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Outpatient Physical Therapy Management of a Patient with Chronic Low Back Pain and Lumbar Disc Herniation: A Case Study

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OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF A PATIENT WITH CHRONIC LOW BACK PAIN AND LUMBAR DISC HERNIATION: A CASE STUDY

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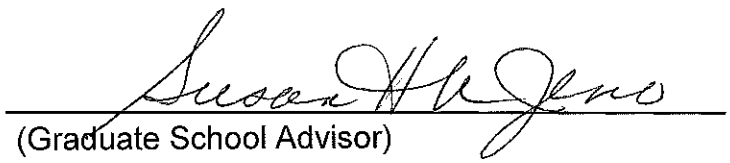

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ABSTRACT

Background and Purpose: Low back pain is a condition that affects 70% of the adult population between 18 and 65, as well as the young and elderly. Many people that have low back pain often have recurrent pain episodes. This negatively affects functional activities of daily living and living with chronic pain can take a psychological toll on the individual. The anatomy of the low back and the surrounding musculature play a pivotal role in standing and sitting tasks. The role of the physical therapist in treating an individual with low back pain is to identify the nature of the pain and what intervention the patient will best respond to in order to enhance their function. The physical therapist must rule in and out diagnoses through a thorough examination and evaluate the patient based on the findings. Any outcome measures utilized should assess functional tasks as well as subjective pain ratings and improvements in strength or range of motion. The purpose of this case study is to describe the physical therapy diagnosis and treatment of a 17 year old patient diagnosed with chronic low back pain.

Case Description: The present case study describes a 17 year old female patient during an episode of chronic low back pain. The high school athlete was limited in social and athletic activities due to the chronic low back pain. The patient had previous episodes of low back pain that resolved without physical therapy treatment. The initial examination and evaluation as well as the subsequent interventions are listed in the present case study. The plan of care for this patient was described in detail and included the prognosis and functional outcomes following the treatment plan.

Intervention: Interventions include Medx treatment sessions on a biweekly basis. Other interventions include therapeutic exercises as well as neuromuscular retraining exercises.

Outcomes: The specific outcome measure used in the present study was the Focus On Therapeutic Outcomes. The patient made improvements in pain level as well as function. A primary goal of the patient was to be able to return to hockey with minimal pain levels. She was able to do so by the end of the 8 week rehabilitation period.

Discussion: The outcome of the present study was consistent with the current literature. The combination of progressive resistance exercises along with neuromuscular coordination techniques improved her function in recreational activities as well as activities of daily living. Pain was also decreased over the course of treatment. This may have been due to the patient's improved ability to contract her transverse abdominis during functional movements. Limitations of the current study were also discussed along with future study implications.

CHAPTER I

BACKGROUND AND PURPOSE

According to McIntosh et al.[1], low back pain is a condition suffered by 70% of adults. It is estimated that 85% of the afflicted are then considered to have an unknown or "non-specific" etiology. The condition itself is defined as pain, tension, or stiffness that is located between the inferior gluteal muscles and the ribs, and can be with or without radicular symptoms.[1] It is then further classified as chronic if the episode lasts for 3 months or more.[2] This definition excludes back pain that results from a comorbidity such as scoliosis or back pain resulting from disc herniations.[2] Defined by this criteria, chronic low back pain is not specific to only an adult population; it is also a prevalent condition in many young adults as well as the elderly population. [1,2]

The spine is composed of a combination of structures including bones, ligaments, tendons, muscles, spinal cord, intervertebral discs, and nerve roots.[3] The lower back has 5 bony structures called vertebrae that are labeled L1-L5.[3] These structures support and protect the spinal cord and the involved nerve roots. Paravertebral musculature play a crucial role in lumbar vertebrae stability as well as mobility. These muscles attach to the spine on different parts of the vertebrae such as the spinous process and transverse process. Some of them also connect to the pelvis.[3] Abnormal shortening of these muscles can lead to pain and possible disc derangements. [3] The intervertebral discs lie in between the vertebrae and are composed of an inner layer

jelly like substance called the nucleus pulposus and a fibrous outer layer called the annulus fibrosus. [3] Nerve roots emerge from the spinal cord through the intervertebral foramen and innervate different areas of the body.. Each nerve root supplies an area of the skin called a dermatome which can be assessed in a sensory examination.[3] If sensation in the area is diminished, a clinician is more able to pinpoint the compromised nerve root. The most commonly affected structures are usually the discs in between the vertebrae or a joint dysfunction in between the vertebrae.[1,2,3]

Low back pain can originate from a variety of causes such as acute trauma, sustained abnormal posture, or repeated motions (specifically flexion). Low back pain in young individuals between the ages of 8 and 15 is often a result of a fracture in the part of the spine called the pars interarticularis.[3] If the fracture is unstable the condition is then labeled as spondylolisthesis graded on the amount of movement in the vertebrae. [4] Low back pain can also be caused from sacral iliac (SI) dysfunction.[5] Abnormal movement between the sacrum and the ilium may cause the lumbar region to compensate and make up for the lack of mobility in the SI joint. [5] A set of 5 provocation tests are used to determine whether the patient has pain originating from the SI. If 3 or more of these tests are positive, then a diagnosis of SI pain is given.

In cases of acute trauma or heavy loading, a nerve or nerve root can become "pinched" by a portion of the disc that has protruded out of the vertebral alignment.[3] This herniation of the disc can cause radicular pain into the hips or lower extremities.[3] Degeneration of the disc itself is called degenerative disc disease and can result in instability of the spine and also be a source of pain.[3] Acute low back pain can be caused by a variety of physical triggers such as lifting heavy objects, participating in vigorous

physical activity, and slipping/falling.[4] Any of these activities can lead to a derangement of the disc and subsequent low back pain.[6] A sustained flexed posture in the lumbar spine that often happens with prolonged periods of sitting can also lead to derangements of intervertebral discs.[6] Occupations that require many repetitions of bending at the waist often result in disc derangements. [6]

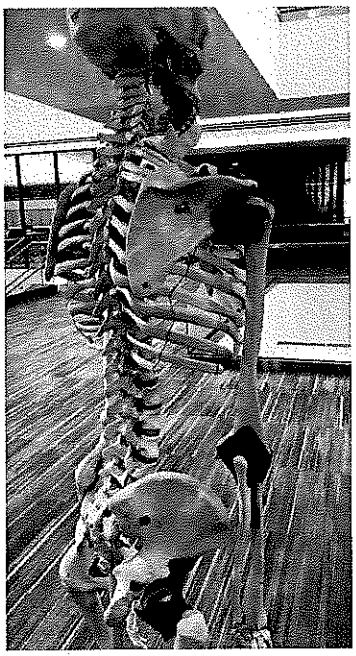

Figure 1. An anatomical model of the human spine.

There are many diagnostic tests that help clinicians determine what is contributing to a patient's low back pain. Diagnostic procedures such as the Straight Leg Raise and the Slump Test are used to rule in or out the likelihood or nerve root pathology.[6] The straight leg raise is a passive test performed by the clinician with the patient in supine. The patient's leg is positioned in adduction and internal rotation before the clinician lifts their leg in a position of full knee extension. The test is terminated when the patient verbalizes tightness or pain in the back or leg.[6] The slump test is performed with the patient in a

seated position. The first step for the patient to slump forward with their thoracic and lumbar spine. If no pain is present, then the patient is asked to put their hands behind their back and bend their chin towards their chest. Finally, the patient will actively extend one knee and is asked to verbalize whether their symptoms are replicated. Both of these tests are considered positive if the patients symptoms are replicated at any point during the test.[6] A set of 5 provocative tests for the SI joint include Gapping (Distraction), Thigh Thrust, Compression, Gaenslen's, and Sacral Thrust.[5] These tests are meant to determine if the SI joint is the source of pain.[5] The Gapping or Distraction Test is performed with the patient in supine and force is applied outward on both sides of the hips by the clinician. The Thigh Thrust is performed with patient in supine and one leg bent to 90 degrees of hip flexion while the clinician provides downward pressure. A Compression test is performed with the patient in sidelying and the clinician providing a downward force on the patient's hip. Gaenslen's test is performed with the patient in supine and one leg held by the patient in a position of maximal hip flexion. The clinician provides force into hip flexion and extension of both legs. Finally, the Sacral Thrust is performed with the patient in prone and pressure applied at a high velocity downwardly over the sacrum. All of these tests are considered positive if the patient's symptoms are replicated in the SI joint region. Often, clinicians suspect SI pathology if 3 or more of the 5 tests are positive.[5]

Psychological factors can also play a role in causing low back pain. Fatigue, stress, and alcohol can all contribute to episodes of low back pain.[7] Conversely, low back pain can lead to higher levels of depression and anxiety.[1,7] Psychological benefits of

exercise may include a short-term alleviation of depression.[1] Exercise has been shown to be effective in managing mood in certain individuals.[1]

While some episodes of non-specific low back pain have what appears to be a favorable prognosis without subsequent episodes of low back pain, the cases are often recurrent with consecutive episodes varying in severity and duration.[2] There are a variety of interventions that can be used to treat low back pain such as exercise, manual therapy, massage therapy, and heat modalities. In a systematic review by Inani et al [8], exercise has been found to be an effective form of treatment in patients presenting to clinicians with chronic, non-specific low back pain at their first follow up period after treatment with an improvement of 13.3 points of a 100 point scale for pain, as well a 6.9 point improvement for function (out of a 100 point scale). A score of 100 for pain is the most pain-free score possible and a score of 100 for function indicates optimal functioning. Exercise as an intervention may improve function by increasing muscle flexibility, back strength, and cardiorespiratory fitness.[1,4] A study by Searle et al[9] showed that exercise may reduce pain for a time period of up to 1 hour after performing aerobic exercise in otherwise healthy patients.

Isolating the lumbar extensor muscles in an effort to improve low back pain and function has been found to be effective in treating a 20 yr. old female college basketball player with chronic low back pain.[10] A MedX machine was used in this case to allow the isolation of the lumbar musculature by fixing the pelvis in a stable position while the patient performed isotonic contractions of the low back muscles.[10] Limiting pelvic

movement allows the lumbar muscles to contract in isolation. The stabilization also prevents any unwanted movements that could potentially hurt the client.[10] After 10

weeks of MedX and progressive resistance training, the college basketball player showed a 368% increase in lumbar strength, 41 % increase in sagittal plane lumbar ROM as well as a 41% decrease in pain level.[6]

Figure 2. A person performing a bird dog exercise to stabilize low back.

Other interventions have been found to be effective in treating non-specific low back pain as well. Namnagani et al.[2] compared manual therapy vs McKenzie method in treating low back pain in adults. A follow up was conducted after a year that revealed no significant differences in back pain between the two modalities. Greenberger HB et al.[1] determined that a significant relation existed between treatment type that a patient received and age. Older patients typically received more soft tissue mobilization while younger patients received more postural exercises, joint mobilization, or McKenzie

exercises. A systematic review by Quaseem et al.[11] showed low quality evidence that massage therapy moderately improved short-term low back pain and function compared with a control. The review also indicated moderate evidence showing that superficial heat improved pain relief compared to a placebo. Both therapies provided greater pain relief and improved function when used in conjunction with exercise.[11]

A systematic review revealed a subgroup analysis that revealed that exercises involving coordination and resistance training had a significant effect in improving chronic low back pain for patients compared to other types of exercise.[1] Whole body exercises involving core resistance training utilizing the transverse abdominis resulted in the largest effect size of all the exercise groupings. Activation of the transverse abdominis (TA) and multifidus or lack thereof is present in patients with chronic low back pain according to Hides et al.[12] Patients with the inability to contract the TA were more likely to have poor contraction of the multifidus or vice versa. Conversely, good contraction of one muscle often resulted in higher quality contractions of the other.[12] These muscles are found to have a crucial role in providing stability in the lumbar spine.[1,6,12,13] Both of these studies indicate that motor control of the TA decreases pain levels and improves function in patients with chronic low back pain. Core musculature also plays a pivotal role in sustaining proper posture.[12] I think Low back pain can be further worsened in prolonged postures. A study by Agarwal et al[13] provided evidence that sit to stand workstations may reduce low back pain in office workers.

An objective way of measuring therapeutic outcomes is a tool called Focus on Therapeutic Outcomes (FOTO). [14] Focus on Therapeutic Outcomes aims to improve the experience of the patients treated in physical therapy as well as reduce the cost of

healthcare for the patient. [14] The outcome tool is beneficial for both the patient and the clinician because it takes approximately 7 minutes to complete and can be immediately accessed by the clinician.[14] The FOTO score uses computer adaptive testing to predict functional outcomes. It scores patients on a scale of 0-100 with higher scores indicating a higher overall level of function.

The research supporting the efficacy of exercise in reducing low back pain and improving function was used as a rationale in the present case study. The focus of this case study was on the treatment plan for a patient with chronic low back pain. The purpose of this case study was to discuss the interventions used in an outpatient facility as well as the prognosis of the patient after the course of treatment. The screening criteria for patient selection included an informed consent and a referral for physical therapy from the Minnesota Spine Institute. There is a gap in the current literature regarding the effectiveness of a MedX machine on teenagers with chronic low back pain. This case study supported the efficacy of exercise in improving low back function and reducing low back pain and advocate for a physical therapist's ability to implement an effective plan of care for patients with chronic low back pain.

CHAPTER 2

CASE DESCRIPTION

The patient was a 17-year-old white female diagnosed with chronic low back pain with no radicular symptoms. The pain had lasted around 3 months and the patient had not received any physical therapy treatment in the past. She was very physically active and participated in hockey and track at her high school as a senior and resided at home with her parents and younger sister in a 3-story home in a suburban area. On the first day of therapy, she related that stair climbing was not difficult, however, sitting or standing for long periods of time aggravated her symptoms. She also was having family relationship issues at home that she felt were causing her to have a lot of stress. The patient had no comorbidities and was otherwise healthy, excluding the current condition. She states that she was not prescribed any medications to treat her low back pain at the time of initial physical therapy consult. She reported using heat on her low back at night and expressed concern about whether she should continue heating her low back. She was attending high school and was not employed at any time during the 8-week course of treatment. During the initial subjective history, she related that her back hurt during class and that it got worse throughout the day. She described the pain as achy with numbness running down her left gluteus maximus. The patient described her pain as being 4/10 consistently and 8/10 at the worst. The pain was rated on a scale from 0-10 with 10 being the worst pain possible and 0 being no pain at all.[16] The referral for therapy was given by

the Minnesota Spine Center Institute and prescribed MEDX sessions at each physical therapy session in order to strengthen her low back.

During the patient's initial visit, her HR and BP were found to be within normal limits for a 17-year-old female. The patient was 5'7'' and 130 lbs, with a BMI of 20.4. All of these vitals indicate a healthy weight status for the patient's demographic. The patient presented with a slouched posture with rounded shoulders and forward head. The patient took no medications throughout the course of treatment. No imaging had been done prior to the initial treatment session. No apparent cognitive deficiencies were present during the initial evaluation or subsequent visits, thereby eliminating the need for a cognitive exam.

Along with the MedX prescription, physical therapy orders were to provide a home exercise program that the patient could use to improve trunk coordination and stabilization. She had reported having low back pain in the past, but never for this long of an episode, or of severe enough intensity that she deemed warranted medical attention. During the initial evaluation, the patient was very quiet and did not openly volunteer information without being prompted by a clinician. After a thorough history was taken, the patient was considered to be safe to start physical therapy due to a lack of comorbidities and contraindications to manual therapy.

Examination

After the history was taken, observation revealed that the patient's left paraspinals were hypertrophied compared to her right. Upon palpation of the paraspinal musculature, tenderness was elicited bilaterally with the left side being more tender than the right. Dermatomes were all intact during the sensory exam. The pain was localized within the

inferior ribs and the gluteal musculature which is characteristic of chronic nonspecific low back pain.[1] Movement testing revealed restricted flexion and extension; however, side-bending was not limited in either direction. Lumbar flexion and extension were measured to be 45 and 0 degrees, respectively. Range of motion (ROM) deficits severe enough to limit functional tasks specific to the patient are important clinical notes to determine the necessity of a MedX prescription.

Following the ROM examination, hip manual muscle testing was performed. Table 1 below shows the results of that examination.

Table 1. Hip Manual Muscle Testing

Hip MMT	**Left**	**Right**
Flexion	4/5	4/5
Extension	5/5	5/5
Abduction	3/5	3/5
External Rotation	4/5	4/5
Internal Rotation	4/5	4/5

Following the hip manual muscle testing, hip ROM was assessed passively and actively. All motions were within the normal range in both hips. MedX treatment would not start until the second visit because it was important to know the patient baseline strength levels in order to determine the proper settings on the machine. To assess abdominal strength, the patient was placed in supine and asked to lift one leg off the ground while contracting her transverse abdominis (TA). She was able to do this however it caused some

discomfort. Sacroiliac provocation tests were then performed in order to rule out SI dysfunction (see Table 2).

Evaluation, Diagnosis, Plan of Care and Prognosis

Since more than 3/5 of the SI tests were negative, the SI joint was ruled out as the origin of her pain.[5] The diagnosis of the patient was labeled chronic low back pain since she had been experiencing symptoms for longer than 3 months. Her inability to maintain a neutral spine during abdominal exercises qualified her for a progressive exercise program in order to improve lumbar stability. Core strengthening has been found to be beneficial in improving low back pain and function in athletic populations. [1,] While her hip mobility was within the normal range of motion, she displayed weakness in all hip motions but extension. Flexion, internal rotation, and external rotation of the hip were also targeted in the home exercise program. Research supports that activation of the TA helps improve low back pain and function.[8,9,12] Core strengthening was also heavily implemented in the home exercise program. Abduction exercises were added to her home exercise program as well, since her hip abduction tested the weakest out of all hip motions.

The plan of care was set for 8 weeks. The examination revealed a list of problems including low back weakness, as well as weakened hip musculature. Specifically, abduction was the weakest hip movement. This can be a cause for concern since hip abductors play an important role in stabilizing the pelvis during gait and stance.[13] Initially, the patient was seen twice a week with a reduction to 1 time per week upon improvement of her symptoms. Short term goals included the ability to hold a plank for 1 set of 30 seconds with a pain level of 2/10 or below, as well as being able to sit for 30

minutes without an increase in pain above 2/10, both to be met in 2 weeks. This client's prognosis was favorable due to her age and her activity level.

Table 2. Sacral-Iliac Provocative Tests

Hip Test	Right	Left
Distraction	-	-
Compression	+	+
Thigh thrust	-	-
FABER	-	-
Gaenslen's	-	-

* - indicates a negative test result

\+ indicates a positive test result

CHAPTER 3

INTERVENTION

The interventions that comprised the plan of care for the patient were a combination of MedX sessions and core stabilization exercises. Multiple studies have found that exercises involving the patient's whole body are more effective in reducing low back pain than resistance training that isolates a certain muscle.[4,15] The patient began her home exercise program in a supine position due to the level of pain that she presented with (6/10) on the first day of treatment. These exercises targeted the TA through isometric and isotonic contractions. The specific repetition (reps) and sets are listed in Table 3.

Each physical therapy session lasted 45 minutes for a total of 12 sessions over an 8 week period. This is excluding the several occasions the patient called in sick. The patient was monitored throughout every treatment session by a physical therapist and a student physical therapist. The patient was continuously asked for feedback during exercise sessions. This included inquiring about the patient's pain level, and where the patient felt muscle activation. Each session began with 5 minutes on a treadmill before beginning MedX treatment. Before beginning any supine exercises, the patient was instructed in diaphragmatic breathing and proper alignment of her thorax over her pelvis. Posture education was given verbally for both standing and supine positions.

The exercises themselves consisted of a TA set progression that started in hooklying position. The patient performed a single leg heel slide by sliding their heel

along the table while being verbally and manually cued to engage the core musculature throughout the entire exercise. This cuing was executed during each exercise. Progression of an exercise would occur after the patient was able to complete 3 sets of 10 repetitions with a neutral spine. The rest of the progression is shown in Table 3.

Table 3. Transverse Abdominis Exercise Progression

Exercise	Definition
Supine single leg glide	Similar to single leg heel slide except heel is 2" off table
Double Heel Slide	Both heels slide across table simultaneously
Double Heel Glide	Both heels glide 2" off the table simultaneously

Gluteal bridges were performed in supine with a green theraband wrapped around the knees approximately 3 inches above the knee joint. These were done by the patient elevating their hips using their gluteal muscles while in hooklying and engaging their core throughout the movement to maintain a neutral spine. The patient performed 3 sets of 10 repetitions with a 3 second isometric contraction with the hips in end range extension . A mini crunch was also performed in hooklying for 3 sets of 10 and began by the patient engaging their core and attempting to slowly raise their shoulder blades off the table. The patient was instructed to avoid lumbar movement during this exercise. The patient then moved into quadruped to perform the bird dog exercise (see Figure 2). This

was done by the patient extending their opposite arm and leg simultaneously and maintaining core control. Two sets of 10 with a 3 second hold were performed for this exercise.

Functional exercises began during the second week of therapy. Supine and hooklying exercises were still performed at the beginning of each session, however, increasing emphasis was put on closed chain exercises throughout the 8 week plan of care. Each functional exercise was performed for 3 sets of 10 repetitions. Body weight squats were performed by the patient. Verbal cuing was given to promote core engagement and diaphragmatic breathing throughout the exercise. If knee valgus was observed, cuing would also be given to promote neutral tracking of the knee. Squats were progressed throughout the 8 week treatment plan as shown in Table 4. A hip hinge was performed in standing with the patient holding a dowel rod against their back while maintaining three points of contact (head, upper back, and butt). Hip hinges were progressed to a deadlift by first increasing the repetitions and then increasing the weight on the bar. Monster walks were performed by tying a red theraband around the midfoot in standing. The patient would then perform the exercise by sidestepping with one leg while keeping the knees and hips slightly bent and engaging the hip abductors to maintain balance. Core exercises such as the Pallof press were used to improve anti-rotation strength in the patient's core. This exercise involves a resistance band and an isometric hold by the patient to create resistance from the band. The patient's home exercise program is shown in the table below.

MedX sessions began on the second visit. Initial range of motion settings were 39 degrees of lumbar flexion and 6 degrees from full lumbar extension. Initial resistance by

the machine was set at 45 lbs and incrementally increased, maintained, or decreased depending on patients pain level. A counterbalance to the patient's weight was calibrated by the machine based off of the patient's bodyweight of 130 lbs. Femur restraints and a cervical pad were fitted to the patient to ensure secure lower extremities and comfortable head placement. The table below lists the progression the patient made over the 8 week plan of care.

Table 4. Home Exercise Program

Week 1	TA Sets	Supine Gluteal Bridges	Mini Crunch
Week 2	TA Set Progression	BW Mini Squat	Hip Hinge with Dowel Rod
Week 3	TA Set Progression	Squat w/Theraband	Monster Walks
Week 4	TA Set Progression	Single Leg Forward Lunge	Monster Walk w/ Theraband
Week 5	TA Set Progression	Reverse Lunge	Fire Hydrant w/ Theraband
Week 6	Side Plank	Goblet Squat	Barbell Deadlift
Week 7	Side Plank w/ Theraband	Front Squat w/ Barbell	Increased Repetitions on Deadlift
Week 8	Pallof Press	Back Squat w/ Barbell	Increased Weight on Deadlift

BW-Body Weight

The patient was not able to make it to therapy on several occasions due to other activities. This presented the challenge of adjusting the MedX machine at a pace that allowed the patient to make progress without excessive overload. After each therapy session was completed, a review of the HEP was performed to clarify each exercise. Any questions the patient had regarding her treatment plan were also addressed at the end of each session.

Table 5. MedX Progression

Week	Session 1	Session 2
Week 1	45 #, 12 reps	50 #, 12 reps
Week 2	55#, 12 reps	55#, 12 reps
Week 3	60#, 12 reps	65 #, 12 reps
Week 4	60 #, 10 reps	60 #, 12 reps
Week 5	65#, 12 reps	70 #, 10 reps
Week 6	65 #, 12 reps	Discontinued due to improvement
Week 7	70 #, 12 reps	Discontinued due to improvement
Week 8	75 # 12 reps	Discontinued due to improvement

#-pounds (lb)

CHAPTER 4

OUTCOMES

The outcomes for the patient were positive considering that each goal was met by the end of the plan of care. Despite several sessions being missed, the patient made steady progress on the MedX machine, indicating lumbar muscle strength improvement. The patient was also able to progress her HEP and perform functional exercises pain free by discharge. Subjective and objective outcome measures were both conducted in order to determine the patient's progress up until discharge. The objective measures includes a FOTO score, lumbar ROM, hip manual muscle testing, a TA contraction test, and the MedX score. The only subjective measurement that was performed was a pain scale of 0-10 (0=no pain, 10=most pain ever felt in their whole life).

The FOTO scores uses computer adaptive testing to predict functional outcomes. The test scores patients on a scale of 0-100 with higher scores indicating a higher overall level of function. The client initially scored a 73/100 during their first visit. The client improved by 23 points and ended with a score of 96/100 at discharge. Hip abduction manual muscle testing was performed bilaterally every two weeks of treatment. The first 4 weeks elicited no change in hip strength, however, by the 6th week hip abduction had improved from 3/5 to 4/5 bilaterally with a pain level of 0/10. By the end of the 8 week plan of care, hip abduction improved from 3/5 to 5/5 bilaterally with a pain level of 0/10. Hip flexion, internal rotation, and external rotation also improved bilaterally from 4/5 to

5/5 with a pain level of 0/10 by discharge. The patient was asked to perform a TA isometric contraction for 5 seconds in a supine position with both legs extended and elevated 3 inches from the ground (the most advanced exercise in the TA progression). This test was considered a best of practice assessment of core strength by the clinic. The patient was able to hold the contraction for 10 seconds with a pain level of 0/10. The patient improved her MedX score from 45 lbs. to 70 lbs. of resistance. She was able to perform the exercise at this weight for 12 repetitions with a pain level of 0/10 at discharge.

Lumbar flexion improved from 45 degrees to 90 degrees with a pain level of 2/10. Lumbar extension increased from 0 degrees to 20 degrees with 0/10 pain. The patient's lumbar rotation was no longer painful and was symmetrical bilaterally at discharge. This motion was measured by observation bilaterally. A pain level of 8/10 at worst was given during the first visit. Prolonged periods of time greater than a half hour aggravated her symptoms the most by the end of treatment. Her pain level, however, had changed to a 2/10 at worst at discharge.

Overall, the patient was very compliant with the home exercise program. She was able to perform exercises without much reminding of form at the beginning of each session. The only issue with compliance was the several occasions she missed therapy due to other activities. This lack of communication was addressed and resolved over the last half of her treatment. Overall, the patient was very satisfied with her outcomes. The patient was able to reach all her goals by the end of her treatment sessions. She was able to resume playing hockey with a pain level of 2/10 at the worst. She was also able to focus during class more consistently due to her reduction in pain. She was also able to

perform transfers to and from a chair with a pain level of 2/10 or below. She was very enthusiastic about continuing her HEP at discharge and expressed her thanks for providing her with a plan of care that helped achieve her goals.

CHAPTER 5

DISCUSSION

The patient made significant increases in lumbar strength and functional mobility by the day of discharge. The patient was able to return to sport with a minimal pain level of 2/10. The patient also significantly improved her hip strength which is integral in preventing low back pain.[5,12] The patient consistently performed her HEP throughout the course of treatment. Individuals with low back pain often respond well to exercises involving motor control rather than focusing on improving strength alone.[15] This may be a reason why all goals were met by the end of treatment. Strong emphasis was given on maintain core activation throughout the concentric and eccentric portions of the HEP. Both functional and objective goals were achieved and met with patient satisfaction. The patient also had several internal factors that may have played a role in her success. She had a hard work ethic instilled in her from years as an athlete. She also had an optimistic personality and a positive outlook on her prognosis throughout the 8 weeks of treatment.

Her improvement in lumbar ROM were significant as well. This allowed her to progress her HEP to more functional exercises and also improved her ability to transfer from a chair without pain. Flexion was the most improved lumbar motion, and this was reflected in her ability to perform hip hinges and improve functional tasks.

There were limitations to this case study that should be addressed in order to improve further studies involving patients with low back pain. It would have been

optimal to have the patient present at all scheduled appointments in order to consistently track her progress over time. The verbal encouragement during MedX sessions may have influenced the maximum amount of repetitions performed during every session. More repetitions may have been performed by the patient depending on how motivated they felt during the treatment session.

Further investigations may look at the effect of other modalities on adolescents with chronic low back pain. Therapeutic exercise and MedX treatment may not be the most efficient combination of modalities to treat a patient with chronic low back pain since manual therapy and massage have also been found to be effective.[1] Learning how to control lumbar flexion in hockey specific movements by simulating them in the clinic may also improve low back health in this specific population.

Reflective Practice

There are some additional questions that could have been asked in the initial PT consult. These include red flag questions such as if the patient had any unexplained weight loss, a urinary tract infection, or symptoms of a fever. If the patient answered yes to any of these questions, then they would have been referred to their physician. An inquiry on family history of back pain could also have been made in an effort to rule out congenital diagnoses such as vertebral stenosis or scoliosis. During the examination, it may have been more time efficient to only perform 3 SI tests instead of all 5. If one of the tests were positive then it would be necessary to perform the remaining tests as well. This would save time in the initial examination. I would have wanted to perform more specific measurements of lumbar motion in order to have an objective way of looking at

improvement in lumbar mobility over the course of treatment. This could have been achieved by using an inclinometer or tape measure. Changes to the plan of care would have been elimination of the Med X machine or changed to 1 x per week. This is because I believe that it took away from conventional exercise education. By allowing for more practice of the HEP inside the clinic, better technique would have been performed at home as well. I would want to see more evidence for the effectiveness in MedX treatment for high school athletes to see if that modality would be warranted in similar cases. Some additional referrals I would make is to a neurologist at the beginning of the treatment plan since she was having radicular symptoms for longer than a month. I would also have wanted to refer for imaging for the same reason at the beginning of the plan of care.

REFERENCES

1. McIntosh G, Hall H. Low back pain (acute). *BMJ Clin Evid.* 2011;2011:1102. Published 2011 May 9.

2. Fasuyi FO, Fabunmi AA, Adegoke BOA. Hamstring muscle length and pelvic tilt range among individuals with and without low back pain. *J Body Mov Ther.* 2017;21(2):246-250. doi:10.1016/j.jbmt.2016.06.002

3. Steffens D, Ferreira ML, Latimer J, et al. What triggers an episode of acute low back pain? A case-crossover study. *Arthritis Care Res (Hoboken).* 2015;67(3):403-410. doi:10.1002/acr.22533

4. Kirk Whetstone, M. (n.d.). The Basics of Back Pain and Spinal Anatomy. Retrieved August 24, 2020, from https://www.spine-health.com/blog/basics-back-pain-and-spinal-anatomy

5. Sacroiliac Joint Special Test Cluster. (n.d.). Retrieved August 24, 2020, from https://www.physio-pedia.com/Sacroiliac_Joint_Special_Test_Cluster

6. Agarwal S, Steinmaus C, Harris-Adamson C. Sit-stand workstations and impact on low back discomfort: a systematic review and meta-analysis. *Ergonomics.* 2018;61(4):538-552. doi:10.1080/00140139.2017.1402960

7. Kirk Whetstone, M. (n.d.). The Basics of Back Pain and Spinal Anatomy. Retrieved August 24, 2020, from https://www.spine-health.com/blog/basics-back-pain-and-spinal-anatomy

8. Hoffman MD, Hoffman DR. Does aerobic exercise improve pain perception and mood? A review of the evidence related to healthy and chronic pain subjects. *Curr Pain Headache Rep*. 2007;11(2):93-97. doi:10.1007/s11916-007-0004-z

9. Searle A, Spink M, Ho A, Chuter V. Exercise interventions for the treatment of chronic low back pain: a systematic review and meta-analysis of randomised controlled trials. *Clin Rehabil*. 2015;29(12):1155-1167

10. Shahvarpour A, Gagnon D, Preuss R, Henry SM, Larivière C. Trunk postural balance and low back pain: Reliability and relationship with clinical changes following a lumbar stabilization exercise program. *Gait Posture*. 2018;61:375-381. doi:10.1016/j.gaitpost.2018.02.006

11. Winslow JJ, Jackson M, Getzin A, Costello M. Rehabilitation of a Young Athlete With Extension-Based Low Back Pain Addressing Motor-Control Impairments and Central Sensitization. *J Athl Train*. 2018;53(2):168-173. doi:10.4085/1062-6050-238-16

12. Qaseem A, Wilt TJ, McLean RM, Forciea MA; Clinical Guidelines Committee of the American College of Physicians. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. *Ann Intern Med*. 2017;166(7):514-530. doi:10.7326/M16-2367

13. Hides J, Stanton W, Mendis MD, Sexton M. The relationship of transversus abdominis and lumbar multifidus clinical muscle tests in patients with chronic low back pain. *Man Ther*. 2011;16(6):573-577. doi:10.1016/j.math.2011.05.007

14. Smith D, Bissell G, Bruce-Low S, Wakefield C. The effect of lumbar extension training with and without pelvic stabilization on lumbar strength and low back pain. *J Back Musculoskelet Rehabil*. 2011;24(4):241-249. doi:10.3233/BMR-2011-0301

13. Inani SB, Selkar SP. Effect of core stabilization exercises versus conventional exercises on pain and functional status in patients with non-specific low back pain: a randomized clinical trial. *J Back Musculoskelet Rehabil*. 2013;26(1):37-43. doi:10.3233/BMR-2012-0348

14.https://www.valleyhealthlink.com/documents/rehab%20symposium%202019/Why-Outcomes-Why-FOTO.pdf

15. O'Sullivan PB, Burnett A, Floyd AN, et al. Lumbar repositioning deficit in a specific low back pain population. *Spine (Phila Pa 1976)*. 2003;28(10):1074-1079. doi:10.1097/01.BRS.0000061990.56113.6F

16. Haefeli M, Elfering A. Pain assessment. *Eur Spine J*. 2006;15 Suppl 1(Suppl 1):S17-S24. doi:10.1007/s00586-005-1044-x