soreness, and increasing the flexibility of the hip flexor muscle. Unfortunately, the body of evidence for the use of therapeutic ultrasound in treating pain and muscle soreness is highly variable and insufficient. There particularly is little to no evidence on using this modality for treating the iliopsoas muscles. The majority of research that has been done has looked at its effectiveness for treating low back pain and various muscle and tendon inflammatory conditions. A study completed nearly 2 decades ago on the effectiveness of therapeutic ultrasound for treating soft tissue found that this method enhanced the recovery in nearly 2/3 of the patients in this study for the treatment of lateral epicondylitis.¹⁵ This study shows the effectiveness it may have on painful inflammatory conditions. Recent evidence on using ultrasound over trigger points in the trapezius muscle revealed that it was effective in decreasing the stiffness of a trigger point.¹⁶ Even though this study showed positive results on trigger points of the trapezius muscle, they believe that these results may be generalizable to other muscle trigger points throughout the body. Another study released in 2008 found similar results on the effectiveness of ultrasound over trigger points as it yielded short term effects for pain management on various trigger point sites.¹⁷ The other major benefit of using ultrasound over painful trigger points is that it is comfortable to administer, unlike

many traditional methods used such as massage and trigger point release techniques.

The electrical stimulation and ultrasound were administered once per day while the patient was in the hospital. Walking was also performed one time daily, and the patient worked up to ambulating 120 feet by the 5th day in the hospital. Light passive range of motion was also completed daily as able within the patient's pain tolerance in order to prevent loss of motion. All passive motion was completed in the supine position and included shoulder and elbow flexion, hip and knee flexion, lower trunk rotations, and cervical spine motions in all directions as permitted by the patient.

After being transferred to the transitional care unit, the plan of care for this patient consisted of a continuation of the efforts to provide pain relief, while increasing the patient's therapeutic exercise and activities involvement in order to improve the patient's functional status. Daily walking was continued and she was able to ambulate up to 150 feet on her first days in the TCU, as stated in her TCU evaluation section. The first exercises that were implemented were a standing iliopsoas stretch, quad sets, assisted heel slides, assisted hip abduction, cervical rotations and stretching, shoulder shrugs, and short arc quads (SAQs). After four days of carrying out these exercises, more exercise were added to the therapy program including standing hip abduction, mini squats, and standing marching. As strength progressed, more exercises were introduced including step-ups using a four-inch step which was increased up to 8-inch steps by discharge, and heel-to-toe raises. At this time, the patient still had limited cervical range of

motion and experienced increased pain in this area; therefore, a spinal manipulation was performed

A high velocity, low amplitude thrust manipulation was performed to the upper thoracic spine to help with pain and motion; this yielded improvement in both areas of pain and ROM for the patient, and therefore was repeated two days later to both the upper and mid-thoracic spine. Immediately following the technique the client reported that the manipulation felt great and she stated that she received an immediate decrease in pain of approximately 2-3 points on the 10 point ordinal pain scale. The manipulation that was performed involved supine thrust manipulations, in which the patient was laid on her back



Figure 1. Thoracic Manipulation. Taken from J Orthop Sports Phys Ther. 2011;41(9):633-642.³

with arms across the chest.³ The PT then slightly lifted the patient's upper back from the plinth in order to slide one arm underneath the client's back in order to place the hand at the desired spinal level. Since it was done to both the mid-thoracic and upper thoracic spine, the hand was placed in each of these locations on separate attempts. Once the hand was positioned correctly, the therapist then pulled the patient's elbows toward the chest in order to passively place the spine in cervical and thoracic flexion. The PT then administered a high-velocity, low-amplitude thrust through the arms of the patient at the targeted level using his chest to administer the force. Another reason that the manipulation was performed is because there is evidence that supports the use of spinal manipulations for the treatment of cervicogenic headaches, which our patient was experiencing. A systematic review of several randomly controlled trials (RCTs) was published in 2011 and found that 6 of the (RCTs) suggested that spinal manipulation is an effective treatment technique for dealing with cervicogenic headaches over other methods of treatment such as drug therapy, massage, and various other PT interventions.¹⁸ However, 3 of the RCTs in this review reported no difference in pain levels or in headache duration when comparing the spinal manipulations to a control group and the other intervention methods.

The following day after the first manipulation, manual therapy trigger point treatment was executed at the tender point of the iliopsoas and oblique muscles directly after therapeutic ultrasound was administered to this area. This was done this way because research supports the use of ultrasound for decreasing

stiffness of muscle trigger points throughout the body.^{15, 16} Additionally, manual compression therapy applied to tender trigger points of various parts of the body such as of the shoulder muscles has proven to be effective in reducing pain and symptoms when combined with stretching and other modalities such as ice.¹⁹ That is why I believe it may also be effective in other trigger point areas such as in the iliopsoas muscle which was performed in this case. A few days later after the manual trigger point therapy was administered, long arc quads (LAQs), cervical isometrics, and scapula protraction-retraction exercises were initiated. At this time, the patient had worked up to ambulating over 1000 feet, and therefore gait training using a single point cane was instructed; the patient performed quite well using this device at a distance of 400 feet. The next progressions that were made were performing sit-to-stands, seated rows with theraband, and then various balance drills. Balance exercises that were done included Romberg stance with eyes open and eyes closed, tandem standing, modified tandem with Airex foam, and Romberg stance on the foam. At this point the patient was ambulating over 800 feet using the cane. Up until five days prior to discharge, the interferential current (IFC), ice, and ultrasounds (US) were performed once daily during one of the two treatment sessions. Throughout every treatment session with this patient, her SaO₂ was monitored using a handheld pulse oximeter. This is a portable piece of medical equipment that indirectly monitors the saturation of oxygen in a person's blood.²⁰ This noninvasive oxygen monitoring system also measured the patient's heart rate which was a valuable piece of information to receive during treatment sessions.

In healthy individuals, 95% to 100% is generally the acceptable normal range that we look for oxygen saturation to remain between. However, since this patient had severe COPD it was common for her to drop down to 90% or slightly below. The goal at all times was to maintain oxygen saturation above 90%; if it dropped below, the intensity of therapy was either decreased or it was stopped until the saturation increased to normal levels.

The time frame of care activity began on the patient's admission into the hospital where she remained for six days, and then was transferred to a transitional rehab unit until she was discharged two weeks later. Occupational therapy was also involved with this patient to work on improving her upper extremity function as well as cognition. In addition, the patient also received speech therapy to work on improving any speech related pathologies. The nursing staff was actively involved in many other aspects of her care, including taking her for walks on the weekends in order to make sure she stayed active, mobile, and continued to improve endurance.

CHAPTER IV

OUTCOMES

The patient improved very well in several areas while receiving therapy treatment and the various interventions performed during her stay in the hospital and TCU. She stated she experienced temporary pain relief from the various modalities including electrical stimulation, ultrasound, and ice which lasted for several hours. Subjectively she reported a two-point, short-term decrease in her pain level on the 0 to 10 numeric pain rating scale that lasted 2 to 4 days following the thoracic manipulations. She improved her ambulation from the hospital admission date of 15 feet using a front wheeled walker to over 800 feet 2 weeks later using a single point cane. During data collection and the reassessment of goals prior to discharge, all of the patient's lower extremity range of motion was found to be within functional limits (WFL). Formal strength reassessment revealed left hip quadriceps strength was improved to a 4+/5, hamstrings were 4/5, hip flexion had improved to a 4-/5, hip adduction 3+/5, hip abduction 4-/5, and ankle dorsiflexion 5/5. The patient was independent with all transfers at this point and was able to perform all transfers without using her upper extremities to support her cervical spine and left leg. During the last 3 to 5 days of the client's stay in the transitional care unit her pain ranged from 4/10 to 7/10. However, on the last day that the patient received PT she reported her pain a 4 to 5/10. Her

pain levels had not dropped as rapidly as hoped for and expected by the therapists, but she had definitely made large gains from the 10/10 pain she was experience during the first several days of her care activity. The client stated that she was now able to get in and out of bed, go to the bathroom, and be mobile by walking, independently and at bearable pain levels. Gait was analyzed and found to be equal bilaterally with the patient utilizing appropriate heel-strike and toe-off technique with both lower extremities; however, her pace of walking was slower than her prior, normal speed. Unfortunately, a formal discharge was not able to be completed with this patient because her father died during the week prior to her expected discharge. As a result, she left the facility to attend her father's funeral two days prior to her scheduled discharge day at the facility and did not return. Therefore, final measurements and an evaluation of her latest physical health were not able to be performed, including a follow-up of the Lower Extremity Functional Scale. It would have been beneficial to obtain her LEFS score prior to discharge because the scale has been found to be a responsive functional measure.¹¹ An 8 point change in the scale score is needed to reflect true clinical change. Compliance was not an issue as the patient was in the transitional care unit and did not refuse a single therapy session throughout her stay.

Table 1. Left Leg Strength Manual Muscle Test Results		
Movement Tested:	During TCU Evaluation:	At Discharge:
Knee Flexion	4/5	4/5
Knee Extension	4/5	4+/5
Hip Flexion	2/5	4-/5
Hip Adduction	2/5	3+/5
Hip Abduction	3/5	4-/5

CHAPTER V

DISCUSSION

The results yielded by this case are likely due to a variety of reasons and the approach to therapy that was taken. In the situation where the patient was experiencing such intense pain, the number-one goal was to decrease pain before starting any active forms of therapy; this was accomplished through the use of modalities. At the acute stage of this case, active exercises including stretching and strengthening may have only resulted in an increase of pain and a prolonged flare-up. The thought for beginning an exercise-based plan of care was that as soon as the patient's intense, acute pain decreased, an exercise program was to be implemented. This was done in order to get her up-and-moving as soon as possible to avoid further atrophy and deconditioning from occurring. On the conservative end, I, as the student PT, did not want to push the patient too fast causing a flare-up of pain symptoms, and therefore a setback in the progression of therapy. I felt that this was a good example of how to treat a patient suffering from whiplash and other soft-tissue injuries, by controlling pain initially and then implementing range of motion and strength exercises. There is no definitive evidence as to whether or not conservative forms of treatment for whiplash produce better or inferior results than more active, exercise-based rehabilitation methods. The Cochrane Collaboration put together a review in

2011 examining various methods of conservative treatment compared to active methods, and found no concrete results supporting one method over the other.⁴ Certain individual studies revealed that some methods of treatment were more effective than others; however, after comparisons of several studies were made, the results were found to be inconsistent and variable. Therefore, after analyzing the many research studies available on whiplash I found that the overall body of research for this type of injury is of poor quality. The Cochrane Review on this topic from 2011 states that “Therefore, clearly effective treatments are not supported at this time for the treatment of acute, subacute, or chronic symptoms of whiplash-associated disorders.”⁴ The relief the patient received from the electrical stimulation and ice was clinically significant, and I felt that this was representative of the results that electrical stimulation can have on acute pain. The thoracic manipulation that was performed was followed with short term relief for the patient. Long term results were not able to be obtained as the patient was not in the facility for a long enough time period to examine long term effects. Many studies do support the effectiveness of this method for various acute neck issues, but the problem is that most of the research excludes whiplash injuries. Perhaps this is because the prognosis and recovery rate for whiplash associated disorders has shown to be variable and recovery rates are often inconsistent from one individual to the next. This is why most studies choose to exclude whiplash injuries from their studies because the researchers feel that patient’s with whiplash may skew the results. One study published in 2009 by Gonzalez-Iglesias found that thoracic spine thrust manipulation will yield superior results for

patients with acute neck pain that last 1 month or greater.⁷ In this study, clients from the control and experimental group received the same treatment of 5 sessions of electrothermal therapy over a 3-week time frame, except patients in the experimental group received the thrust manipulation on the first, third, and fifth visits as well. Limitations of this case study are that the sample size only included one patient, and the one patient had pre-existing medical problems and comorbidities; therefore, what worked well for this patient may not be able to be generalized to a normal population of people with whiplash injuries. Further high-quality research needs to be done including a large sample size that is an adequate representation of the normal population of adults. Additional research should include full data on outcome measurements and assessments, with planned follow-up appointments at periodic intervals throughout the following year.

A distinction needs to be made about the medical diagnosis of this patient following the accident. Concussions and mild traumatic brain injuries (MTBI) are synonymous with one another, as a concussion is a MTBI.²¹ There is often great confusion about this issue as they are sometimes both listed in the medical diagnosis separately, which was done in this case. Also, as I carried out research on this topic I occasionally found discrepancies on this issue.

Reflective Practice

As the student PT in this case report I realize that I have not yet completed my education and have limited clinical experience; therefore, my clinical skills and judgment need continual revising. After reflecting on the care

activity that I provided for this patient there are many things that I would not change about the decisions I made and a few things that I would do differently. First, I would have taken a more thorough history on the initial evaluation to learn more about the patient. I would have asked several questions to learn more about what her level of function was prior to the accident such as: what kinds of leisure activities did she enjoy, was she was able to independently care for herself and her home prior to the accident, did her current lung disease restrict her in your daily life, and what types of things was she not able to do that she once was before the progression of her COPD. In my examination, I would have performed a formal balance test such as the Berg Balance test, Tinetti Balance Assessment, or the Mini-BestTest which recently has been receiving a lot of positive attention. In addition, I would have taken formal handheld goniometric measurements of all lower extremity motions instead of estimating ROM through visual assessment. I also would have administered a functional scale to evaluate the patient's neck function such as the Neck Disability Index. Throughout her therapy sessions, the patient's oxygen levels were monitored regularly to make sure that they remained within an adequate range. However, I wish I would have done a more sufficient job at regularly documenting the exact readings in her daily therapy notes. Another objective measure I wish that I would have obtained was goniometric measurements of the cervical spine before and after the thoracic spine manipulations were performed. This would have given me a measurable report on the effectiveness of the manipulations that were performed. Looking at the plan of care I do not feel that I would have made any

changes. I do, however, wish that I would have had the ability to make a follow up phone call to this patient in order to determine how she was doing since returning home. This was not possible for me to perform with this patient because my last day in the clinic where the treatment in this case report was performed was only a few days following her discharge home. This was an extremely involved patient with severe comorbidities and high pain levels. The progressions made were slow, and as the student PT, I was careful not to push the patient too far causing increased pain and setbacks. The client's preexisting deconditioned physical status had a negative influence on the patient's recovery and I feel that it played a key role interfering with her therapy progress.

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