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Outpatient Management of Low Back and Neck Pain with Radicular Symptoms

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Outpatient Management of Low Back and Neck Pain with Radicular Symptoms

by

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PERMISSION

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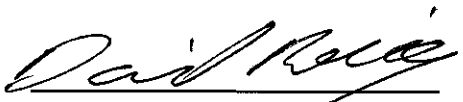
(Graduate School Advisor)



(Chairperson, Physical Therapy)

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ABSTRACT

Background and Purpose. Neck and back pain are very prevalent in the world today. This pain can range mild to debilitating. The purpose of this case study is to examine the use of physical therapy for patients with neck and back pain.

Case Description. A 49 year old female with neck and back pain with radiculopathy. The patient presented with decreased cervical range of motion, kyphotic posture with rounded shoulders and forward head and was seen for a total of six weeks. (20 visits)

Intervention. The treatment of the patient involved education on posture/body mechanics/exercises, manual therapy techniques, modalities as needed, movement preferential patterns, dry needling myofascial release.

Outcomes. Following physical therapy program the patient achieved full cervical range of motion and a feeling of neck pain being reduced by 85-90%. She also had elimination of numbness and tingling into left upper extremity as well as no complaint of back pain. Patient tolerance to activities improved while being able to sleep through the night with increased her overall quality of life noted.

Discussion. Rationale for treatment was based largely on the McKenzie method which showed to be beneficial for the treatment of neck and back pain along with strengthening, myofascial release, dry needling, and e-stim as needed for pain relief.

CHAPTER I

BACKGROUND AND PURPOSE

Neck pain and low back pain are an all too common diagnosis for many people. Back pain is one of the most common ailments for individuals. It has been reported that 80% of population experience back pain during their lives and it is also the leading cause of disability world wide.[1] Beyond that, it is the third most common reason for a Doctor's visit in the US. The last estimate of spending on back pain in the US alone was approximately 86 billion dollars.[1] Back pain is a serious issue that is troublesome and encountered by the majority of people. Neck pain is also very prevalent and is second only to back pain for musculoskeletal conditions.[2] However, in a 16 year cross-sectional population survey study, Leijon[3] found neck-shoulder-arm pain in concurrence with back pain only occurred 10.8% of the time in females. These two pathologies can be a large burden on an individual's daily life, especially when they are combined and centered around the spinal column.

The spine includes 33 vertebrae which make up the spinal column. The spine can be separated into seven cervical vertebrae, 12 thoracic, five lumbar, five sacral, and four coccyx vertebrae. From the cervical region to the end of the lumbar region all the vertebrae are movable, while the sacral and coccyx vertebrae are fused.[4] In between each of the moveable vertebrae are discs that help to absorb shocks and distribute weight through the spine. The main functions of the spine are to protect the spinal cord and

exiting nerve roots, support the thorax, support upright posture, provide attachments for

muscles as well as provide trunk mobility.[5] Figures 1 and 2 below are visual representations of spinal column.

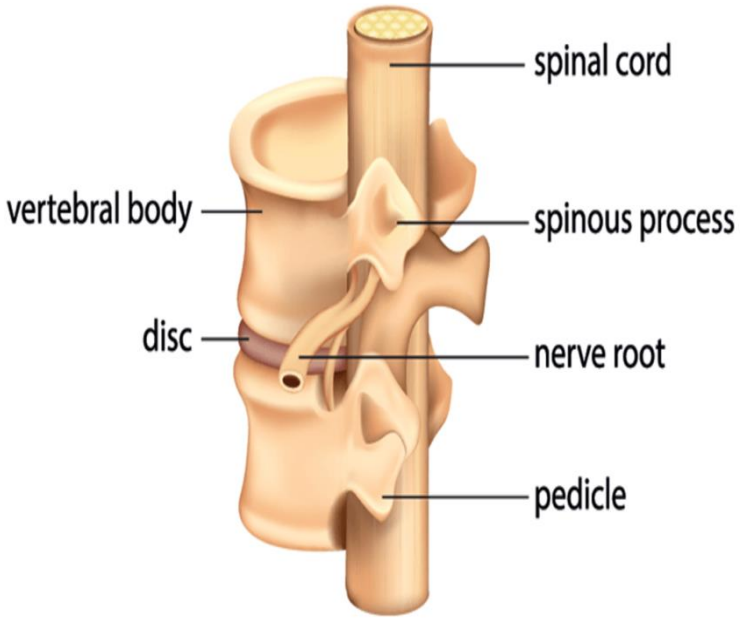


Figure 1. Vertebrae Anatomy[6]

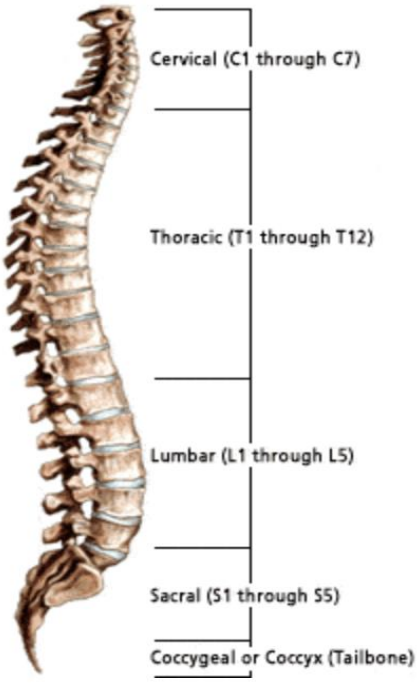


Figure 2. Vertebral Column[7]

There are many different causes of back and neck pain, making pinpoint diagnoses hard to establish. Causes of back pain may include traumatic injuries, soft tissue disorders, bulged discs, joint malalignment, vertebral stenosis, or postural problems. McKenzie[8,9] attributes the propensity for neck and back pain to our postural alignment in day to day life. Furthermore, McKenzie[8,9] stated that the majority of individuals spend most of their time in a flexed position, whether it be work or in our leisure, putting more stress on the neck and back. Back pain can be localized in a specific point, a broad region, or even send radicular symptoms down part or all of the lower extremities.[10] This pain can range from an annoyance all the way to debilitating pain;

keeping individuals from completing their activities of daily living (ADLs) such as household chores, ambulation, shopping, etc. Neck pain, similar in fashion, can be localized or radicular with symptoms traveling into the upper extremities. This can cause weakness, numbness or tingling in extremities, sharp or dull pain, aching, and can increase in intensity with certain movements.[11]

Investigating spinal pathologies from the lens of the McKenzie method and mechanical diagnosis and treatment (MDT), spinal pathologies can be placed into different categories. The three main categories are derangement, dysfunction and postural syndrome. Derangements are an internal change in the normal resting position of affected joint surfaces.[12] This category of pathology is the most common of the three syndromes seen in the population. Derangements should have a directional preference, or a direction in which changes the patients pain, and with correct loading of tissues should be able to relocate providing fast and lasting results.[12] Dysfunctions are characterized by pain caused by mechanical deformation of abnormally shortened tissue.[12] This can be caused from scar tissue, contractures, adherence, or adaptive shortening. Individuals with dysfunctions only feel pain at end ranges when shortened tissue is put under stressed or loaded. Dysfunctions are typically the least common of the three syndromes with post-surgical patients at the highest risk. The third syndrome, postural syndrome, happens when normal tissue is subjected to abnormal loading. Static load or time in certain positions is the prime factor for postural syndromes.[12] Postural syndromes usually occur in younger individuals with sedentary lifestyles who usually have localized pain.

Following the opioid crisis, conservative care for spinal pathologies have become more common with increased prevalence of physical therapy and chiropractic care. Conservative care is a great option due to the concerted effort to cut back on prescription pill usage due to increased

addiction with prolonged used of opioids. Physical therapists can utilize a wide array of exercises and techniques to treat low back pain such as manipulations, mobilizations, muscle energy techniques (MET), mechanical diagnosis treatment (MDT), pain neuroscience education (PNE), as well as stretching and strengthening. A study compared physical therapy, injections, and surgery for treatment of low back pain and total costs at the 12 month mark following back pain. The study identified physical therapy as the most economic pathway, followed by injections, followed by surgery. [13] Neck pain is treated in much of the same way with use of manipulations, mobilizations, MDT, as well as stretching and strengthening. Insurance companies are turning to conservative care first prior to authorizations for surgical interventions.[14] This has been shown to cut the overall cost of treatment for patients because it decreases the number of surgeries done by patients.[14]

Treatment of neck and low back pain with radicular symptoms in the middle aged female population was the primary focus of the current case study. The majority of treatment followed the MDT approach for neck and back pain with the use of reductive stretches followed by strengthening the core and supporting musculature. The purpose of the current case study was to discuss and review the use of conservative treatment using MDT to treat neck and low back pain, while having evaluated function and self-reported outcomes.

CHAPTER II

CASE DESCRIPTION

The patient was a 48-year-old female who had a history of low back pain and neck pain. She reported neck and back pain commencing on 8/16/19 with no explanation to the aggravation of pain. She was a homemaker and had been for the past three years. Years previously she worked at a local factory that shipped and assembled electronic parts. The patient stated having usually walked three or more times a week for 30 minutes each. Her spouse worked at a local factory and was able to assist her when not working. They lived in a single level home with two steps to enter and a railing on the right.

The patient was awakened by pain during the night, which at times limited her sleep to two to three hours. To alleviate this pain, she utilized cold packs as well as over the counter nonsteroidal anti-inflammatory drugs (NSAID). The pain which interrupted her sleep was primarily located medial to the left scapula with associated numbness and tingling in her left arm. Numbness and tingling would increased when she raised her arm greater than 90 degrees of shoulder flexion. Due to the pain, and numbness and tingling in her left arm when raised to approximately 90 degrees, driving was affected secondary to having to use only her right arm on the steering wheel.

She reported having been treated by a chiropractor decreased her pain acutely; however, only short acting results with minimal relief were noted thereafter. The patient decided to discontinue chiropractic care secondary to plateauing of symptoms. Activities which increased her symptoms include standing with symptom relief offered via prone lying. She reported a

history of smoking, however, is currently trying to quit. The patient stated having had difficulty lifting grocery bags with her left arm and completing house tasks due to pain. The patient also utilized a pain management clinic for pain injections for her low back pain and expressed concern that she might need to go back to them. Her main method to help alleviate back and neck pain was to utilize ice and a home transcutaneous electrical nerve stimulation (TENS) unit as needed. She reported that the ice she used at home only helped while it was cold and she would repeatedly change the ice packs throughout the night. The home TENS unit would sometimes relieve the muscle pains in her back for a period of time and other times the pain would return after the TENS unit was taken off. The patient's pain level at the time of visit was reported as an eight on the 0-10 numeric pain scale.[15]

The patient was referred to care from her primary care physician to be evaluated and treated by a physical therapist for her neck and low back pain. The patient's chief complaint at the time of her initial visit was neck pain with numbness and tingling into her left upper extremity that kept her from sleeping at night. No imaging had taken place prior to her initial visit to physical therapy.

Examination, Evaluation, and Diagnosis

The physical therapy evaluation was based on the McKenzie method of mechanical diagnosis and treatment (MDT).[16] On initial evaluation, the patient presented to physical therapy with marked forward head posture as well as forward, rounded shoulders with increased kyphosis in the thoracic spine. Patient also presented with a slight right cervical lateral shift to the right. She appeared to be very cautious with cervical and trunk motion without segmental motion when surveying the room or turning to ambulate.

The patient had obvious cervical range of motion loss. Motion loss was categorized as nil, minimal, moderate, or marked depending on the percentage to which she was limited. Restricted cervical spine motion was as follows; marked loss noted during cervical extension and left rotation, moderate loss during cervical flexion, and minimal loss during right cervical rotation. Lumbar range of motion was not formally measured, but approximately screened following the same criteria for movement loss as cervical motion. Lumbar movement was also assessed with minimal loss noted during flexion and left side gliding, moderate loss during extension, and nil loss during right side glide.

Following range of motion testing, repeated movements were tested for cervical and lumbar motions starting in the sagittal plane. Repeated cervical flexion movement caused no change while retraction and extension decreased symptoms and improved pain. For lumbar repeated movement testing, trunk flexion increased and worsened pain while extension decreased and improved pain. Tables 1 and 2 have the recorded cervical and lumbar movement loss respectively.

Table 1. Cervical Movement Loss

	Extension	Flexion	Rotation Left	Rotation Right
Degree of motion loss	Marked loss – only able to achieve neutral	Moderate loss – 50 degrees	Marked Loss– 27 degrees	Minimal to moderate loss- 55 degrees

Reference norms 80-90 degrees flexion, 70 degrees extension, rotation up to 90 degrees[17]
*80 degrees and above considered nil loss for rotation.

Table 2. Lumbar Movement Loss

	Extension	Flexion	Side glide Right	Side glide Left
Degree of motion loss	Moderate loss	Minimal loss	Nil loss	Minimal loss

Palpation was used to assess the cervical spine as well as associated musculature of the shoulder girdle and surrounding paraspinal region. Tenderness and tightness were noted along the left upper trapezius greater than the right. In addition, a notable trigger point located medial to the left scapulae. This point was described as a source of discomfort and pain by the patient. Mizutamari et al[18] investigated pain referral with radiculopathy and corresponded scapular pain with nerve root involvement in radiculopathy and suggested medial scapular having been correlated with C7, C8 nerve roots.

A self reported neck disability index (NDI) was completed, which measured the patients cervical pain. According to Vernon[19], the NDI has been shown to be one of the most widely used and validated measures for self-reported disability in patients with neck pain. The patient scored a 30 out of 50. This is score is converted into a 60% disability rating. The minimal detectable change with a 90% confidence interval is a change of five points or 10%.[20] According to the scale it ranked the patient within the severe impairment category.[20] Being severely impaired with neck disability may play a significant role in day to day activities for the patient. Functional activities, such as scanning a room or looking at your surroundings while driving were limited.

Few special tests were completed on this patient. Neural tension tests for radial, ulnar, and median nerves of the upper extremities were completed, which identified adverse neurodynamics for the patient's left upper extremity. Movement loss and preferential movement patterns were assessed during the examination and were a main source for the

evaluation and diagnosis. The assessment of available information lead to a diagnosis of cervical and lumbar derangements,[16] which responded to mechanical extension movements. Specifically, for the cervical region, the diagnosis was a left posterior lateral derangement which resulted in the left sided radicular symptoms into the upper extremity. Derangements most likely applied pressure on the nerve roots causing the peripheralization of symptoms. The diagnosis correlated with the movement restrictions and pain patterns since symptoms increased with flexion and decreased with extension movements. These would be considered classical responses for a derangement when following the MDT method for evaluation. Derangement was distinguished from the other main McKenzie diagnosis of dysfunction and postural syndromes.[12] A dysfunction was ruled out due to the fact that the patient had pain when not at end range and dysfunctions are adaptive shortening with pain at end ranges.[12] Postural syndrome was also ruled out due to motion losses not normally being present and pain being reproduced with sustained postures.[12] The patient presented with abnormal posture, which may have been due to the derangements offsetting her articular surfaces.

Plan of Care and Prognosis:

The patient was seen three times per week for four weeks. Following a progress note three more weeks of therapy, with 20 total therapy visits. The patient's treatments included postural education, body mechanics, exercises, manual therapy techniques, modalities as needed, movement preferential patterns, dry needling, and myofascial release. The patient's primary goal was to become pain free and be able to sleep through the night. The following short and long term goals were created with the patient to improve function and return her to her prior level of function.

Short term goals were as follows:

Following physical therapy intervention patient will be able to:

1. Correct improper posture to decrease stress on cervical and lumbar spine
2. Decrease pain to allow for improved sleep for better quality of life
3. Patient will become independent with home exercise program to help address their impairment and functional deficits

To be met in three weeks.

Long term goals were as follows:

Following physical therapy intervention patient will be able to:

1. Decrease NDI from 30/50 to 14/50 to show improved function
2. Decrease pain level by 85% or more in neck and 70% or more in low back to allow for completion of functional activities independently and without need for compensatory techniques
3. Eliminate radicular symptoms into extremities to allow for driving without pain

To be met in 6 weeks.

The patient's prognosis was determined to be good due to her positive potentials for rehabilitation. According to Cleland et al[21], a four variable model consisting of age below 54, pain does not worsening with flexion, the dominant arm not being effected, and taking a multi-model treatment were all indicators of subjects who were most likely to achieve success with physical therapy. Multi-model treatment needed to consist of manual therapy, cervical traction, and deep neck flexor muscle strengthening.[21] The patient met three of the four criteria, the only one not met was that traction was not used during the treatment of this patient. Cleland et al[21] when three out of four variables were met the likelihood of posttest success was 85%. Other

factors effecting the prognosis was the patient having been an active participant in physical therapy and having been dedicated to working and learning from physical therapy sessions. One factor which may have negatively impacted her physical therapy prognosis was her current smoking status.

CHAPTER III

INTERVENTION

The patient was initially seen three times per week with the average length of each visit being 45 minutes. The first week's primary focus was to control and mitigate the patient's symptoms being caused by her cervical and lumbar derangements. Therapeutic PNE was given to help provide the patient with knowledge and context of pain and how it relates to her individual case. Pain neuroscience education consists of describing in detail the neurobiology and neurophysiology being pain and pain processing by the central nervous system.[22] Part of the education was explaining her physical therapy diagnosis of derangements and how those derangements were pressing on nerves which in turn creates the radicular symptoms down her left arm. Education was provided regarding nerves and their need for blood, space, and movement, and when limited in any of these areas signals that are interpreted by our brain as pain, may be produced. More education was given regarding peripheralization, or symptoms going farther in the extremities, and centralization, pain moving more proximal in the extremities. She learned that as pain moved more centrally it could become more intense and that this was actually a good thing even though it was more painful than when symptoms were more peripherally located. Louw et al[23] completed a systematic review regarding the efficacy of PNE on musculoskeletal pain and found strong evidence which supported the use of PNE for musculoskeletal disorders. The evidence found that PNE reduced pain ratings, limited knowledge of pain, disability, pain catastrophizing, fear-avoidance, as well as unhealthy attitudes

and behaviors regarding pain.[23] The patient responded well to this intervention by becoming more confident as to why she was having her pain.

Along with the PNE, MDT was utilized with the extension movement principle. Exercises that were given included cervical retractions, retractions plus extension, and sustained cervical extensions. Regarding the lumbar derangement, the patient was initially provided prone press-ups for her reductive extension exercise. An example of the home exercise program (HEP) issued at the initial evaluation is attached below.[24] (see Appendix 1) The prescribed exercises were chosen to help reduce the patient's derangement, thus relieving her symptoms and pain. Following exercise completion, the patient's cervical range of motion increased and she reported less numbness and tingling into her left arm. As these exercises became easier and more tolerable, overpressure was added by the physical therapist to increase end-range of motion effects. The patient responded well to increased pressure, further reducing her symptoms. It had been shown that a directional preference and responsiveness to directional preference are predictive factors for neck pain with or without radiculopathy. It had also been shown that patient compliance with directional preference exercises is associated with positive patient responsiveness to conservative care.[25]

Therapy time was also spent on postural awareness for the patient to reduce time spent in forward head, rounded shoulders, excessive kyphotic, and reduced lordotic posture. Postural exercises were provided to place the cervical and lumbar spine in better biomechanical alignment and reduce stress on associated structures. After several sessions and queing the patient could correct poor posture by herself.

While radicular symptoms in both the patients left arm and leg decreased, her low back and medial scapular symptoms increased. This increase in pain was attributed to centralization of

the patients pain. Strengthening exercises were introduced as tolerated and strengthening focused on core and hip musculature, deep neck flexor activation with use of biofeedback bladder, and isotonic cervical flexion, bilateral side bending, and extension. In addition upper extremity nerve glides were utilized to improve neural tissue movement and inherent blood supply to improve the patients adverse neurodynamics.

Radicular symptoms continued to decrease mid-way through the patients plan of care. She complained of intermittent left arm symptoms less intensity as previously noted. She also reported no radicular symptoms into her right lower extremity with only minimal low back pain. However, the pain medial to her left scapular area had increased significantly causing problems with sleep. In conjunction with her extension exercises and base level strengthening, myofascial release with Graston tools were applied to the patients trigger point areas and were reported to provide relief post treatment. When pain limited the patients ability to perform strengthening exercises, electrical stimulation and ice were applied as needed to break the pain, spasm, pain cycle when her pain was limiting her ability to perform strengthening exercises. Limitations were still present within the cervical spine in range of motion, as well as strength within neck musculature. The primary limited movement was left cervical rotation due to pain. Using Mulligans theory of positional faults, it was found that with the use of sustained natural apophyseal glides (SNAGs) the patient was able to achieve increased cervical rotation without pain.[26] This aligned with the "PILL" green light of no **P**ain, **I**mmediate relief, and **L**ong **L**asting results,[26] therefore, rotational SNAGs were implemented into the exercise program.

As physical therapy approached the end of the patient's plan of care, mobility and strengthening exercise progression continued. Physical therapy was able to work on peak strengthening exercises to maintain the gains in range of motion as well as posture. The mobility

exercises were focused on the cervical spine with retraction plus extension, lateral flexion, and rotation. All exercises were completed with physical therapy overpressure. In addition, dry needling was implemented to release trigger points and relieve painful areas medial to the left scapula. The dry needling was tolerated well and provided lasting results for the patient in terms of her pain ratings. Strengthening exercises continued to be progressed altering of resistance. Further exercises completed at this stage included bridging with alternating leg extension, bird dog, 30 repetitions of four way cervical isotonics, and continued deep neck flexor activations with biofeedback. The goal of the exercises were to increase the endurance and strength of supporting spine musculature in order to maintain corrected posture and decrease the amount of stress being placed upon the spine and associated intervertebral discs. The patient overall responded well to physical therapy treatement only having a couple negative responses where treatment flared up her symptoms causing treatment to shift towards decreasing symptoms. This tolerance to treatments allowed the patient to have positive outcomes from physical therapy.

CHAPTER IV

OUTCOMES

The overall outcomes for this patient were very good because of her increase in ROM and significant decrease in pain. The patient was treated for 20 sessions of physical therapy and was able to meet all of her physical therapy goals. Both objective and subjective outcome measures were used to interpret the benefits the patient received from physical therapy. The objective measures used in this case were the neck disability index, cervical and lumbar range of motion, and neural tension testing. Subjective measures evaluated at were perceived pain rating, presence of radicular symptoms, and perceived overall recovery.

During the initial evaluation the patient scored a 30/50 on the NDI ranking in the severe impairment category. At the time of discharge her score on the NDI was a 10/50 improving to the mild impairment category, a 20-point improvement. The minimal clinical important difference (MCID) for patients with radicular symptomsn was 8.5 on the NDI.[27] This showed a large change in the patient's functional improvement of her cervical spine. In addition, the patient reported having been able to complete ADLs with much greater ease compared to initial visit.

Range of motion reassessment revealed normalized cervical range of motion except for left rotation, which was 77 degrees categorized a minimal loss. This minimal loss for left rotation gained 50 degrees of motion from initial evaluation, which was 27 degrees of rotation. Right rotation improved from 55 degrees to 82 degrees. Neck extension also increased from being only able to reach neutral to having nil movement loss. Finally, the patient was able to increase neck

flexion from 50 degrees to within normal limits as evidenced by her having touched her chin to her chest. The above findings illustrated significant gains to her cervical range of motion. These gains assisted in her ability to complete ADL's such as driving safely by being able to check blind spots. Her lumbar range of motion also improved from the initial visit. The patient went from moderate loss of lumbar extension to nil loss and was also able to normalize the minimal losses in flexion and left side glide. Tables 3 and 4 compare initial to discharge movement loss for the cervical and lumbar spine regions respectively.

Table 3. Initial vs Discharge Cervical Movement Loss

	Extension	Flexion	Rotation Right	Left Rotation
Initial motion loss	Marked loss only able to achieve neutral	Moderate loss 50 degrees	Marked loss 27 degrees	Minimal to moderate loss 55 degrees
Discharge motion loss	Nil loss	Nill loss	Minimal loss 77 degrees	Nil loss 82 degrees

Table 4. Initial vs Discharge Lumbar Movement Loss

	Extension	Flexion	Side glide right	Side glide left
Initial motion loss	Moderate loss	Minimal loss	Nil loss	Minimal loss
Discharge motion loss	Nil loss	Nil loss	Nil loss	Nil loss

Neural tension testing of the upper extremities was limited at the time of evaluation with intense pain caused by the ulnar tension test and a less intense pain also caused by the median and radial nerve tension tests. Upon discharge the neural tension tests did not provoke symptoms, however they were still reported as uncomfortable by the patient with her left upper extremity

more symptomatic than her right. Overall, through her episode of physical therapy care, the patient was able to increase her tolerance to upper extremity neural tension tests.

Subjectively, the patient reported having felt 85-90% improvement. She felt confident in her ability to control her symptoms with the exercises that she learned while at therapy. This also correlated with her pain scale rating on a scale from 0-10. Her pain rating at discharge was a 1-2/10 on the pain scale for neck while she reported 0/10 back pain. Finally at discharge the patient reported no radicular symptoms into her extremities and stated she had not experienced radicular sumptoms for 2-weeks prior.

Overall, the patient tolerated physical therapy interventions well. There were two instances when physical therapy flared up her pain levels and caused muscle spasms in her back. Following those episodes, the exercise intensity was decreased to within tolerable ranges for the patient. No other adverse events happened with physical therapy. The patient stated she was very happy with the treatment and care she received while at physical therapy. The facet of therapy she liked most was that it provided her with a way to be invested in her own care and gave her the tools she needed help to manage her symptoms if a future flare-up should occur.

CHAPTER V

DISCUSSION

During the duration of conservative therapy for the patient's neck and back pain with radicular symptoms, she made considerable gains in all of her deficient areas including the following. Neck range of motion, lumbar range of motion, pain ratings, functional scales, and overall function. The interventions utilized assisted the patient in meeting all of her stated goals and allowed her to return to her hobbies, complete on ADLs without pain or compensation, and increase her confidence in movement.

Cervical range of motion improved with the use of MDT reductive extension exercises with physical therapist overpressure as well as the use of SNAGs and patient mobilization techniques. All were within normal limits except for left rotation. The greatest increase in range of motion was noted during left rotation which gained 50 degrees over the course of therapy. This assisted with the completion of functional tasks such as being able to look at the driver's side blind spot while maneuvering a vehicle. As noted by Bible et al[28], cervical range of motion required for ADLs such as backing up a car requires 92% of full rotational range of motion. To document this improvement and illustrate the effect of treatment, physical therapy completed cervical rotation measurements each patient encounter. The final cervical spine rotation measurement equaled 77 degress for left rotation giving more than enough range of motion to complete driving requirements.

Lumbar range of motion was normalized in all planes of motion with no movement lost present at the time of discharge. This was completed by utilizing reductive stretches with and

without physical therapist overpressure along with strengthening exercises for core and gluteal musculature. The increase in range of motion and strength allowed her to complete ADLs without need for compensation.

A significant aspect of the patient's recovery was her commitment to following the HEP and willingness to understand and participate in the physical therapy sessions. She was eager to learn the different techniques utilized and the methodology behind the decision to implement the exercises and modalities. This helped to increase the patient's understanding of her pathologies and learn the exercises needed to treat and manage her pain. The patient stated having felt as though she had to the tools and knowledge by the end of therapy to manage her neck and back pain if symptoms should return.

Limitations of this study included the patient having not been seen by the same therapist for every visit. This could have created inter-rater differences between therapists by differing forces of physical therapy overpressure as well as technique of interventions. Inter-rater differences may have also affected therapeutic assessments, such as ROM measurements..

Future research focusing on what interventions work best with MDT and when to utilize them. Low back and neck pain are very prevalent and often hard to treat, responding differently. Finding the efficacy of interventions with the MDT approach could increase a patients prognosis from low back or neck pain. Specifically traction along with MDT would be interesting to see. Traction with MDT approach showed no research articles in a search in pubmed. Studies searching the best intervention mix for treating spinal pathologies are of need.

This case study supported the use of MDT for treatment of neck and back pain. It has already been shown in a multitude of studies to be used in successful in the use of conservative treatment for such pathologies. The primary treatment for the patient's cervical and lumbar

derangements was reductive exercises followed with strengthening and supplemental techniques such as myofascial release, dry needling, and e-stim as needed for pain relief.

REFLECTIVE PRACTICE

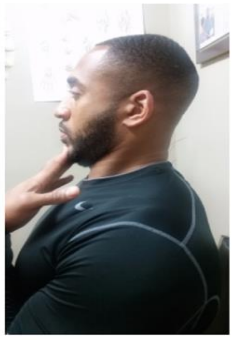
When treating a patient with neck and back pain it is important to know the signs and symptoms that the patient is experiencing. This coupled with the subjective history of the patient will help to differentiate between different pathologies of the spine.

Changes to the plan of care, in retrospect, would have been to include cervical traction trials. A prognostic article identified multimodal treatment including strengthening of the deep neck flexors, manual therapy, and traction provided a better prognosis for those patients.[21] The addition of traction could have enhanced physical therapy sessions and the speed of overall improvement for the patient. Physical therapy could have also provided resources on cessation of smoking for the patient. She had mentioned was in the process of trying to quit but didn't receive any information or resources from physical therapy.

The patient was seen for a total of 20 physical therapy visits with an average of approximately four units charged per session. The main units being for therapeutic exercise, manual therapy, neuro-reeducation, and e-stim unattended. Total cost was approximated to be $2,172.84 with $434.58 out of pocket for the patient. Having analyzed the cost benefits of therapy, it appeared the patient was able to move much more freely and had a better quality of life than prior to therapy. She stated therapy was 100% worth it and she particularly liked how she got to be an active participant in all of the treatment and was given exercises and techniques to utilize at home to work on pain, posture, range of motion restrictions, and strength. Physical therapy appeared to be worth the cost of the treatments from the perspective of the patient.

This case helped influence physical therapy practice as well as professional development in many positive ways. It increased the knowledge of both neck and back pain as well as provided the tools needed to help successfully treat both the stated pathologies. The principles of MDT were able to be used confidently in all areas in order to recognize and treat specific areas of neck and back pain, which will assist in all treatment of future patients with spine pathologies. It also provided an opportunity to broaden research skills which will continue to be utilized in all future patients treated. Increased confidence was gained regarding finding relevant material to help treat patients with multiple pathologies and will allow continual high level of patient care to be delivered. This experience enhanced clinician growth and provided tools which will allow continual improvement in patient care.

APPENDIX: Home Exercise Program



Cervical Retraction + OP

Sit upright in a supportive chair and tuck your chin backwards. Add overpressure until you get to the end of movement.

Repeat 10 Times	Hold 1 Second
Complete 1 Set	Perform 4 Times a Day

Cervical Retraction/Extension

In sitting, begin with head in neutral position. Move head backwards without tucking chin. Keeping the retracted position, slowly extend neck as far back as possible. Keeping retraction, return from extension and relax.

Repeat 10 Times	Hold 1 Second
Complete 1 Set	Perform 4 Times a Day

Sustained Cervical Extension

Lay on your stomach, propped up on elbows. Bring hands into prayer position, place the tips of your fingers under your chin and look up toward the ceiling as far as possible.

Hold 1 Minute
Perform 4 Times a Day

Prone Pressups

Lay on stomach. Place hands on floor/table under shoulders. Press up by straightening arms. Keep back and glutes relaxed during entire exercise. Repeat.

Repeat 10 Times	Hold 1 Second
Complete 1 Set	Perform 4 Times a Day

REFERENCES

1. Fiorenzi, R., 2020. *23 Back Pain Statistics And Facts That Will Suprise You - Start Standing*. [online] Start Standing. Available at: <https://www.startstanding.org/back-pain-statistics-and-facts/#> [Accessed 18 June 2020].

2. Ferrari, Robert. Russel, Anthony S. Neck Pain. In: *Best Practice and Research Clinical Rheumatology*. Elsevier. February 2003

3. Leijon O, Wahlström J, Mulder M. Prevalence of self-reported neck-shoulder-arm pain and concurrent low back pain or psychological distress: time-trends in a general population, 1990-2006. *Spine (Phila Pa 1976)*. 2009;34(17):1863-1868. doi:10.1097/BRS.0b013e3181ab3397

4. InformedHealth.org [Internet]. Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006-. How does the spine work? 2009 Feb 14 [Updated 2019 Feb 14].Available from: https://www.ncbi.nlm.nih.gov/books/NBK279468/

5. Frey, G. and Schmidt, K., 2020. *Understanding Spinal Anatomy: Overview Of The Spine*. [online] Coloradospineinstitute.com. Available at: <https://www.coloradospineinstitute.com/education/anatomy/spine-overview/> [Accessed 23 June 2020].

6. Smith, A., 2020. *Misalignment In The Spine - Subluxations*. [online] C2hwellness.com. Available at: <https://www.c2hwellness.com/misalignment-in-the-spine-subluxations> [Accessed 27 June 2020].

7. Princeton Brain, Spine, and Sports Medicine. 2020. *Spine Anatomy | Princeton Brain, Spine, And Sports Medicine*. [online] Available at: <https://www.princetonbrainandspine.com/resources/learning-center/spine-anatomy/> [Accessed 27 June 2020].

8. McKenzie R. *Treat Your Own Back*. Paraparaumu, N.Z.: McKenzie Global Ltd; 2018.

9. McKenzie R. *Treat Your Own Neck*. Paraparaumu, Kapiti Coast, Wellington, New Zealand: McKenzie Global Ltd; 2018.

10. Mayo Clinic. 2020. *Back Pain - Symptoms And Causes*. [online] Available at: <https://www.mayoclinic.org/diseases-conditions/back-pain/symptoms-causes/syc-20369906> [Accessed 28 June 2020].

11. John Hopkins Medicine. 2020. *Radiculopathy*. [online] Available at: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/radiculopathy> [Accessed 28 June 2020].

12. Kevin, O. The Mckenzie Method: Mechanical Diagnosis and Treatment PT 426 – Manual Therapy I. Lectured presentation at: University of North Dakota; April 2019; Grand Forks, ND.

13. Aptqi.com. 2020. [online] Available at: <http://www.aptqi.com/Resources/documents/APTQI-Complete-Study-Initial-Treatment-Intervention-Lumbago-May-2017.pdf> [Accessed 4 July 2020].

14. Green, J., 2020. *Health Insurers Look For Ways To Cut Costs For Back Surgery*. [online] Modern Healthcare. Available at: <https://www.modernhealthcare.com/article/20180827/NEWS/180829918/health-insurers-look-for-ways-to-cut-costs-for-back-surgery> [Accessed 4 July 2020].

15. Shirley Ryan AbilityLab. 2020. *Numeric Pain Rating Scale*. [online] Available at: <https://www.sralab.org/rehabilitation-measures/numeric-pain-rating-scale> [Accessed 6 July 2020].

16. McKenzie, Robin A. *The Cervical and Thoracic Spine: Mechanical Diagnosis & Therapy, 2 Vol Set (808-2).* 2nd Edition. 2006.

17. Swartz EE, Floyd RT, Cendoma M. Cervical spine functional anatomy and the biomechanics of injury due to compressive loading. *J Athl Train*. 2005;40(3):155-161.

18. Mizutamari M, Sei A, Tokiyoshi A, et al. Corresponding scapular pain with the nerve root involved in cervical radiculopathy. *J Orthop Surg (Hong Kong)*. 2010;18(3):356-360. doi:10.1177/230949901001800320

19. Vernon H. The Neck Disability Index: state-of-the-art, 1991-2008. *J Manipulative Physiol Ther*. 2008;31(7):491-502. doi:10.1016/j.jmpt.2008.08.006

20. Physiopedia. 2020. *Neck Disability Index*. [online] Available at: <https://www.physio-pedia.com/Neck_Disability_Index> [Accessed 20 July 2020].

21. Joshua A Cleland, Julie M Fritz, Julie M Whitman, Rachel Heath, Predictors of Short-Term Outcome in People With a Clinical Diagnosis of Cervical Radiculopathy, *Physical Therapy*, Volume 87, Issue 12, 1 December 2007, Pages 1619–1632, https://doi.org/10.2522/ptj.20060287

22. Physiopedia. 2020. *Pain Neuroscience Education (PNE)*. [online] Available at: <https://www.physiopedia.com/Pain_Neuroscience_Education_(PNE)#:~:text=Pain%20neuroscience%20education%20(PNE)%2C,processing%20by%20the%20nervous%20system.> [Accessed 7 July 2020].

23. Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiother Theory Pract*. 2016;32(5):332-355. doi:10.1080/09593985.2016.1194646

24. Ryan, R., 2020. *Hep2go - Exercise Editor*. [online] Hep2go.com. Available at: <https://www.hep2go.com/print_card.php?userRef=gcidfkgmfake> [Accessed 6 July 2020].

25. Holmes B, Brazauskas R, Cassidy LD, Wiegand RA. Factors in Patient Responsiveness to Directional Preference-Matched Treatment of Neck Pain With or Without Upper Extremity Radiation. *J Patient Cent Res Rev*. 2017;4(2):60-68. Published 2017 Apr 25. doi:10.17294/2330-0698.1271

26. Physiopedia. 2020. *Mulligan Concept*. [online] Available at: <https://www.physio-pedia.com/Mulligan_Concept> [Accessed 20 July 2020].

27. Ian A. Young PT, DSc, James Dunning PT, DPT, Raymond Butts PT, PhD, Firas Mourad PT, DPT & Joshua A. Cleland PT, PhD (2019) Reliability, construct validity, and responsiveness of the neck disability index and numeric pain rating scale in patients with mechanical neck pain without upper extremity symptoms, Physiotherapy Theory and Practice, 35:12, 1328-1335, DOI: 10.1080/09593985.2018.1471763

28. Bible JE, Biswas D, Miller CP, Whang PG, Grauer JN. Normal functional range of motion of the cervical spine during 15 activities of daily living. *J Spinal Disord Tech*. 2010;23(1):15-21. doi:10.1097/BSD.0b013e3181981632