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Therapeutic Exercises: A Conservative Approach To The Treatment Of Chronic Low Back Pain

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Abstract:

Chronic low back pain is becoming a worldwide epidemic; millions suffer from this condition every year. Back pain is one of the most frequent reasons cited for patient visits every year. It is the second most reason for days of missed work following the flu. Chronic low back pain is defined as pain persisting in the low back region for greater than three months. This pain may originate from a variety of factors. These factors can include, but are not limited to injury, disease, or different stressors on the body. Pain in the low back region may be felt as sharp, dull, achy, burning, specific, or vague. Due to the complex nature of chronic low back pain and the variety of forms in which it can take place there are a variety of different tools used to diagnose it. Research has determined the best ways to diagnose chronic low back pain, but has still not found the best way to treat chronic low back pain. This literature review will analyze one treatment form for chronic low back pain, therapeutic exercises. The following text states that therapeutic exercises are an effective conservative treatment option for chronic low back pain. The most effective therapeutic exercise approach is one that incorporates exercises from several different methods into the rehabilitation plan.

Therapeutic Exercises: A Conservative Approach to the Treatment of Chronic Low Back Pain.

Introduction

Chronic low back pain is defined as pain persisting in the low back region for greater than three months. Pain may originate from a variety of factors including, but not limited to injury, disease, or different stressors on the body. Pain in the low back region may be felt as sharp, dull, achy, burning, specific, or vague. Chronic low back pain can be classified as specific or non-specific. Specific low back pains causation can be identified through a pathophysiological mechanism. Major causes of specific low back pain are hernia nuclei pulposi (with nerve root compromise), ankylosing spondylitis (inflammatory diseases), infection, osteoporosis, rheumatoid arthritis, fracture, or tumor[1,2]. Non-specific low back pain has symptoms without a clear cause. This makes up the large majority of low back pain patients encompassing 90% of all patients with chronic low back pain. Baerga et al. estimates that of the 17.1% of musculoskeletal patients that are diagnosed with acute low back pain 24%-80% of them with have another episode of low back pain within a year[2].

As a result of the many underlying causes of chronic low back pain, many suffer from this condition. Chronic low back pain is becoming a worldwide epidemic. It is one of the most frequent reasons cited for patient visits every year. It is the second most reason for days of missed work following the flu[2]. Because of the chronic nature of low back pain, it is the United States' number one cause of disability. Studies have estimated that 149 million workdays are missed in the United States every year due to low back pain. This time off work costs the United States an estimated $100-$200 billion dollars each year. The majority of these costs come from

decreased productivity, lost wages, and health care costs. The prevalence of low back pain is increasing at astronomical rates as well. A study done in Sweden estimated the number of low back pain claims quadrupled in thirty years[2,3].

Although chronic low back pain is difficult to treat, several predisposing factors have been identified. Physical predisposing factors include a genetic history of relatives with chronic low back pain. Patients who are overweight or are heavy smokers are shown to have a higher incidence of chronic low back pain[4]. Also the older the individual is, the more prone they are to suffer from chronic low back pain. Work related factors were also shown to have a major correlation with incidence of low back pain. Occupations that require increase bending and heavy lifting show a higher level of chronic low back pain reports than occupations that did not. Psychosocial factors also play a major role in the prevalence of chronic low back pain. Individuals with depression were more likely to take longer to recover from episode of low back pain and have a higher reoccurrence rate. Those who were afraid that they would be isolated at work or have low social support at work were also shown to have an increased recovery period from chronic low back pain[4].

Within the last twenty years there has been a rise in the amount of research devoted to the treatment, identification, and prevent of chronic low back pain. Due to the fact that I am currently studying in the orthopedic field of athletic training and physical therapy, chronic low back pain will be a pathology that I will treat often in the clinical setting. With the number of chronic low back patients rising in the United States, I need to become an expert at the three facets of therapy: prevention, identification, and intervention. As a physical therapy and athletic training student, I would like to focus my studies on the intervention aspect of chronic low back

pain. I will also specifically study what therapeutic exercising techniques are proven through evidence based practice to be most effective at treating chronic low back pain.

Research Questions

As was discussed in the previous section, chronic low back pain is very costly to the American people and is rising at a very rapid rate. Despite the increased money and time that has been put towards the research of chronic low back pain, there are still many unanswered questions as to the pathogenesis, identification, and treatment of chronic low back pain. Since the majority of chronic low back pain patients are workers compensation patients, the goal of therapy has been to return patients to work at a functioning and relatively pain free level. Many studies have been done to examine the treatment options that are best suited for chronic low back pain. Some studies have found great results for reduction of pain using manual therapy techniques. However, the manual therapy techniques benefits only last as long as treatment is provided by the therapist. Due to the large patient population, the current medical market does not have the resources to treat a patient for low back pain over their entire life span. Another treatment option has been surgery. While studies have been shown that surgery has been effective for treating certain low back pathologies such as discogenic pathologies, it is very expensive and the recovery period is very extensive. Also surgery cannot be performed on patients suffering from non-specific chronic low back pain. This, as mentioned in the introduction, accounts for 90% of chronic low back pain cases. The best treatment option for chronic low back pain is still up for debate among doctors, researchers, and educators. However, studies have shown that certain therapeutic exercises have been shown to be very effective at treating and preventing the symptoms of chronic low back pain. Therapeutic exercises have also been shown to be a very cost effective and time efficient method. A barrier to this method is

patient compliance. Patients are reluctant to want to exercise when they are in pain. Also patients have been shown to stop doing their home exercise program once therapy has ended, making chronic low back pain likely to reoccur.

There are multiple questions I seek to answer through research analysis. The first question I pose involves the anatomy, etiology, and epidemiology of chronic low back pain. Specifically, I will be identifying the patients most susceptible to suffer from chronic low back pain and the factors that can cause chronic low back pain. I will also be identifying the basic anatomical variances that occur with the major forms of chronic low back pain. My second question looks at identifying the diagnostic criteria that has been shown through research to have the best results for identifying chronic low back pain. I will be breaking this up into the two major forms of chronic low back pain, specific and nonspecific, since each will have its own separate diagnostic criteria. The third question I want to answer is what therapeutic exercise program is the most effective at treating chronic low back pain. These questions all must be answered in order to understand how to effectively treat chronic low back pain.

In order to answer these questions, I researched peer reviewed articles on these specific topics. I also examined case studies as well as literature reviews to obtain a variety of research. I am also using the current low back patients I am treating at the Indiana State University clinic to determine the most effective method of therapeutic exercises.

Chronic low back pain is defined as pain persisting in the low back region for greater than three months. It can come in two forms: specific and nonspecific. Chronic low back pain is an epidemic that is increasing every year costing the United States billions of dollars. Many different causes of chronic low back pain have been identified, but the best viable intervention has not. Therefore, I am conducting a literature review to identify the therapeutic exercise

interventions that best treat chronic low back pain symptoms. To determine if therapeutic exercise interventions for chronic low back pain are effective, I have conducted in depth research of chronic low back pain: anatomy, etiology, epidemiology, diagnostic technique, and different therapeutic exercise interventions. Using the data that I have gathered, I will synthesize the best therapeutic interventions for patients suffering from chronic low back pain.

Overview

As was discussed in the previous sections, chronic low back pain is pain the low back region for greater than three months. It can be specific or nonspecific. In the following sections the pathogenesis, etiology, epidemiology, diagnosis, and therapeutic exercise treatment options will be discussed. It is important to be educated in each of these facets in order to treat chronic low back pain because of its complex and varying nature. For specific chronic low back pain I will be discussing two of the most prevalent sources of chronic low back pain. These include sacral iliac dysfunction, and discogenic pathologies. I will also discuss the areas listed above in relation to non-specific chronic low back pain.

Etiology and Epidemiology

Most studies agree that 70-85% of the general population will suffer from low back pain at some time throughout their life [3,5]. Anderson provides general facts about the epidemic of low back pain in the U.S. stating, "In the USA, back pain is the most common cause of activity limitation in people younger than 45 years, the second most frequent reason for visits to the physician, the fifth-ranking cause of admission to hospital, and the third most common cause of surgical procedures. About 2% of the US workforce are compensated for back injuries each year" [5]. Statistics similar to these can be found world-wide in other industrialized nations. Incidence of chronic low back pain is reported higher in women than in men. 7.03% of women

have reported low back impairments versus only 5.73% of men.[5] Studies have also found that whites are more likely to report suffering from low back pain than African Americans. There is a significant difference between these two ethnicities with whites (6.87%) having almost double the number of low back impairments than African Americans (3.87%)[5]. Prevalence of low back pain changed with age groups. Individuals under the age of 18 saw only a 1% chance of suffering from a significant back impairment. The highest prevalence of chronic low back pain was seen in individuals over 84 and between 45-64, both having over a 9% chance of suffering from chronic low back pain[5]. Another area that has been shown to be concurrent with chronic low back pain is psychological disorders. Many patients suffering from chronic low back pain either had these disorders before the onset of chronic low back pain or developed it as a result of it. The three most common psychological disorder associated with chronic low back pain were depression, substance misuse, and anxiety disorders. A study was done by Polatin and colleagues of 200 patients with chronic low back pain. Of these 200 patients, 77% met diagnostic criteria of life long psychiatric disorders [6]. The link between psychological distress and low back emphasizes the need for psychological help as much as therapeutic help in the treatment of individuals with chronic low back pain. Overall, chronic low back pain is an epidemic on the rise in most industrialized countries of the world.

Pathogenesis

In order to treat chronic low back pain, you must first understand the complex factors that cause it. The wide variety of forms of chronic low back pain require it to be divide into two main categories as well as subcategories. The two main categories are specific and non-specific low back pain. Specific means that pathology can be accurately diagnosed through a history, objective measures, and diagnostic imagery. This text will look at two of the main forms of

specific low back pain. These two major types are discgenic low back pain and sacral iliac joint dysfunction. Non-specific chronic low back pain is defined as pain lasting longer than three months in the low back region that cannot be identified as a specific pathology.

To begin with, I will discuss the pathogenesis of specific chronic low back pain. The specific pathology that I will examine first is discogenic chronic low back pain. A study done by Kallewaard and colleagues found that 40% of low back pain is due to a discogenic cause[8].

The main cause of discogenic back pain is a herniated disc. A herniated disk is degeneration, tearing, or cracking found in the annulus fibrosus that causes a bulging of the disk that lies between the vertebral bodies. Research has found that when the annular tears occur the bodies healing mechanisms create blood vessels and nociceptors around and inside the annulus. The nociceptors can then become sensitive by various inflammatory repair mechanisms leading to chronic low back pain[8]. These discs are used for shock absorption and padding between the vertebral bodies.[7] When this bulging occurs it can protrude into the spinal canal causing radicular pain into the back, buttocks, and leg. There is usually sharp, centrally located pain near the spinal cord that radiates down a dermatomal pattern. Since a herniated disc affects the nervous system, patients will often report numbness, tingling, or weakness down into their leg.[7,10] For the low back, specifically, these discs are found between the lumbar vertebrae. The disks most often affected are the L4-L5 and the L5-S1. The cause of a herniated disc is usually forward bending with twisting that places a large amount of force on the lumbar vertebrae[7].

Overtime the annulus fibrosis degenerates. The proteoglycan fibers are replaced with collagen fibers in the disc. This decreases the water binding ability making the disc less effective at shock absorption; therefore, increased forces are placed throughout the spine and low back.

As it becomes weaker the chance for a desk herniation becomes higher[9]. This explains why the older population is more likely to suffer from low back pain.

The severity of a tear to the annulus fibrosis can be divided into IV grades. Grade I being the least severe and grade IV being the most severe. Each grade is linked to the percentage of the annulus fibrosis that has been torn. Patients typically become symptomatic at a grade III rupture[8,10]. Once there is a tear in the annulus fibrosis, cytokines are introduced to the area for healing purposes. However, these cytokines also disrupt the chemical balance of the nucleus causing decreased oxygen diffusion, increased local lactate levels, and increased pH level. All of this leads to pain in the disc.

The second major cause of low back pain that I will be discussing is sacroiliac (SI) joint dysfunction. A study done by Simon et al found that 13-48% of all low back pain was caused by the sacroiliac joint[11]. The sacroiliac is the joint formed by the sacrum and the ilium. It is connected by many strong ligaments that allow a small amount of motion to take place[7]. The SI joint is responsible supporting the entire weight of the axial body and upper extremities. Since the SI joint is a synovial joint: inflammation, sprains, hypermobility, and hypomobility may occur. All of these may cause pain in the lower back. Many recent studies have stated that SI joint asymmetries and sacrum hypomobility may be a precursor to pain in the lumbar region. Asymmetries in the SI joint may also lead to spasms in the piriformis, a small band like muscle that runs along the buttocks. The sciatic nerve runs through the piriformis. As a result, any spasms caused by the piriformis will irritate the sciatic nerve causing low back pain, pain in the buttocks, and pain running down the leg. Often times SI joint dysfunction will occur along with a lumbar discogenic pathology. Madani and colleagues performed a study on 150 patients that had a diagnosed lumbar discogenic pathology. Of those 150, 46 were found to have SI joint

dysfunction through several diagnostic criteria. These patients were also experiencing pain related to their SI joint dysfunction, suggesting that when a patient is found to have a lumbar discogenic pathology through imaging that SI joint dysfunction must all be assessed as the possible cause of radicular pain[11].

A SI joint sprain may occur with falls from a height, downhill running, and repetitive unilateral activities such as golf, dancing, punting, hurdling, or gymnastics.[7] Any of these mechanisms may cause lengthening and irritation of the sacrotuberous and sacrospinous ligaments. Also these unilateral forces may also cause an asymmetry to one side of the pelvis. This asymmetry may cause pain and neurological deficits as previously discussed. As can be seen, the SI joint is one of the most complex joints of the body. It is very difficult to diagnose the exact cause of the dysfunction making it a very difficult area to treat.

The third and final form of chronic low back pain that will be discussed is nonspecific chronic low back pain. Nonspecific chronic low back pain is pain in the lower back that persists for longer than three months. An exact pathology cannot be diagnosed through imaging or special tests. The nonspecific group contains 90% of all chronic low back patients[1]. Patients with nonspecific chronic low back pain typically have poor functional movements. The clinician can implement a movement screen such as the Functional Movement Screen (FMS) or the Selective Functional Movement Assessment (SFMA) to identify impaired mechanical movement patterns throughout the body. Once these impairments have been identified they can be treated through a variety of different stretches and therapeutic exercises. In summary, the clinician is treating the impairments rather than the pathology. Overall, this is a relatively new way of treating patients that has shown success in those with unidentified low back pathologies[1].

Nonspecific chronic low back pain has also been shown to be linked to mental disorders. Those having depression, anxiety, or substance misuse issues are more likely to suffer from chronic low back pain. Polatin and colleagues found that of the 200 patients with chronic low back pain 77% met diagnostic criteria of life long psychiatric disorders[6]. The link between psychological distress and low back emphasizes the need for psychological help as much as therapeutic help in the treatment of individuals with chronic low back pain.

As has been discussed in my previous sections, chronic low back pain is an extremely difficult area to treat. Therefore understanding the anatomy of the low back is essential. Comprehending the pathophysiology of each pathology is very difficult and takes years of experience to understand due to the complex nature of the low back. Every low back patient presents itself in its own unique way making it very difficult to treat and diagnose.

Diagnosis

Due to the wide variety of pathologies encompassing chronic low back pain and the complex anatomical features it involves, diagnosing chronic low back pain is very difficult. This explains why 90% of all chronic low back pain patients fall under the non-specific category[1]. There is no gold standard for diagnosing chronic low back pain as a whole. However, sub categories of chronic low back pain have their own diagnostic criteria. There are several methods that are used together in the diagnosis of chronic low back pain. These include an accurate history with mechanism of injury, type of pain, level of pain, time period of symptoms, alleviating and aggravating actions, as well as many other factors. Objective measurements such as range of motion, manual muscle testing, and dermatome and myotome screenings will also be used to determine the pathology. Special tests and diagnostic imaging are also major components in determining chronic low back pain. In order to be diagnosed with chronic low back pain an

individual must have pain for greater than three months[1]. In the following sections I will discuss the diagnostic criteria for two of the major pathologies of chronic low back pain, discogenic low back pain and SI joint dysfunction, as well as the diagnostic criteria for non-specific chronic low back pain.

Discogenic low back pain will be the pathology diagnosis I will discuss first. Typically the patient will express radiating pain down the buttocks and possibly into the leg depending upon where the disc herniation is located. Some patients may report hearing a pop or snap at the time of injury. Patients will often state that their pain decreases when they lay on their back or stand and hyperextend their back. Their symptoms will usually get worse with prolonged sitting or bending over. Patients with a disc herniation may also report pain with coughing or sneezing[10,11,12]. Objectively, patients with a discogenic pathology will typically have pain in all lumbar motions except extension. Pain is often alleviated with repeated hyperextension. The patient will usually present with posture laterally side bending away from the side of disc herniation. The patient will also have a forward bent posture. Often times the cause of the disc herniation was due to the fact the patient had a weak core. Muscle spasms may also be present in the patient's lumbar region[10,11,12]. There are also special tests that can be used to diagnose discogenic low back pain. These special tests involve having the patient move in a particular motion or perform a certain activity that reproduces pain or symptoms. These tests are not 100% accurate and therefore can be used as a guide to whether or not an MRI is needed[10]. The special tests that have been found to be most accurate for diagnosing lumbar discogenic pathology are as follows: Straight leg raise, crossed straight leg raise, valsalva test, SLUMP test, centralization test, Milgram, quadrant, and FABER test[7]. MRI and CT are very accurate imaging techniques for diagnosing discogenic low back pain. However, MRI will give false positives sometimes.

Studies have found that an MRI will show many people have disc degeneration or disc herniation even though they are asymptomatic. This also means that an MRI will show that a patient with neurological pain has a discogenic pathology even though that is not the actual cause of their pain[10]. As a result, discography is the gold standard for diagnosing discogenic pathologies. A discography is performed by inserting a needle in the NP of the target discus and injecting contrast agent in order to test the sensitivity of the discus to gradually increasing distending pressures[10].

Diagnostic criteria for SI joint dysfunction is the next subject that will be discussed. SI joint dysfunction can be caused by asymmetries of the SI joint as well as a hypermobile or hypomobile sacrum. Patients will often complain of pain in the buttocks that may radiate into the leg. Patients may also present with pain upon palpation of posterior superior iliac spine (PSIS) and anterior superior iliac spine (ASIS). Research has found that patients who have pain with palpation to the sacral sulcus 93% of the time have SI joint dysfunction[13]. Decreased hip and lumbar range of motion were also shown to be linked to SI joint dysfunction[14]. There are two tests clusters that have been shown to be effective at diagnosing SI joint dysfunction. The first special test cluster is called the provocation tests. There is one palpation and four tests that are included in this. The four tests are called the thigh thrust, the compression/distraction test, sacral thrusts, and the Gaeslen's test. 3/5 positive tests have a 91% specificity and 87% sensitivity making it a clinically relevant special test to rule in or out SI joint dysfunction[13]. The second test cluster is called the SIJ asymmetry cluster. There are four tests involved with this cluster. They are called the standing flexion test, seated PSIS test, supine to long sit test, and prone knee bend test. Three out of four positive tests for this cluster has been considered to be relevant to rule in or out SI joint dysfunction[13]. MRI and CT scans are also used for diagnosing SI joint

dysfunction. The gold standard in diagnostic testing for the SI joint is the sacral iliac intra-articular anesthetic block. This involves using an analgesic to numb the nerves innervating the sacral iliac joint and looking to see if this decreases or eliminates symptoms. Positive implications of SI joint dysfunction with the test are alleviation of symptoms of the SI joint[13].

The last diagnostic criteria that will be discussed are that for non-specific chronic low back pain. As a result of its non-specific nature the diagnostic criteria is vague. Non-specific chronic low back pain has been described as pain in the low back region that has lasted for longer than 3 months[1]. The patient may or may not experience pain radiating down into the buttocks or leg. The patient typically will have decrease hip and lumbar range of motion[14]. Also the patient will present with poor core strength[7]. The special tests listed above as well as many others may present with positive or negative signs. Diagnostic imaging such as MRI and CT will display negative results. Patients with chronic non-specific low back pain will often present with psychological symptoms. The three most common psychological disorder associated with chronic low back pain were depression, substance misuse, and anxiety disorders[6]. The link between psychological distress and low back pain emphasizes the need for psychological evaluation for possible concurrent diagnosis with non-specific chronic low back pain.

Prognosis

The prognosis for chronic low back pain continues to improve with further research and new rehabilitative techniques. Studies have shown that with therapy pain levels can decrease and remission times between episodes of low back pain can increase. Complete and total remission of pain in chronic low back pain is rare. A study done by Verkerk et al. found that 61.7% of patients had a 30% improvement in disability after two months of therapy. As has been discussed earlier, chronic low back pain is a very difficult musculoskeletal disorder to diagnose

and treat[15]. There are a variety of treatment options for chronic low back pain. There are surgical options based on the severity and form of chronic low back as well as pharmaceutical options to treat the pain. A conservative approach through physical therapy is another option. Types of conservative treatment options are manual therapy, use of modalities, and therapeutic exercises. Most often a combination of the three are used. In the following sections, different forms of therapeutic exercises will be discussed and assessed for their ability to treat chronic low back pain.

Therapeutic Exercise Treatment Option 1: Core Training

Core training is the most widely used therapeutic exercise treatment option for chronic low back pain. The definition of core training has changed over the years. In the past, core training was defined as the exercises that were essential in the training of athletes. These exercises included the squat, deadlift, bench press, and many others. However, in the mid-1990's researchers in Australia discovered the role of certain intrinsic muscles of the trunk in stabilizing the spine[16]. They found that three muscle groups are essential to the strength and stabilization of the low back. These three muscle groups are the transverse abdominis, the multifidi, and the rotators of the low back[16]. Core training can be divided into four major areas. These four areas are core control, core stability, core strength, and core function. All four areas must be improved to treat a patient with chronic low back pain.

Core control refers to when lower abdominal, low back, and pelvic muscles work together to stabilize the lumbar spine in order to protect it from non-functional motions. It also is used to build a strong base for all movements of the extremities to occur[16]. Core control exercises typically involve isometric movements of the extremity meaning little to no movement of the lumbar spine or pelvis occur. Core stability is the lumbar spine and pelvis ability to

support themselves in proper alignment when performing dynamic movements. Exercises falling under this category require multidirectional control of the lumbar spine and some form of instability. Instability can be introduced by using balancing on foam rollers or therapeutic balls while performing the exercise[16]. Core strength, as the name implies, involves strengthening the major muscle groups that perform movements of the lumbar spine and pelvis. These exercises cause strong contractions of the prime movers that cause visible movements. These exercises may be progressed as the patient's strength improves[7]. The last core area is the core function phase. This is the most important phase since these exercises are similar to the motions the patient will perform daily. These exercises are usually performed in the seated or standing position and are dynamic. Applying proper form to these exercises is essential[16].

A study was performed on 44 patients with chronic low back pain. These patients were divided into two groups, a control group and a treatment group. The treatment group was provided a ten week core program. They found that the treatment group had decreased pain and functional improvements at 0, 3, 6, and 30 months[2]. Another study was done on multifidus strengthening. A weak multifidus has been shown to have a high correlation with chronic low back pain. In a randomized trial of 39 patients with low back pain and multifidus strength asymmetry, those that received a core exercise program had increased multifidus size recovery in 10 weeks. Follow ups with these patients one and three years later found that those in the treatment group had a decreased incidence of low back pain when compared to those in the control group[2]. Reoccurrence of low back pain at one year was 84% in the control group and 30% in the treatment group and at three years was 75% in the control group and 35% in the treatment group. Another study was performed on female office workers. A total number of 53 participants were separated into a control and intervention group. The intervention group

received a 30-minute CORE program, five times per week, for eight weeks, with additional use of hot-packs and transcutaneous electrical nerve stimulation, while the control group used only hot-packs and transcutaneous electrical nerve stimulation[17]. The study found that the intervention group has significantly lower levels of pain at rest and with movement. The patients in the intervention group had significantly increased active range of motion and proprioception when compared to the control group suggesting that core training is an effective method for treating patients with chronic low back pain[17]. Core training is one of the therapeutic exercise methods that has been used to treat low back pain. Research suggests that a multi-exercise method approach is the most effective for treating those with chronic low back pain.

Therapeutic Exercise Treatment Option 2: The McKenzie Method

While core training has been shown to be effective at treating patients with chronic low back pain, there are other alternatives to treating the patient conservatively through therapeutic exercises. One alternative system is known as the McKenzie method. An advantage of the McKenzie method over core training is that it involves an assessment component. The assessment is of symptomatic and mechanical responses to repeated movements and sustained positions. Based upon the patients' responses to this assessment they are divided into one of three groups: derangement, dysfunction, and posture[18]. The group the patient is placed under will determine the exercise intervention they will receive. The derangement group typically makes up the largest group of patients. The patients experience pain that moves to a central location in the lower back with repeated movements known as centralization. Therefore these patients are treated with repeated movements or sustained positions that could reduce pain. Patients that are assessed as dysfunction have pain at end range of motion with only one movement and no centralization occurs with repeated movements. Patients are then treated with exercises in the

painful range of motion. The postural syndrome group is patients that experience intermittent pain upon prolonged positioning at end range of motion. An example of this would be sitting in a slumped position. Postural correction exercises are the treatment option for patients falling under this category[18]. Educating the patient to treat themselves is what makes the McKenzie method unique. The goal of the McKenzie method is to make the patient able to control their pain independent of the therapist. This is done through postural education, a specific home exercise program, and educating the patients to move through painful motions[18].

Studies regarding the McKenzie method have found varying results. One study done on 148 patients with chronic low back pain found the McKenzie method was effective for treating both pain and disability. The study also found that the McKenzie method was a more effective treatment option than other therapeutic exercise intervention methods such as the Back School[19]. However, another study found conflicting results. This study was performed on 148 individuals who were divided into two groups. The first group saw a doctor and was given advice to take acetaminophen and keep moving. The second group received the same treatment as the first group, but was also given a McKenzie method treatment intervention. The study found that after a three week follow up the patient had no significant differences in pain, disability, or function when compared between groups[20]. Results of this study mean that the McKenzie method is not an effective short term treatment method. However, it does not mean that the McKenzie method is ineffective as a long term method of treating low back pain or at preventing further low back pain episodes from occurring. Conflicting results regarding the McKenzie method are common due to researcher bias.

Therapeutic Exercise Treatment Option 3: Pressure Biofeedback

Core training and McKenzie method both focused on strengthening the entire trunk and appendages of the body. The pressure biofeedback unit, however focuses on strengthening one muscle of the core, the transverse abdominis. The transverse abdominis is the only muscle in the core that connects to the abdominal wall as well as to the spine making it essential for pelvic and lumbar stability. It also the most internal muscle of the abdomen located behind the internal oblique[21]. Contraction of transversus abdominis leads to increased intra-abdominal pressure, tensioning of the thoracolumbar fascia and a narrowing of the abdominal wall without pelvic or spine movement. This limitation of pelvic and spine movement is necessary in preventing low back pain.

It is very difficult to measure a contraction of the transverse abdominis or to tell if the transverse abdominis is contracting at all. Electromyography is the most accurate way to see if the patient is contracting their transverse abdominis during exercise. However, this is very expensive, involves training, and is painful for the patient, therefore it is not practical in clinical use. The biofeedback pressure unit is a cheap and simple mechanism that can be used to measure if the transverse abdominis is contracting[21]. The biofeedback pressure unit looks similar to a blood pressure cuff. The pad is placed under the lumbar spine and air is placed into it until the pressure monitor measures 40mmhg. The patient is then told to contract their transverse abdominis until the pressure monitor reads 60mmhg. The patient then must keep the monitor with ±5mmhg of 60mmhg throughout the duration of the exercise. It is also important that the patient maintain breathing while completing the exercise.

A study was done on 30 participants in India who were suffering from low back pain. The participants were divided into two groups. Group A received lumbar stabilization exercises

with a biofeedback unit and group B received only lumbar stabilization exercises. The study found significant improvements in disability in group A, 3 weeks from baseline, compared to group B. These results suggest the using a biofeedback unit with lumbar stabilization exercises may be considered as a useful tool for deep abdominal function. Lumbar stabilization exercises using pressure biofeedback are more beneficial than lumbar stabilization exercises alone in mechanical low back pain patients[22].

Conclusion

Chronic low back pain is an epidemic that is running rapid through the United States and other industrialized countries throughout the world. Back pain is one of the most frequent reasons cited for patient visits every year. It is the second most reason for days of missed work following the flu2. Because of the chronic nature of low back pain, it is the United States' number one cause of disability. Studies have estimated that 149 million workdays are missed in the United States every year due to low back pain. This time off work costs the United States an estimated $100-$200 billion dollars each year. Worse yet studies have shown that it continues to increase. Chronic low back pain is defined as pain persisting in the low back region for greater than three months. Chronic low back pain may originate from a variety of factors. These factors can include, but are not limited to injury, disease, or different stressors on the body. Pain in the low back region may be felt as sharp, dull, achy, burning, specific, or vague. Three of the major forms of chronic low back pain are discogenic low back pain, SI joint dysfunction, and non-specific chronic low back pain. Due to the wide variety of forms of chronic low back pain there is no set standard for diagnosing chronic low back pain. Imaging such as MRI and CT are used in most cases to diagnose chronic low back pain. Along with diagnostic imaging, an accurate medical history, objective measurements, and special tests are used to diagnose an individual

with chronic low back pain. Due to the wide variety and complex nature of chronic low back pain there are many treatment options for it. The conservative approach for chronic low back pain includes rest, therapeutic exercises, modalities, and manual therapy. Typically a well-developed conservative treatment approach will include aspects of all 4. There are invasive approaches for the treatment of chronic low back such as surgery. Surgery should be used as a last approach when conservative options have not been effective. As a result, this literature review analyzed chronic low back pain as an osteopathic disease as well as reviewed whether or not therapeutic exercises were a valid treatment option for chronic low back pain. Many peer reviewed sources were gathered and analyzed to answer this hypothesis.

The first therapeutic exercise that was evaluated was core training. One study found that the intervention group has significantly lower levels of pain at rest and with movement. The patients in the intervention group had significantly increased active range of motion and proprioception when compared to the control group suggesting that core training is an effective method for treating patients with chronic low back pain. Another study found that core training was also effective for strengthening the multifidus, a major contributor to low back pain. This study found that those who received a core exercise program had increased multifidus size recovery in 10 weeks. Follow ups with these patients one and three years later found that those in the treatment group had a decreased incidence of low back pain when compared to those in the control group. From the research examined, a core training program is an effective treatment option for patients suffering from chronic low back pain. The second therapeutic exercise treatment option examined was the McKenzie method. The studies examined had conflicting results about the effectiveness of the McKenzie method for treating chronic low back pain. The first study found that the McKenzie method was more effective for treating pain and disability

than other forms of therapeutic exercises for low back pain. However, the second study found very different results. This study concluded that the McKenzie method, as a treatment option for low back pain, was no more effective at treating pain and disability than just going to the doctor and taking acetaminophen. As a result further research is needed to determine if the McKenzie method is a valid treatment option for chronic low back pain. The final treatment option that was examined was the pressure biofeedback unit. The studies suggested that the biofeedback unit with lumbar stabilization exercises may be considered as a useful tool for deep abdominal function. They also found that lumbar stabilization exercises using pressure biofeedback are more beneficial than lumbar stabilization exercises alone in mechanical low back pain patients.

Each therapeutic exercise treatment option was different. Therefore, each option provided certain benefits. As a result, multiple therapeutic exercises treatment options should be incorporated into a treatment plan for a patient with chronic low back pain. Every patient is different and as such each patient should be given treatments in a way that benefits them the most. This researched confirmed the hypothesis that therapeutic exercises are a beneficial treatment option for patients suffering from chronic low back pain.

Further research should evaluate the effectiveness of a combination of therapeutic exercise methods in the treatment of chronic low back pain. It should then compare that to single methods in order to find out what combinations are most effective. This research can now be used by athletic trainers, physical therapists, and personal trainers in the treatment of patients suffering from chronic low back pain.

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