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A Case Report: Physical Therapy Management of a 25-Year-Old Female Experiencing a Whiplash Injury and Low Back Pain

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A CASE REPORT: PHYSICAL THERAPY MANAGEMENT OF A 25-YEAR-OLD
FEMALE EXPERIENCING A WHIPLASH INJURY AND LOW BACK PAIN

by

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Bachelor of Science of General Studies with Emphasis in Health Science
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A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

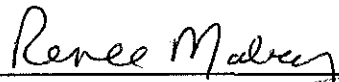
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in partial fulfillment of the requirements for the degree of


Doctor of Physical Therapy

Grand Forks, North Dakota
May 12, 2018

This Scholarly Project, submitted by Carmen Stanhope 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)



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ABSTRACT

Background and Purpose. There is a prevalence of whiplash mechanism injuries affecting the cervical spine following motor vehicle accidents. The approximate incidence in Western societies for whiplash associated disorder is 1 case for every 1,000 people in the population. The purpose of this case study is to describe the physical therapy examination, evaluation, diagnosis, prognosis, and interventions used in the treatment of a patient with whiplash associated disorder.

Case Description. This case study describes the clinical presentation, physical therapy intervention, and outcomes of a young adult female following a rear end motor vehicle accident (MVA). The patient presented to physical therapy approximately three weeks following the accident, with decreased cervical range of motion, daily headaches, cervical pain, tight suboccipitals muscles, low back pain, and paresthesia into her right forearm.

Intervention. The treatment of this patient involved manual therapy, education, strengthening, range of motion, neuromuscular re-education, and upper and lower extremity neural mobilizations.

Outcomes. Following PT intervention, the patient achieved full cervical and lumbar range of motion, normal neurodynamics, decreased cervical and low back pain, improved posture, and complete alleviation of headaches. The patient also achieved complete alleviation of numbness and tingling into the forearm and tightness in cervical and low back muscles was also eliminated.

Discussion. It has been shown that patients who have been seen in the acute/sub-acute phase of whiplash associated disorder have better outcomes than those in the chronic phase if treated by physical therapy. This case study helps to provide a description of effective and quality treatment of whiplash associated disorder.

CHAPTER I

BACKGROUND AND PURPOSE

A whiplash mechanism injury is an “acceleration-deceleration mechanism of energy transfer to the neck, from a rear or side impact motor vehicle accident”.¹ A whiplash mechanism injury is now termed whiplash associated disorder (WAD) due to varying symptoms post motor vehicle accidents (MVA’s).² These symptoms not only include neck pain, but also pain in adjacent body regions and other cognitive and somatic symptoms.²

WAD is generally categorized as a soft-tissue injury of the neck.³ The injury occurs when the head goes into rapid hyperextension and the anterior neck muscles (sternocleidomastoid [SCM], longus coli and capitus, and scalenes) forcefully contract overstressing of muscles.³ As a result of this muscle strain, those suffering from WAD usually exhibit moderate or severe pain in the neck, lower back, shoulder, or upper back and an abnormal neutral resting head posture.^{2,4,5} The mechanism of injury could also potentially damage the brain via a coup-contrecoup injury. A coup injury is one in which there is a “contusion to the brain that occurs at the area of brain adjacent to the location at which the skull impacts with a fixed external object”.⁶ A contrecoup injury is one in which there is a “contusion to the brain that occurs at the area of brain opposite the area of skull impact”.⁶ These types of injuries are common in MVAs as people tend to hit their heads on windshields, headboards, or the steering wheel. Other anatomical structures typically involved in WAD are the upper brainstem; vertebral artery; spine, specifically

C1, C2; the vertebral discs or vertebral end plates; and the spinal ligaments, specifically the alar, apical, transverse, or anterior longitudinal ligaments.³ Trauma and damage to the spinal ligaments, discs, and nerves are the primary contributors to chronic cervical pain.³ Accompanying symptoms include pain and altered neurodynamics in the shoulder, arm, or hand; fatigue; concentration difficulties; dizziness; visual and auditory symptoms; emotional disturbances; and cervicogenic headaches.^{3,4,7} Emotional disturbances such as anxiety, depression, and general irritability, as well as poor coping strategies, low self-efficacy beliefs, and high disability levels are very common following a traumatic MVA.¹ Among the many symptoms, cervicogenic headaches and neck pain are the most common.⁸ The Quebec Task Force has developed a classification of severity of WAD as shown in Table 1 in order to accurately diagnose the severity of WAD.¹⁵

According to the Centers for Disease Control and Prevention (CDC)⁹, in 2013, crash related deaths cost \$44 billion in direct medical and work loss costs. Also, each year from MVAs, are approximately 4 million United States emergency department visits.^{10,11} The approximate incidence in Western societies for whiplash associated disorder is 1 case for every 1,000 people in the population.¹ More than half of those suffering from WAD will report symptoms 6 months after the injury¹². At 1 year post-injury, 50% of people with whiplash-associated disorders (WAD) still report neck pain.¹³ Persistent pain after a MVA is common and costly to the public.¹⁴

The standard intervention of initial rest, application of a soft collar, and gradual self-mobilization has been shown to be ineffective in treating WAD and has a poor prognosis for long-term results.⁷ The prognosis of those with WAD is better when participants are subjected to active cervical range of motion, McKenzie principles,

postural education, manual therapy techniques, and a strengthening and stabilization interventions.^{4,5,7} The prognosis and outcomes also improve if the patient is seen during the acute and sub-acute stages rather than the chronic stage.⁴ If the patient is seen in the chronic stage or is not seen at all by a physician or physical therapy following a whiplash mechanism injury, more than half will report symptoms of pain and disability a year after the injury.¹⁴

Table 1. Quebec Task Force Classification of Whiplash Associated Disorder¹⁵

Grade	Presentation
I	Neck pain complaint, stiffness, or tenderness only No physical signs
II	Neck complaint Musculoskeletal signs: <ul style="list-style-type: none"> • Decreased range of motion • Point tenderness
III	Neck complaint Neurological signs: <ul style="list-style-type: none"> • Decreased or absent deep tendon reflexes • Muscle weakness • Sensory deficits
IV	Neck complain and fracture or dislocation

The purpose of this case study is to describe the physical therapy examination, evaluation, diagnosis, prognosis, and interventions used in the treatment of a patient with whiplash associated disorder.

CHAPTER II

CASE DESCRIPTION

This case study describes the clinical presentation, physical therapy intervention, and outcomes of a young adult female following a rear end motor vehicle accident (MVA). Consequently, the patient suffered a whiplash mechanism injury, causing trauma to her head, neck, and low back. She experienced a MVA in early October and was seen status post MVA in the emergency department (ED). Upon initial presentation, the patient underwent examination and evaluation. Her evaluation in the ED showed signs and symptoms consistent with whiplash associated disorder (WAD) Grade II according to the Quebec Task Force Classification system.¹⁵ Radiographic imaging of the patient's cervical spine was not performed, consistent with Sterling et al.,¹⁶ and her clinical presentation: there is no evidence to support the use of imaging in any form in WAD Grade II. The patient was discharged home following emergency room care. The patient's symptoms progressed with continued headaches, neck, and back pain. In late October, the patient went to her primary care physician (PCP) to obtain further medical treatment. The patient was referred to physical therapy for evaluation and treatment for cervicogenic headaches, cervical and lumbar pain. The patient presented to physical therapy approximately three weeks following the accident, with decreased cervical range of motion, daily headaches, cervical pain, tight suboccipital muscles, low back pain, and paresthesia into her right forearm. The patient's past medical history was unremarkable.

She was taking acetaminophen as needed for headache pain. She was employed as a program specialist that requires 50% of job duties sitting at a computer. She reported experiencing difficulties completing duties and attending her job due to pain. Her pain and other symptoms worsened as the day progresses.

Prior to injury the patient competed in marathons, competed in athletic competitions, and led a physically active lifestyle. Since injury, the patient was having trouble competing and participating, and reported a decrease in overall level of flexibility since the accident. Also, she had been having difficulty reading and driving due to pain. No other concerns were noted by the patient.

The treatment of this patient involved manual therapy, education, strengthening, range of motion, neuromuscular re-education, and upper and lower extremity neural mobilizations. Following PT intervention, the patient achieved full cervical and lumbar range of motion, normal neurodynamics, decreased cervical and low back pain, improved posture, and complete alleviation of headaches. The patient also achieved complete alleviation of numbness and tingling into the forearm; tightness in cervical and low back muscles was also eliminated. Rationale for treatment was based on evidence based practice and the work of McKenzie¹⁷ and Mulligan¹⁸, which focused on the treatment of cervical and lumbar derangements as well as treating the patient's present symptoms. Treatment was altered or progressed based on the patient response.

Examination, Evaluation and Diagnosis

The physical therapy examination and evaluation was based on a McKenzie evaluation¹⁷ and mechanically-determined directional preference of the cervical and lumbar spine. Order of operation for the examination was based on *Orthopedic Physical Assessment* by Magee¹⁹ of the lumbar and cervical spine.

Initially, the patient was instructed to complete the Neck Disability Index (NDI). The NDI is one of the most commonly used self-reported outcome measures to evaluate neck pain.²⁰ A systematic review of the NDI stated the outcome measure has acceptable reliability and has correlation coefficients (ICCs) that range from .50-.98.²⁰ The patient scored 12/50, meaning she is suffering with a mild disability. According to Croft et al.²¹ the “optimal NDI cutoff point for differentiating recovery state after whiplash is 15”.²¹ The sensitivity and specificity values of the NDI cut score of 15 to are 82% and 81%, respectively.²¹

Upon initial observation, the patient did not appear to be in a significant amount of pain. The patient presented with forward rounded shoulders and decreased lumbar lordosis. A quick screen of muscle strength was conducted and showed no abnormal findings of the upper and lower extremities. The patient demonstrated fair active range of motion (AROM) in the cervical and lumbar spine, which was limited by pain, especially with right trunk rotation and cervical flexion. Cervical and lumbar spine AROM was measured using a goniometer and tape measure and measurements are shown on Table 2 below.

Table 2. Initial Cervical and Lumbar Range of Motion (in degrees)	
	ROM
Cervical Extension	54
Cervical Flexion	36

R Cervical Rotation	63
L Cervical Rotation	69
Lumbar Extension	13
Lumbar Flexion	Fingers to the floor

Myotomes of the upper and lower extremities were negative bilaterally. Upper extremity dermatomal testing did not show any deficits. The patient did not have any palpable tenderness in the neck or low back. However, tight musculature was noted in posterior neck (suboccipitals), and low back (paraspinals). Neural tension tests demonstrated moderate losses to the median, ulnar, and radial nerves, right more than the left. Special tests were performed and are listed in Table 3 with their sensitivity and specificity percentages, along with patient presentation and symptoms.

Table 3. Sensitivity and Specificity of Special Tests²²

	Sensitivity	Specificity	Patient Presentation
Upper Limb Tension Test (ULTT)– Median ²³	97%	22%	Increased paresthesia, R>L
Upper Limb Tension Test – Ulnar ²⁴	60%	40%	Increased paresthesia, pain, R>L
Upper Limb Tension Test – Radial ²³	72%	33%	Increased paresthesia, R>L
Spurling’s Test ²⁵	93%	95%	Pain, increased paresthesia
Straight Leg Raise for Nerve Root Compression ²⁶	97%	57%	Neural tension, pain R: 63 degrees L: 65 degrees
Slump Test for Nerve Root Compression ²⁷	83%	55%	Produced neural pain
Vertebral Artery Test ²⁸	0%	67-90%	Negative

Initial evaluation data indicated that this patient would not be classified in the postural category for McKenzie Syndromes. Rather, this patient likely has a derangement of both the cervical and lumbar spine along with a muscle dysfunction from a whiplash mechanism injury, causing tight musculature of the upper trapezius, suboccipitals, and scalenes bilaterally, and strain of the anterior neck musculature. The patient has moderate upper extremity neural tension contributing to the numbness and tingling into the right forearm.

Following the physical therapy examination and evaluation, the patient received a physical therapy diagnosis of cervicalgia, low back pain, pain in the thoracic spine, and strain of the muscle, fascia, and tendon at the neck. This diagnosis is consistent with what is termed whiplash associated disorder, grade II.

Prognosis and Plan of Care

Physical therapy is reasonable and necessary to regain range of motion, restore function, and strengthen core muscles for stability to decrease risk of further/future injury. In accordance with the patient's goals and acute/sub-acute injury the patient's rehabilitation potential is excellent. As noted in Chapter 1 in the Review of Literature section, the prognosis is very good for those in the acute and sub-acute phases.

The patient was scheduled to attend physical therapy 2-3 sessions for 60 minutes per week for 4-8 weeks, in order for the patient to become fully functional without pain. The plan for treatment decrease pain and improve function through therapeutic exercise, education, and manual therapy techniques. Activities during each session varied upon patient presentation that day, severity of symptoms, or level of progression following previous therapy session.

Goals for this patient included increasing cervical and lumbar range of motion, decreasing the occurrence of headaches, eliminating numbness, and tingling into the right forearm, decreasing her NDI score, and decreasing cervical and lumbar pain and tightness. The goals were to be met within 4-8 weeks with the use of physical therapy intervention. These goals would help the patient return to normal ADLs and enable her to perform her job better and without pain. Re-evaluation was to occur on or before the 10th visit to examine the patient's progress during therapy and to decide whether to continue treatment or make a back to the physician.

CHAPTER III

INTERVENTION

The patient was seen 3 days a week for 60 minute sessions for 5 weeks. The focus of treatment involved manual therapy, education, strengthening, range of motion, neuromuscular re-education, and upper and lower extremity neural mobilizations. Intervention techniques were chosen in accordance with the patient's goals. All interventions were progressed or regressed based on patient tolerance and signs and symptoms upon arrival to PT and during therapeutic interventions. Initially, the patient required visual and demonstrative explanations along with moderate verbal cues to correct form during stabilization exercises. As treatment progressed, cues were no longer needed.

Week One

The first week's intervention plan involved pain-relieving modalities including moist hot packs to the patient's cervical and lumbar spine. She was instructed to perform pain-free prone press-ups and supine cervical retraction. Light strengthening was initiated on the core stix, specifically: rows, the fly, and the reverse fly. McConnell tape was applied in an "X" fashion to the back to prevent slouching and promote lumbar lordosis and thoracic extension. The patient was educated on the slouch-overcorrect. Manual therapy techniques were utilized, including grades 2-4 central PA glides to the lumbar, thoracic, and cervical spine to decrease pain and increase segmental range of motion.

Upper cervical flexion with distraction was performed to reduce headache symptoms. Neural mobilization/gliding techniques to the median, radial, and ulnar nerves were used to desensitize the nervous system. Trigger point release to sub occipitals, upper trapezius, and scalenes released tension and tone in the posterior and anterior cervical muscles and C2 headache sustained natural apophyseal glides (SNAGs) relieved headache symptoms.

After 1 week, the patient continued to experience daily headaches and low back and neck pain. The numbness and tingling into her right forearm had been alleviated, but she was still having trouble getting asleep. There was an increase in cervical flexion and lumbar extension range of motion following week 1. Posture continued to be poor in sitting and with exercise and moderate cues were needed to correct.

Week Two

Over the weekend, transitioning into the second week, the patient ran a 10K and noted moderate pain and soreness in the cervical and lumbar spine during activity and following activity. Patient reported having trouble falling asleep due to headache pain.

During week 2, treatment included pain-relieving modalities of moist hot packs to the cervical and lumbar spines. Therapeutic exercise was progressed during week 2 after pain was reduced to ensure core, upper extremity, and cervical stabilization. The patient required moderate verbal cues to maintain core stabilization during exercise. Specific exercises included core stix as mentioned in week 1, scapular shrugs and scapular retraction exercises with weights. Manual therapy techniques were continued as well as prone press-ups and cervical retractions. Manual static and rhythmic traction/decompression and upper cervical flexion with distraction was performed with

the patient in a supine position. The patient was educated and instructed to perform self-cervical headache SNAGs if symptoms occurred at home.²⁹

The patient reported sleeping better after week 2 her low back pain decreased. She increased her physical activity during week 2 and did not experience any neck or back pain with activity. The patient continued to experience headaches on a regular basis, but was benefitting from formal PT to abolish frequency of headaches and to educate on how to self-treat at home.

Week Three

Following week 2 into the beginning of week 3, the patient continued to experience head and neck pain with prolonged sitting at work and driving long distances. During the third week of treatment, the patient continued with core, upper extremity, and cervical strengthening; she was able maintain lumbar lordosis and shoulder/scapular retraction. Foam roll activities, with the foam roll vertical and the patient lying supine, included shoulder flexion, horizontal abduction, and external rotation. Cervical stabilization exercises were added during week 3 with emphasis deep cervical flexors and proprioception awareness. Cervical isometric exercises were performed with a small ball on the wall, side bending right and left, retraction, and flexion. Manual therapy consisted of the same techniques as week 1 and 2.

A re-evaluation was conducted at the end of week 3. The patient reported less frequent headaches. She also had achieved normal cervical and lumbar range of motion and returned to the gym due to the decrease in low back and neck pain. She did experience mild muscle tightness and pain in the cervical region after sitting for an extended period of time, but is no longer experiencing lumbar pain with sitting. Her pain

decreased with proper postural alignment. During re-evaluation, the patient scored a 3/50 on the NDI, this indicated no disability. She continued to benefit from formal physical therapy to address cervical, lumbar, and core stabilization, to completely alleviate headaches, and to prevent risk of re-injury.

Week Four

Following week three progressing into week 4, the patient did not experience any headaches or neck pain. The patient had attended several meetings and had driven long distances and did not experience any headache pain. Physical activity outside of PT had been progressed due to decreased pain.

Week 4 focused on a progressive ROM, strengthening, and stabilization regimen in accordance with the previous weeks of exercises. The free motion machine was utilized during week 4 for rows, low rows, shoulder flexion and extension, and latissimus pull downs. Improvements in posture with static and dynamic activities was noted. Patients HEP continued to provide relief if pain did recur.

Week Five/Discharge

The final week of treatment focused on progressive core, cervical, and upper extremity strengthening to reduce the chance of recurrence. Manual therapy was continued as well. At discharge, the patient had full cervical and lumbar range of motion as shown in Table 4. She also had normal neurodynamics in bilateral upper extremities. She had not experienced a headache for over two weeks and had shown improvements with posture. At discharge, the patient stated that she was “at 100% of normal and no longer thought about her headaches and neck pain.”

CHAPTER IV

OUTCOMES

Treatment consisted of education regarding spine posture and body mechanics, manual therapy techniques, neural mobilization/flossing techniques, modalities as required, stabilization and strengthening, and functional training to improve home/work activities. Treatment that proved effective for this patient with cervical, lumbar, and headache symptoms included: Mulligan headache therapy, repeated cervical retraction, repeated lumbar prone press-ups, and neural mobilizations, along with core strengthening activities. Upon initial evaluation, the patient completed the Neck Disability Index (NDI), scoring 12/50, suffering with mild disability. At discharge, the patient scored a 0/50 on the NDI, meaning the patient had no disability. The following are the areas in which she improved on the NDI: pain intensity, reading, headaches, work, driving, sleeping, recreation, and concentration.

Following the 5-week outpatient physical therapy management, this patient rated her overall improvement since onset of therapy at 100%. She showed improvements with both cervical and lumbar range of motion, as shown on Table 2 and 4. By the end of therapy she had normal neurodynamics and had full range with the upper extremity neural tension tests. She had not experienced a headache in the last two weeks of therapy due to the strengthening, stabilization, and manual therapy techniques performed. Posture and core stability had improved and the patient no longer needed verbal cues in static

standing and with therapeutic exercises. There was no longer evidence of tight and tender musculature upon palpation to the cervical and lumbar spine musculature. All goals were met following physical therapy intervention. The patient is likely to continue to progress with performance of her HEP and participation in a gym regimen following discharge.

Table 4. Discharge Cervical and Lumbar Range of Motion (in degrees)	
	ROM
Cervical Extension	65
Cervical Flexion	49
R Cervical Rotation	80
L Cervical Rotation	76
Lumbar Extension	27
Lumbar Flexion	Palms to the floor

CHAPTER V

DISCUSSION

Following the 5-week physical therapy intervention of a whiplash mechanism injury, the patient demonstrated improvements in cervical and lumbar ROM, decreased in pain, and normal neurodynamics. Better outcomes occur if patients are seen during the acute and sub-acute stages rather than the chronic stage.⁴ According to Kamper et al.¹² and Sterling et al.¹⁶, recovery, if it occurs, takes place within the first 2-3 months following this injury with a plateau in recovery following this time period. The most consistent risk factors to predict poor functional recovery are initial high levels of reported pain and disability.¹⁴ Due to the acute nature of the whiplash mechanism injury, low levels of pain (3/10), and mild disability (12/50) on the NDI, the patient was a great candidate for recovery and success following physical therapy intervention. Also, the patient's prior level of activity, physical fitness level, and young age contributed to a quick and successful recovery.

The patient was able to return to the level of physical activity prior to her injury. She also returned to yoga classes and started training for another running competition. Following physical therapy intervention, the patient no longer was absent from work due to headaches and her level of productivity while at work also improved. At work, she was able to sit for longer periods of time, read without headache symptoms, and concentrate better. Due to treatment and the alleviation of headaches, the patient was able to study for

and complete the Graduate Record Examination (GRE) without the complications of headaches, neck, and low back pain.

A systematic review was conducted on the guidelines for physical therapist on treating WAD in the acute, sub-acute, and chronic phases of the injury process.⁴ This systematic review showed during the acute phase of WAD, 0-2 weeks post-injury, active exercise, education on self-management, manual mobilizations, and return to normal ADLs should be the intervention plan.⁴ During the sub-acute phase, >2-12 weeks, manual techniques, postural training, psychological input, soft tissue techniques, and deep neck muscle retraining should be the intervention plan.⁴ As for the chronic phase, >12 weeks, there is a lack of evidence on treatment plan due to the severity of symptoms at this stage in the injury process.⁴ In conducting research on the clinical guidelines for treatment of those suffering a whiplash mechanism injury, the plan of care conducted for this patient is in accordance with current evidence on WAD.⁴ Further research should be performed to discuss the prognosis and treatment options for those suffering from chronic whiplash symptoms.

Limitations of this case study include the fact that a headache functional assessment or questionnaire was not used. A frequently used assessment is the Migraine Disability Assessment score.³⁰ This assessment looks at number of days missed at work and days where productivity at work was reduced by half or more due to headache symptoms.³⁰ It also addresses household duties and social, family, and leisure activities Stewart. It would have been beneficial to see the improvements, specifically on the patient's headache symptoms and progression of headaches through the course of treatment.

Another limitation of this case study was the inability to follow-up with the patient after discharge from therapy. Return of symptoms, current level of function, and long-term effects of treatment are unknown. In a study conducted by Bunketorp et al.⁸ over half of the subjects in their study involved in a MVA that were diagnosed with WAD reported neck pain 17 years after the MVA. Though some outcomes for those suffering from WAD may be poor, this patient demonstrated a full recovery and was discharged with a HEP and information on how to manage her symptoms.

Overall, this case study provided evidence for successful physical therapy evaluation, examination, treatment, and outcomes of a 25-year-old female following a rear-end MVA. This patient was treated during the acute/sub-acute phase of injury, making the prognosis excellent for this patient. Functional and objective measures during initial and discharge evaluations showed drastic improvements. The combination of a progressive ROM, strengthening, and stabilization regimen, manual therapy techniques, postural education and retraining, and deep neck muscle retraining served as a great plan of care in treating someone with acute/sub-acute WAD.

Reflective Practice

Neck pain is one of the leading diagnoses seen by a physical therapist. Following my first year of physical therapy in-class education, I did not feel well equipped to perform a treatment from start to finish for a patient coming into the clinic complaining of neck pain. My clinical instructor (CI) gave me the tools, prior to evaluating this patient, in order for me to feel comfortable treating individuals with cervical pain, lumbar pain, paresthesia of the upper extremities, and headache symptoms. Though my CI gave

me these tools, that does not make me an expert on the subject and through conducting this case study, I have realized there are things I would have done differently.

In taking the history, several other questions could have been addressed specifically regarding the collision/accident, specifically, how fast was she going, how fast was the other car going, did she see the collision coming, did she hit her head on the dashboard or the steering wheel. I also could have expanded on specific treatment within the emergency department following the motor vehicle accident and what was the reason behind the ED physician not performing imaging of the cervical spine. These types of questions would have given me a better picture of all that occurred regarding the MVA.

During the initial evaluation, I did get objective measurements for ROM of the cervical and lumbar spine, but it would have been helpful to get specific strength testing of the cervical and lumbar spine, as well as grip strength. Due to the upper extremity paresthesia, obtaining grip strength using a dynamometer would have been beneficial in comparing initial strength to discharge strength to show progression and improvements for insurance and reimbursement purposes. As I continue to treat patients and further my skills, I will become more comfortable in determining a prognosis and plan of care. In looking back on this case, I could have conducted more research on the topic of whiplash and the prognosis that comes along with the diagnosis of WAD. In the future, I will use evidence based practice to drive my treatment of patients with a diagnosis in which I am unfamiliar.

During my time in outpatient orthopedics, I gained immense amounts of knowledge when it comes to learning new interventions and manual therapy techniques, especially for the cervical spine. In continuing with my education and clinical

experiences I hope to carry over this new level of knowledge and produce successful outcomes for patient with cervical, low back, and headache pain in the future. Gaining the understanding from writing this case study, specifically the anatomy, physiology, typical patient presentation, and clinical intervention timelines will make me better equipped to evaluate and treat whiplash mechanism injuries from MVAs, or by any other mechanism.

In my future as a physical therapist, I will refer to this case and use the intervention techniques that were successful for a patient with a whiplash mechanism injury and low back pain. I will also take into account that items that should have been addressed and incorporate those missed items into my future evaluations and treatments. This case report is very beneficial to improve my physical therapy examination, evaluation, diagnosis, prognosis, intervention, and outcomes as a student physical therapist.

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