Spring 5-19-2021

The effects of the McKenzie Method and strengthening/ stabilization exercises in patients with chronic nonspecific low back pain.

LuFei Harder

Murray State University Honors College

HONORS THESIS

Certificate of Approval

The effects of the McKenzie Method and strengthening/stabilization exercises in patients with chronic nonspecific low back pain.

LuFei Harder
May 2021

Approved to fulfill the
requirements of HON 437

_____
Dr. Amelia Dodd
Applied Health Sciences

Approved to fulfill the
Honors Thesis requirement
of the Murray State Honors
Diploma

_____
Dr. Warren Edminster, Executive Director
Honors College

Examination Approval Page

Author: LuFei Harder

Project Title: The effects of the McKenzie Method and strengthening/stabilization exercises in patients with chronic nonspecific low back pain.

Department: Applied Health Sciences

Date of Defense: April 19, 2021

Approval by Examining Committee:

_____ _____
(Dr. Amelia Dodd, Advisor) (Date)

_____ _____
(Mr. Jeremy Erdmann, Committee Member) (Date)

_____ _____
(Dr. Jessica Naber, Committee Member) (Date)

The effects of the McKenzie Method and strengthening/stabilization exercises in patients with chronic nonspecific low back pain.

Submitted in partial fulfillment
of the requirements
for the Murray State University Honors Diploma

LuFei Harder

May 2021

ABSTRACT

Background & objective: Low back pain is a frequent problem that the majority of people will face at some point in their lifetime. Exercise has been advocated as an effective treatment for chronic nonspecific low back pain; however, there is a lack of consensus on the best form of exercise treatment. This review was designed to compare the effectiveness of the McKenzie Method against stabilization/strengthening exercises in patients with chronic nonspecific low back pain.

Methods: A literature review examining McKenzie and stabilization exercises for chronic nonspecific low back pain were identified from three databases.

Results: A total of nine articles were selected to be included in this review. Included in this review was one systematic review, one literature review with meta-analysis, two reviews, four randomized controlled trials (RCT), and one test-retest design. Each study included McKenzie Method and/or stabilization exercises. Pain and functional disability were reported as outcome measures.

Conclusion: Each of the studies reported improvements in the form of decreased pain and/or functional disability with the use of the McKenzie Method and/or stabilization/strengthening techniques. The selection of the treatment intervention should be individualized based on patient presentation and examination findings.

Key Words: McKenzie Method, MDT, Chronic Nonspecific Low back pain, Stabilization exercises

TABLE OF CONTENTS

LIST OF TABLES AND IMAGES

Image

Table

INTRODUCTION

Low back pain (LBP) is located in the lumbosacral spinal region and the paraspinal region which encompasses the buttocks and upper thigh and is considered one of the most common problems in adults.[1,-5] The incidence and prevalence of low back pain constitutes a major public health issue with widespread economic, physiologic, and psychological costs.[2,4-6] LBP affects over 50% of the general population, and over 70% of adults have at least one episode of LBP in their lifetime.[2,5,7-9] In the United States, over $100 billion a year is put toward treating LBP.[11] Contributing to the economic burden is the large number of work days lost due to having to go to treatments, or because the pain is so intense it affects the individual's daily living activities.[12] One researcher estimated a $3.2 billion reduction in the gross domestic product due to LBP, and found back pain to be the leading cause of early retirement for working individuals.[4]

Low back pain is one of the most common medical problems that leads to an absence from work, activity restrictions such as carrying objects, sitting, or standing for long periods of time, twisting, and squatting, and participation limitations in work, recreational activities, and family events, and functional disability.[1,2] Research has supported the idea that individuals that suffer from low back pain are often part of the fear-avoidance model, which states that people's fear of pain aggravates pain, leading to chronic pain and long term functional disability.[1] By alleviating a patient's back pain through exercise it in turn helps patients recover physically and psychologically.[1,10] Exercise helps patients confront their pain and lead to recovery as they can conquer their fear of pain and no longer have to avoid the pain associated with their low back.[1,10]

There are often risk factors associated with LBP that include smoking, obesity, age, gender, physically strenuous work, and sedentary work.[13] Research has determined the two main causes of low back pain to be from prolonged periods of sitting and a lack of exercise.[2]

Low back pain is often associated with the clinical findings of 1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, 2) referred or radiating pain into a lower extremity, and 3) generalized pain, which allow clinicians to classify a patient into more specific low back pain categories.[5] Low back pain can present in adults as chronic low back pain (CNLBP), subacute, and acute low back pain (ALBP).[1,-3,7,14] Previous studies have defined CNLBP as a back pain problem that has lasted more than 12 weeks (3 months).[3] Acute low back pain has been defined as less than 6 weeks in duration.[1,3,14] Individuals can be further classified into specific or nonspecific low back pain. The majority of individuals that are treated for back pain are treated for nonspecific back pain (>85%), but in about 1-10% of cases a specific cause is identified.[12,13] Individuals are classified with specific low back pain if they present with any of the following conditions: cauda equina compression, fractures, severe radiculopathy, spondylolisthesis (grade 2 or greater) or spondylolysis, previous back surgery, or spinal stenosis.[15,16] Individuals that do not present with any of the previously mentioned conditions are categorized as nonspecific low back pain as no specific pathophysiological mechanism explains the back pain.[1,3,7]

Patients with CNLBP may present with weakened core, back instability, and postural malalignment resulting in recurrent low back pain.[11,15] This review will explore two different interventions commonly used in rehabilitation settings to reduce back pain

and functional disability in adults that present with CNLBP. Following a brief review of spinal anatomy and pathophysiology of the spine, the researcher will provide an overview of the methods used to find articles to include in this review, will relay results of these studies, and will discuss the implications of adding these exercise methods into an individual's treatment plan in the clinic.

The aim of this review was to address the following clinical question: In adults with low back pain, is the McKenzie Method more effective than strengthening/stabilization exercises in decreasing pain and improving overall function?

Spinal Anatomy

The spinal structure is designed to help individuals maintain upright posture and absorb shock through three normal curves: cervical lordosis, thoracic kyphosis, and lumbar lordosis.[2] Proper spinal alignment also depends on static stabilizing structures such as the facet joints, spinal ligaments, and intervertebral discs. The muscles provide dynamic stability by absorbing the energy of loading on the spine.[2] The core muscles, consisting of the trunk muscles from the diaphragm to the pelvic floor muscles, help provide dynamic stabilization for the lumbar spine as seen in Image 1.

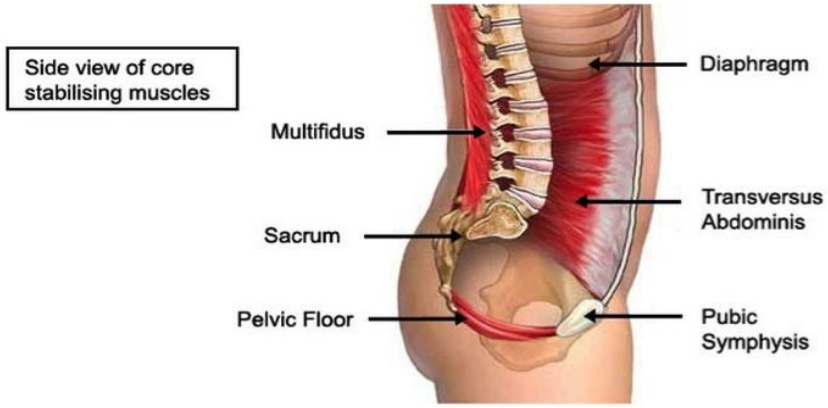


Image 1. Lateral view of the core stabilizing muscles.[17] The deep core muscles include the Multifidus, Transverse Abdominis, Internal Obliques, Diaphragm, and the Pelvic Floor muscles.[17]

The anterior core muscles include the rectus abdominis, the internal and external obliques, and the most critical muscle for stability, the transversus abdominis.[2] The transversus abdominis muscle is used to maintain spinal alignment in the neutral position and help to better support the spine under greater load without comprising the position of the spine.[2] As seen in Image 2, the erector spinae muscle group, includes the spinalis, longissimus, and iliocostalis, span multiple levels of the spine to provide individuals with erect posture.[2] Deep to the erector spinae muscles is the multifidus, semispinalis and rotatores muscles that help provide segmental stability to the individual

vertebrae and increase the stiffness of the spine during functional movement and when spinal stability is challenged.[2,18] The deep compartment muscles of the lumbar and abdominal regions, specifically the multifidus and the transverse abdominis, provide essential stability to the spine and are the most critical to stabilize the spine during activity.[2]

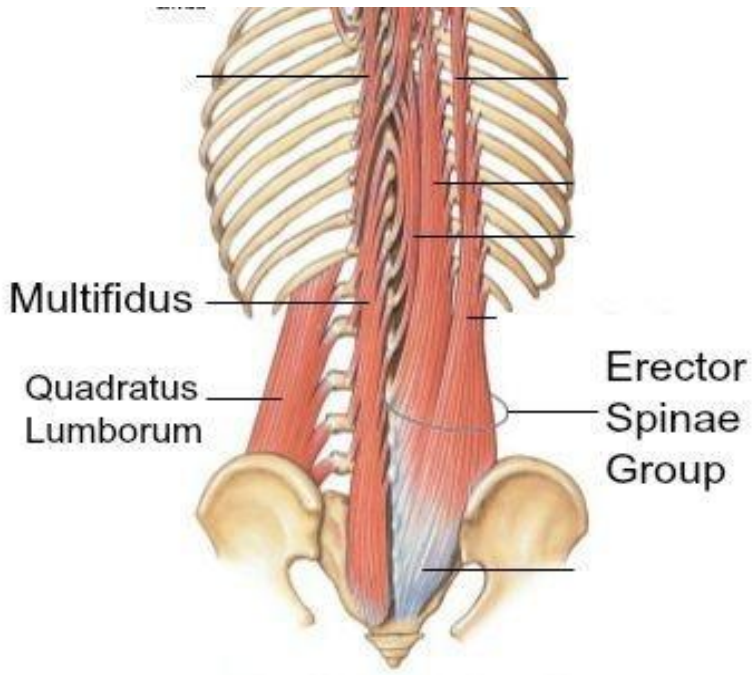


Image 2. Posterior view of the erector spinae group and multifidus muscles that provide support to the spine to maintain stiffness during functional movement.[19]

Intervertebral Disc Structure

The intervertebral disc is a fibrocartilaginous tissue designed to absorb and dissipate the loads on the spinal column and allow smooth movement of the spine.[8] A

disc is made up of a tough outer ring called the annulus fibrosus that protects the gel-like interior of each disc, known as the nucleus pulposus.[6,8] The nucleus pulposus is normally made up of 70-80% water content to help maintain disc height and dissipate loads.[8] In a healthy intervertebral disc, the vascular and neural elements are limited to the peripheral fibers of the annulus fibrosus.[8] Image 3 compares a healthy disc to a degenerated disc.

Pathophysiology of Low Back Pain

Research has shown that prolonged sitting is detrimental to the maintenance of proper spinal alignment and stability as there is an increased mechanical load placed on the spine leading to an increased prevalence of low back pain in adults.[2] One research study found that while standing, approximately 100-kg of compression is being placed on to the spinal discs and with sitting these forces increase to approximately 140-kg. Compression on the spine can rise to 185-kg with forward bending while sitting.[2] Overloading the deep compartment muscles can lead to muscle injury, atrophy, fatigue, spinal joint or disc herniation/degeneration which can compromise the stabilizing effects of these structures resulting in shearing forces that can cause low back pain as seen in Image 3.[2,6] In individuals with CNLBP, the multifidus was found to be smaller compared to healthy individuals at different levels of the lumbar spine.[20] As the multifidus becomes more atrophied, the more unstable the spine becomes as the multifidus can no longer effectively provide dynamic stability.[2,5,20] Researchers have reported that patients with LBP will often find the multifidus more difficult to activate than the transversus abdominis or pelvic floor muscles.[18] Since, the multifidus is important to segmental spinal stability it is important for individuals to focus on re-educating this muscle as well

as the transversus abdominis.[18] Low back pain is often a symptom of the weakened muscles in the lower lumbar region of the spine which can lead to functional disability and pain in individuals, and it can lead to disc degeneration and herniation.[2,18,20]

The causes of low back pain vary from each individual but potential sources include the intervertebral discs, facet joints, vertebrae, neural structures, muscles, ligaments, and fascia.[8] One of the most common causes that may lead to low back pain is general disc degeneration (Image 3).[6] Disc degeneration can cause an inflammatory response which plays an important role in pain generation at the low back level.[6] The relationship between intervertebral disc degeneration and low back is not clearly understood by researchers as there are many contributing factors to low back pain.[8] Degenerated discs may have an increased growth of nerve fibers and blood vessels within the annulus fibrosus and nucleus pulposus, or increased sensitization of nerve endings by release of chemical mediators that may contribute to the development of pain in the back.[8] Another factor of disc degeneration is the loss of disc structure that may alter the loading response and alignment of the rest of the spinal column, including the facet joints, ligaments, and muscles, which may also become pain generators.[8] As individuals get older disc volume and shape change, and may result in degenerative changes of lumbar discs by age 50.[8] Over time, discs will begin to break down due to general wear and tear and the discs will lose some of the fluid that makes them spongy, and as a result, the disc becomes flatter and harder.[6] Image 3 shows an example of a degenerative disc impinging on a nerve that could cause the patient pain compared to a healthy disc that does not affect the spinal nerves.

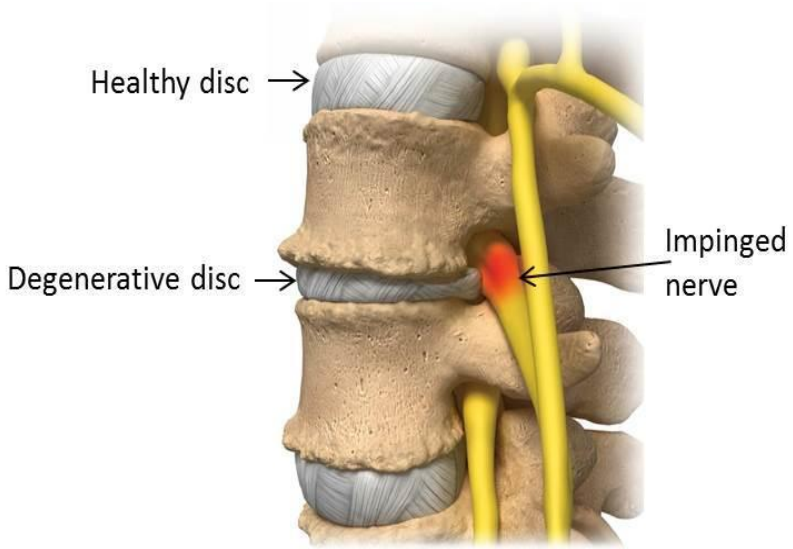


Image 3. Lateral view of a healthy disc versus a degenerated disc that has led to an impinged nerve in the spine.[21]

As more pressure or stress is placed on the spine, the disc's outer ring (annulus ring) may begin to bulge, crack, or tear.[6] These injuries are often seen in the lower back near the lumbar section of the spine due to adults twisting or bending.[6] The disc protrusion will begin to push against the nearby spinal nerve root, irritating the nerve.[6] This is known as a herniated disc, an example can be seen in Image 4.[6] A herniated disc is a spinal degenerative disorders that can occur in the lower back and will cause symptoms that include: pain in the patient's buttocks, thigh, and calf, numbness or tingling, and weakness in the muscles innervated by the affected nerve.[6]

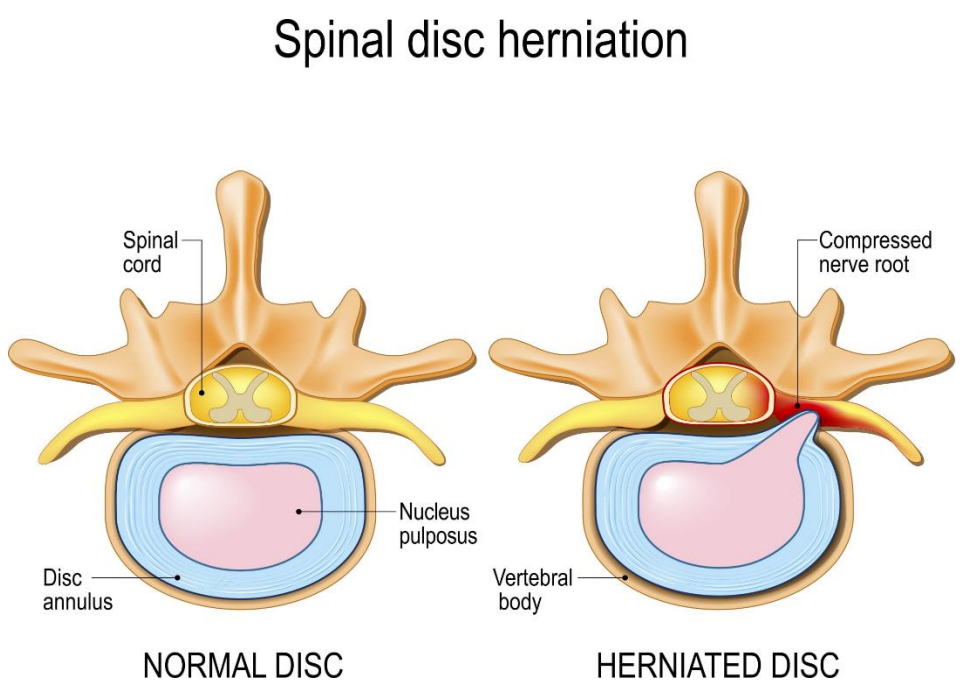


Image 4. Normal disc versus a herniated disc causing a compressed nerve root.[22]

One study determined there was an increased incidence of herniated discs in individuals with more fatigued or weakened multifidus and transverse abdominis muscles.[23] Muscle injury or fatigue or disc degeneration can compromise the stabilizing effects of the structures in the spine causing pain.[2,6] Therefore, it is essential for individuals to strengthen their deep compartment muscles that help stabilize and support the spine to decrease the wear and tear on the discs and decrease the chance of a herniated disc.[23] It is vital individuals understand the importance of healthy intervertebral discs as they are what helps with posture and dissipating the loads placed on the spine.[6] To help reduce disc degeneration and improve the stability of the spinal

column individuals can participate in various exercises to improve posture/alignments, improve movement mechanics, and strengthen the surrounding tissues and muscles.

Effective, efficient treatment of individuals with low back pain include surgical or conservative (nonsurgical) treatments.[24] Ninety percent of sciatica (a type of pain that emanates from the low back) cases caused by lumbar disc herniation was reduced when treated with conservative measures.[24] The conservative treatment included physical therapy, ergonomic instruction, education/counseling for home-based exercises, and pharmacological treatments like non-steroidal anti-inflammatory drugs (NSAIDs).[24] One study found no supportive evidence that surgical treatment reduced the severity of sciatica pain or improved the quality of life of patients with disc herniation when compared to conservative treatments.[24] The researchers did find that individuals pain was relieved more quickly for those that received the surgical treatment, but the difference was no longer present after 3 months.[24] But, surgery was not more effective for improving quality of life or functional disability, or for improving pain levels at the midterm and long-term follow up.[24] Surgical intervention is more beneficial for individuals that have debilitating pain symptoms and are seeking quick pain relief, but both surgical and conservative treatments had long-term beneficial effects for individuals with LBP.[24] The Low Back Pain Guidelines recommends the use of physical exercise, or other non-pharmacological treatments.[10] Treatments often consist of pain education, and education about the causes of LBP, the mechanisms, and the prognosis.[3,10] Therapists should promote the benefits of physical activity and exercise as a treatment tool, or promote exercise alone or in combination with education to prevent and manage CNLBP.[3,10] Low back pain guidelines promote the avoidance of

bed rest and the continuation of activities, modified as needed, and the use of exercise as a first-line treatment.[10] There are a variety of exercise programs that can be used as treatment for LBP including: yoga, stretching, hydrotherapy exercises, tai chi, McKenzie exercises, and back schools. These treatments can be done as group exercise, individual programs, or home exercises.[10] A thorough evaluation/examination is important as it helps guide the therapist in choosing the most beneficial intervention for the patient. Two common interventions to help reduce back pain and functional disability are the McKenzie Method and core stabilization and strengthening exercises.

McKenzie Method

Clinical guidelines have reported that patients can control and manage back pain through patient instruction and participating in various treatments that focus on exercise programs.[1,7] There are a variety of different exercises individuals can do depending on what category of back pain they present with.[7] The McKenzie Method or the Mechanical Diagnosis and Therapy (MDT), devised by Robin McKenzie, is commonly used by therapists as an assessment and treatment for low back pain and has been used all over the world for more than 60 years.[1,4,5,10,14-16,25, 26] The MDT treatment uses the patient's history, clinical presentation, and a physical examination to determine the course of treatment for an individual.[4,14-16,26] Patients can be categorized into one of three main syndromes (postural, dysfunction, and derangement) to help guide treatment decisions.[4,14-16,26] In MDT, patients can also be categorized based on clinical signs and symptoms including centralization (CEN) and directional preference (DP).[4,14-16,26] Centralization and directional preference are non-transient therapeutic responses that can be elicited during the initial assessment.[16,27] Centralization is a phenomenon in

which distal pain originating from the spine progressively moves to, and remains in, a more central location in response to certain postures or repeated end-range movements.[5,16,27] Directional preference describes the clinical phenomenon in which certain postures or repeated end-range movement result in a lasting decrease in symptom severity and/or have a positive mechanical response such as an increase in ROM.[5,16,27] Directional preference is identified when posture or repeated end-range movements in a single direction (flexion, extension, or side-glide/rotation) decrease or abolish lumbar pain, or cause the referred pain to move more centrally (towards the mid back, neck, or low back).[5,16,27] All patients categorized as CEN have a DP, but some patients with a DP do not have CEN (i.e. patients that already have centralized pain have a directional preference, but patients that have directional preference do not always experience centralization).[4,6,16] Patients who present with CEN or DP are prescribed direction-specific exercises that coincide with their directional preference.[4,5,16,27] Research has shown that pain diminishes and overall mobility improves more rapidly in patients who receive direction-specific exercises consistent with their DP than in patients receiving non consistent exercises, or in patients without a DP.[4,5,16,27]

The McKenzie Method approach is to be used as rapid symptom relief intervention in individuals and is used to assess and manage spinal and extremity musculoskeletal disorders.[3,16] The goal of the McKenzie Method is to have the patient be actively involved in their treatment by performing the prescribed exercises five or six times a day compared to the normal treatment in the clinic of once or twice per week.[25] The long term effects of a patient learning how to self-treat low back pain problems

through the McKenzie Method allows patients to minimize their risk of recurrence and self-treat their symptoms if they recur.[25] The McKenzie Method is known to be an effective and reliable assessment and treatment tool for low back pain, as well as an early prognosis tool for clinicians.[25]

Strengthening and Stabilization Techniques

Another common treatment for LBP involves various exercises to improve the strength and stabilization of the core and back musculature.[1,2,7] The use of strengthening and stabilization exercises have been used on patients with non-specific, chronic and acute low back pain.[1,2,15] Various studies have determined a decrease in spinal stability is one of the major causes of recurrent LBP.[1,2,9,26] Findings suggest that more emphasis should be placed on training the local stabilizer muscles; transversus abdominis and multifidus muscles.[1,2,9,26] Exercises can also focus on other paraspinal, abdominal, diaphragmatic, and pelvic muscles to maintain and improve lumbar spine stability.[1,2,9,26] Core stabilization exercises are aimed at improving neuromuscular control, endurance, and strength of muscles, central to maintain dynamic spinal stability.[9] Research from one study reported individuals with chronic low back pain had delayed activation of their transversus abdominis with respect to their erector spinae, as well as significant atrophy of the multifidus muscle.[1,9]

Retraining the stabilizing muscles of the core is done in a series of steps.[2,28] The first step is to learn how to isolate each individual muscle of the core.[28] The second step is to learn how to co-contract the transverse abdominis in conjunction with the other muscles associated with the core.[28] The final step is to co-contract the entire core including the pelvic floor, transversus abdominis, and multifidus with the larger

superficial muscles during functional activities.[2,28] To isolate and engage the transversus abdominis the individual wants to try to move their navel closer to the spine, or inhale deeply and then slowly blow air out the lips while pulling the navel closer to the spine, this is also called the abdominal drawing-in maneuver (ADIM).[2] To isolate the multifidus (located deep posteriorly), individuals are lying prone (on their stomach) on the table, and are instructed to take a relaxed breath in and out, hold the breath out, and then try to "swell" or contract the muscle.[2] Once individuals learn how to isolate the transversus abdominis and multifidus separately, they can then learn how to co-contract the two together.[18,28] Individuals can activate the deep core structures by co-contracting the transversus abdominis and multifidus muscles, resulting in decreased pain for those with low back pain.[2,28] If the individual is lying supine (on their back) on the ground for the ADIM technique, it is important to not squeeze the buttocks or tilt the pelvis as this will work the superficial abdominals and rectus abdominis, and instead the individual needs to maintain the spine's neutral position or lordosis curvature of the spine to engage the proper muscles.[2] To get the full benefit of strengthening exercises for the core muscles, it is important for an individual to first learn how to activate the deep core muscles through the ADIM technique.[2] The "suck it in" technique is most beneficial for individuals that have chronic low back pain, have had back or abdominal surgery, postpartum women, children with scoliosis, athletes and sedentary individuals.[2] Research has shown that individuals that re-trained their deep multifidus and transversus abdominis muscle showed greater improvement in pain and functional disability compared to individuals that only participated in traditional back exercises.[2]

The “suck it in” maneuver activates the body’s anatomical support system and begins retraining the anatomical girdle to further support the spine.[2] Once the individual has mastered this technique, the anatomical girdle will automatically fire to provide dynamic spinal stabilization during daily activities.[2] The individual can then take the mastered “suck it in” maneuver and begin doing beginner level exercises as they build on retraining their muscles, and then move on to more advanced exercises as their core muscles become stronger through treatment.[2] An example of an advanced exercise that implements the ADIM technique is walking with abdominal hollowing and it is a daily functional activity that activates the trunk muscles, particularly the transversus abdominis and multifidus.[29]

Outcome Measures

Physicians use outcome measures to determine an individual's pain intensity, functional disability, or both related to their low back pain.[1] These tools are useful for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring changes in the patient’s status throughout their course of treatment.[5,30-32] Clinicians can also assess activity limitation and participation restriction through validated performance-based measures, and can use these same measures throughout the course of treatment.[5] Outcome measures for pain include the Visual Analog Scale (VAS) for pain, the Numeric Rating Scale (NRS), and McGill Pain Questionnaire (MPQ). The visual analog scale is a validated, subjective measure for acute and chronic pain.[30-32] Individuals can self-report their score by making a handwritten mark on a 10-cm straight line that represents a continuum between “no pain at all” on the left end of the scale (0 cm) and “worst pain/pain as bad as it could be” on the right end of the scale (10

cm).[30-32] The distance between “no pain at all” and the mark defines the subject’s pain level.[30-32] An example of the VAS can be seen in Appendix A. The numeric rating scale involves having the individual circle the number between 0 and 10 that fits best to their pain intensity.[32] Zero usually represents “no pain at all” whereas ten represents “the worst pain ever possible.” The NRS is a segmented numeric version of the VAS in which the individual places a mark or selects a number that best reflects the intensity of their pain.[31,32] The values on the scale allow a therapist to interpret their pain level and can use these scores to track an individual’s progression throughout their treatment.[31,32] The McGill Pain Questionnaire (MPQ) is a self-reported measure of pain and consists of three major measures: pain-rating index, the number of words chosen to describe pain and the present pain intensity based on a 1-5 intensity scale.[32] The McGill is the most extensive tool to measure pain affection as it assesses both the quality and intensity of subjective pain.[32] The MPQ is composed of 78 words that individuals can choose from that best describe their experience of pain. The pain-rating section of the questionnaire is built on a numerical grading of words describing sensory, affective, and evaluative aspects of pain; the affective subscale further consists of five sets of words individuals must choose from to describe the pain affect.[32] An example of the McGill Pain Questionnaire can be seen in Appendix B.

There are also a variety of outcome measures that are used to measure disability in individuals with low back pain and how it may affect their daily living.[33] The disability tools include the Roland-Morris Disability Questionnaire (RMDQ) and the Oswestry Disability Index or Questionnaire (ODI/ODQ). The RMDQ measures disability in patients with low back pain.[33] The RMDQ is a self-report questionnaire that consists of 24

statements about how low back pain affects functional activities.[33,34] Individuals can check each item that applies to them for that day, and then the number of checked items is added up which gives the individual a total score.[33,34] The items on the checklist include daily activities and functions that may be affected by LBP, such as housework, sleeping, mobility, dressing, getting help, appetite, irritability, pain severity, and impairment.[34] An example of the Roland-Morris Disability Questionnaire can be seen in Appendix C. The ODI/ODQ can be used to assess pain related disability in people with acute, subacute, or chronic low back pain.[34] The questionnaire covers one question on pain and nine additional questions on activities of daily living (personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and traveling).[34] Each item is measured on a 6-point scale, ranging from best scenario (pain does not prevent the patient from participating) to the worst scenario (the pain does prevent the patient from participating at all).[34] An example of the Oswestry Disability Index can be seen in Appendix D.

METHODS

PubMed, EBSCOhost/MEDLINE and Google Scholar were used to attain high quality resources and studies that investigated the effectiveness of exercise therapy in patients with CNLBP. These databases are important to the review as they contain health and social care and medical journals that focus on the McKenzie Method and various exercise therapies for individuals with low back pain. Search strategies are provided in Table 1. Search terms and Boolean operators included “chronic” AND “nonspecific” AND “low back pain” OR “McKenzie Method" OR/AND “stabilization” AND/OR “strengthening” AND “exercise” AND “transverse abdominis” AND “multifidus

OR “MDT” AND/OR “centralization with or without directional preference” can be seen in Table 1.

Table 1. Search Strategy

Key Words	PubMed	EBSCO/MEDLINE	Google Scholar
“Low back pain” OR “Back pain” OR “Lumbar spine pain”	72,975	69,399	18,200
Chronic and/or Nonspecific	1,323,316	3,580	220,000
“Transversus abdominis” OR “Multifidus” OR “Core muscles”	31,801	4,379	858
“Stabilization exercise” OR “Strengthening exercise” OR “McKenzie Method”	19,066	3,192	18,200
“MDT” OR “mechanical diagnosis and therapy”	2,659	3,331	7,190
“Centralization and/or directional preference”	41,644	518	16,700

After the initial search returned thousands of articles, the researcher combined more of the search terms and Boolean operators to further reduce the number of articles available to the researcher. The articles were once again narrowed down by excluding the duplicate articles from each database, and then the remaining articles were included or excluded from the review based on the search criteria as seen in Table 2. Studies were also excluded from the review if participants had neurological disorders, systemic

diseases, cardiovascular diseases, were pregnant, or had serious comorbidities, or were classified as having specific low back pain.[15,16]

Table 2. Search Criteria

Search Criteria
Inclusion Criteria ● Studies about McKenzie Method, MDT or core stabilization and strengthening exercises or both together. ● Studies involving participants with chronic nonspecific low back pain. ● Studies include measurement of pain and disability outcomes. ● Studies that include participants with age over 18 years. ● Studies that include individuals with centralization or a directional preference.
Exclusion Criteria ● Studies that included participants with diagnosed structural abnormalities associated with their LBP. ● Studies that included participants with chronic/systemic illnesses ● Studies that include participants with spinal pathology, history of cancer, serious neurological problems, pregnancy, severe osteoporosis, spondylolisthesis, spondylitis, or rheumatoid arthritis. ● Studies that included participants with specific low back pain. ● Studies that included participants with acute or subacute low back pain

Table 3. Search Terms Used to Guide Search Strategy

- **P**atient/Client Group: Adults with chronic nonspecific low back pain
- **I**ntervention (Assessment): McKenzie Method/MDT
- **C**omparison: Strengthening and/or stabilization exercises
- **O**utcome(s): Pain rating scale and/or functional disability scale

RESULTS

A total of nine articles were included in this review. Table 4 describes the study characteristics from each article included and the study design. Included in this review was one systematic review, three literature reviews, four randomized controlled trials (RCT), and one test-retest design. Out of these nine articles, three articles directly compared McKenzie stabilization exercises, two articles focused on

stabilization/strengthening techniques, four articles focused on the McKenzie treatment, centralization, or directional preference in individuals.[1,4,7,10,15,16,24,26,27]

Table 4. Study Characteristics

Author(s), Title, Journal	Study Design	Participants	Interventions	Findings
Hosseinifar et al.[15] (2013)	RCT	Inclusion: age between 18-50 years, CLBP in the area between the costal margin and buttocks, without reference to the lower extremity (no radicular) pain that lasted more than 3 months.	Stabilization exercise group vs. McKenzie exercise group	Pain decreased following the application of stabilization and McKenzie exercises. Disability decreased only after the application of stabilization exercises.
Busanich et al.[27] (2006)	Literature Review	Each study had to be a randomized or quasi-randomized controlled trial, and the subjects' primary complaint was nonspecific low back pain or neck pain with or without radiation to the extremities.	McKenzie Method vs. NSAIDS, educational booklet, back massage with back care advice, strength training with therapist supervision, spinal mobilization, or general mobility exercises.	McKenzie therapy results in a decrease in short-term pain and disability for low back pain patients compared with other standard treatments. No difference was found between McKenzie therapy and other therapies at intermediate-term follow.

Alhakami et al.[1] (2019)	Systematic Review	The studies had to be randomized controlled trials (RCTs), involve patients with nonspecific chronic low back pain, participants over 18 years old, be about McKenzie or stabilization or both together.	McKenzie therapy group vs. stabilization exercise group	Both McKenzie and stabilization exercises were effective in reducing pain and functional disability scores among individuals suffering from chronic non-specific low back pain.
Halliday et al.[4] (2016)	RCT	Inclusion: a history of 3 months or greater and a DP observed.	McKenzie method vs. motor control exercises	Clinicians could consider using either method; however, patients that did McKenzie reported greater improvement in sense of recover in the short term
Lam et al.[35] (2018)	Literature review with Meta-analysis	Included RCTs examining MDT in patients with LBP.	Effectiveness of McKenzie Method	In patients with CNLBP there is moderate-to high quality evidence that MDT is superior to other rehab interventions for reducing pain and disability.
Moon et al.[7] (2013)	RCT	Patients suffering from nonspecific LBP without any structural or neuropsychological cause, for more than 3 months were included.	Lumbar stabilization vs. lumbar dynamic strengthening exercises	Both lumbar stabilization and dynamic stabilization strengthened the lumbar extensors and reduced LBP.

Akhtar et al.[26] (2017)	RCT	Subjects between the ages of 20 to 60 years and primary complaint of chronic low back pain were recruited.	Core stabilization exercise vs. routine physical therapy	The stabilization exercise program was more effective in reducing pain.
Shipton.[10] (2018)	Literature Review	Studies that looked at different physical interventions for individuals with LBP.	Pilates, yoga, walking, mobilization and manipulation, movement control exercises, and McKenzie Method.	Physical therapy is a first-line treatment for CLBP as it results in decreases for disability.
Apeldoorn et al.[16] (2016)	Test-retest design	Patients presented with LBP as the primary complaint, with or without associated leg pain.	CEN and DP on spinal control in patients with NLBP.	Patients with DP-with-CEN showed improvement in clinical signs of spinal control compared to patients with DP-without-CEN.

According to all the research studies that were included in this review, the outcome measures that were used focused on either pain intensity or functional disability, or both.[1] The outcome measure tools used in the studies varied; for example, studies used pain tools including, the Visual Analog Scale (VAS) for pain, the Numeric Rating Scale (NRS), and McGill Pain Questionnaire (MPQ). There were also various disability tools used in the studies including, the Roland-Morris Disability Questionnaire (RMDQ) and the Oswestry Disability Index or Questionnaire (ODI/ODQ).[24] An example of the outcome measures is provided in the Appendix. All of the included studies in this

review have clear concentrated questions resulting in clear objectives reported. Moreover, all of the outcome measures utilized in these selected studies are valid and reliable.

DISCUSSION

In this review, the researcher set out to investigate whether the McKenzie Method was more effective than stabilization and strengthening exercises of the core and back musculature in terms of reducing pain and functional disability among individuals with chronic nonspecific low back pain. The results from the studies indicated that both McKenzie and stabilization exercises were effective in reducing pain and functional disability score among individuals diagnosed with chronic non-specific low back pain.[1,4,7,9,10,15,16,25,28,35] The McKenzie method is considered to be a highly effective treatment program for patients with nonspecific spinal pain.[14,16,27,35] Before beginning treatment with the McKenzie method, individuals must be categorized into a specific clinical subgroup which is identified as a syndrome with historical and mechanical properties that differentiate it from other syndromes.[14,16,27,35] These syndromes are described as postural, dysfunction, and derangements, and help guide treatment decisions.[14,16,27,35] Along with categorizing individuals into syndromes, they may be further divided based on if they present with clinical signs and symptoms of centralization (CEN) and/or directional preference (DP).[4,14,15,16,27,28,35] Centralization and DP are elicited during the MDT assessment, and are used to guide McKenzie based treatment.[16] Centralization involves having distal pain originating from the spine move to a more central location in response to certain postures or repeated movements, individuals will see a reduction in the area of pain.[16] Directional preference involves

certain postures or movements that result in a lasting decrease in symptom severity and/or increases in a mechanical response like increased range of motion.[16] Once an individual is placed in a syndrome category and determined if they do or do not present with CEN or DP, treatment can be directed accordingly.[4,14,16,27,28]

One study determined if an individual would have better outcomes if they were prescribed specific exercises concordant with their DP, compared to those that are prescribed nonconcordant exercises.[16] Patient specific exercises are focused on pain control and/or elimination in individuals with CNLBP.[16] Apeldoorn et al, concluded that exercises concordant with the patient's DP had improved outcomes compared to nonconcordant exercises, and it appears to be an effective pain control treatment.[16] To measure the pain outcomes, the researcher used back and leg pain intensity ratings using an 11-point visual analogue scale, and the 24-item RMDQ.[16] The study also included secondary outcome measures to include a rating of activity interference at work and home.[16] Based on the secondary outcome measures, individuals with exercises specific to DP had greater improvement in returning to work, home and recreational activity, perceived need for further treatment, and self-rated improvement scores on outcome measures that indicate decreased pain and disability.[16]

Various other researchers have studied how the McKenzie method improved pain outcomes in individuals with chronic nonspecific low back pain, but did not specify if the individuals in the studies presented with DP or CEN.[27] Busanich et al, favored the McKenzie treatment for pain and disability at the short-term follow up of 3 months, when compared with the following treatments: nonsteroidal anti-inflammatory drugs, educational booklet, back massage with back care advice, strength training, spinal

mobilization, or general mobility exercises.[27] Along with favoring the McKenzie method at the 3-month follow-up, the review also found the McKenzie method to be effective at the intermediate term follow up of 3-12 months after completion of the McKenzie exercises for both pain and disability.[27] The studies included in this review suggest that McKenzie therapy is more effective in alleviating back pain compared with other conservative treatment options at the short-term and intermediate follow up.[27]

One study measured the influence of CEN and DP on spinal control in patients with CNLBP and if spinal control improved immediately after eliciting a DP-with-CEN or a DP-without-CEN response.[16] Clinicians who use the MDT treatment have observed improvements in spinal control (a better balance between stiffness and movement) when patients with DP and CEN or patients with DP without CEN are treated with direction-specific exercises.[16] Researchers still do not know the true underlying physiologic mechanism that occurs with the DP with CEN response that results in better spinal control.[16] But, researchers have provided possible explanations for this reduction in pain, which include: increased lumbar multifidus recruitment, decrease in spinal stiffness, improved distribution of tissue loading, improved instantaneous axis of rotation, or the lessening of pain sensitivity.[16] Apeldoorn, et al, concluded that the McKenzie method can be used as a way to categorize and treat individuals and can provide significant improvements in spinal control in individuals with nonspecific low back pain.[16] Based on the results of these studies the researcher can conclude that the McKenzie treatment is effective in reducing pain in individuals with chronic nonspecific low back pain.[16,27] To get the greatest reduction in LBP, individuals need to be

assessed and determined if they have CEN or DP to be prescribed specific exercises concordant with their DP.[16,27,28]

As the results from the studies have indicated, the McKenzie method is an effective way to reduce pain in individuals with CNLBP, but researchers have also determined another technique therapists can use to help decrease pain and disability in individuals with CNLBP. This technique includes stabilization and strengthening exercises to strengthen and develop the transversus abdominis and multifidus to reduce pain and functional disability.[1-3,4,6,7,15] By implementing stabilization and strengthening exercises for the lumbar region, specifically the transversus abdominis and multifidus, the outcome is a reduction in pain and functional disability.[1-3,4,6,7,15]

One study used the VAS and ODQ scores to determine the effectiveness of the strengthening treatment.[7] The researchers found the VAS scores decreased after treatment, and the ODQ scores significantly improved compared to the participant's baseline scores.[7] Training the transverse abdominis, multifidus, and other deep compartment muscles is important as they are the most critical to stabilize the lumbar spine segmentally during activity.[1,2,9,15] As seen in the spinal anatomy section of this review, there is a greater emphasis placed on the transversus abdominis and multifidus as well as the local stabilizer muscles when participating in stabilization exercises to improve spine stability.[2,7] One study found that by having individuals activate their deep core muscles by co-contraction between the transversus abdominis and the multifidus, resulted in decreased pain and improved symmetry exercise in those with low back pain.[2] Lumbar stabilization was found to be a more effective exercise than Pilates and dynamic strengthening for those with chronic low back pain because it promoted the

activation of the transversus abdominis and the multifidus.[2] Lynders, found the co-contraction of the transversus abdominis and multifidus together would most benefit individuals with chronic low back pain.[2] The researcher also found that individuals who retrain their deep multifidus muscle was more effective than traditional back exercises for decreasing pain and functional disability in individuals with chronic low back pain.[2]

Studies have shown the researcher that stabilization exercises and McKenzie exercises show slight improvement on the thickness of the transversus abdominis and other local trunk muscles including the obliquus externus (OE), and obliquus internus (OI).[4] While other studies found that lumbar stabilization exercises and lumbar dynamic strengthening exercises improved the isometric strength of the lumbar musculature and reduced pain in patients with chronic low back pain.[7] Stabilization and strengthening exercises can include lumbar flexion and extension, isometric flexion and extension, and intensive dynamic back exercises.[7] One study looked specifically at improving the neuromuscular control, strength, and endurance of the muscles that are central to maintaining dynamic spinal and trunk stability.[7] These muscles as stated before include the transversus abdominis, multifidus, and the paraspinal, abdominals, diaphragm, and the pelvic muscles.[7] The aim of the study was to look at the effects of lumbar stabilization exercises and lumbar dynamic strengthening exercises on the maximal isometric strength of the extensor muscles, pain severity, and functional disability in individuals with chronic low back pain.[7] Both lumbar stabilization and lumbar dynamic strengthening exercises increased the strength of the lumbar extensor muscles and reduced ODQ pain scores in patients with CNLBP.[7] Overall, strengthening and

stabilization exercises would be beneficial in reducing pain and functional disability in individuals with nonspecific chronic low back pain.[2,7]

While studies have shown both McKenzie exercises and stabilization/strengthening exercises to reduce pain and functional disability, direct comparison between the two have yielded mixed results.[1,4,15] One study showed that pain scores decreased following the application of stabilization and McKenzie exercises, but disability only decreased after the application of stabilization exercises.[15] Hosseinfar et al, concluded that stabilization exercises are more effective than McKenzie exercises in improving the intensity of pain and functional disability score and in increasing the thickness of the transversus abdominis muscle.[15] Alhakami et al, compared McKenzie and stabilization regimens, and concluded there was no statistical difference between groups in terms of pain and functional disability scores.[1] However, both groups reported reduced pain and functional disability.[1] There can be various explanations for these mixed results from these two studies, but it is clear that both stabilization and McKenzie exercises have almost similar results and effectiveness in pain and functional disability reduction and that the two of them are better than general exercises, or other treatments for individuals with chronic nonspecific low back pain.[1,15] Halliday et al, compared McKenzie and motor control exercises on trunk muscles in individuals with chronic low back pain.[4] The study reported that the McKenzie method had no significant effect on increasing trunk muscle thickness, while a significant increase was found for individuals receiving motor control exercises.[4] Halliday et al, also found a small but statistically significant effect in global improvement favoring the McKenzie method when compared to motor control exercises.[4] There was no significant difference observed

between groups for pain or function although perceived sense of improvement was greater in the McKenzie group.[4] The individuals in this study had chronic low back pain with a directional preference.[4] Based on these results, patients with a directional preference, receiving exercises that matched their DP is likely to produce a greater sense of improvement than receiving generalized motor exercises.[4] Clinicians could consider using either method; however, the McKenzie method may be preferable, as patients reported greater improvement in sense of recovery and improvement in the short term compared to those who received motor control exercises.[1,4,15] Researchers also suggest using either stabilization or McKenzie exercises for pain reduction, but using stabilization exercises for greater improvement in functional disability scores.[1,15] However, both McKenzie and stabilization exercises are better than conventional and generalized exercise programs in reducing pain and functional disability in patients with chronic nonspecific low back pain.[1,4,15]

LIMITATIONS

The first limitation in this review is it included articles that did not explicitly state the outcome measures that were used to determine reduced pain and functional disability scores. The second limitation is whether or not the therapists were credentialed in the McKenzie Method and implemented true MDT exercises or focused on McKenzie based exercises. The last limitation of this review is based on the study design of each article, as well as a variety of evidentiary support that was presented as most of the studies were not only McKenzie and/or stabilization but may have included other interventions for comparison.

CONCLUSION

In conclusion, based on the evidence in this review, the researcher has determined both treatment methods, McKenzie Method and strengthening exercises, are effective in treating individuals with chronic nonspecific low back pain. If a patient presents with CEN or DP, the researcher recommends individual specific exercises concordant with the individuals DP. If the patient presents with weakened muscles or decreased ability to activate the transversus abdominis or multifidus, the individual should implement strengthening/stabilization exercises to improve thickness and strength of the core muscles.

REFERENCES

1. Alhakami AM, Davis S, Qasheesh M, Shaphe A, Chaha A. Effects of mckenzie and stabilization exercises in reducing pain intensity and functional disability in individuals with nonspecific chronic low back pain: a systematic review. J. Phys Ther Sci. 2019;590-597. https://doi.org/10.1589/jpts.31.590

2. Lynders C. The critical role of development of the transversus abdominis in the prevention and treatment of low back pain. *HSS J*. 2019;15(3):214-220. doi.10.1007/s11420-019-09717-8

3. Jones KC, Tocco EC, Marshall AN, McLeod TC, Bacon CE. Pain education with therapeutic exercise in chronic nonspecific low back pain rehabilitation: a critically appraised topic. *J Sport Rehabil.* 2020;29:1204-1209. https://doi.org/10.1123/jsr.2019-0345

4. Halliday MH, Pappas E, Hancock MJ, et al. A randomized controlled trial comparing the mckenzie method to motor control exercises in people with chronic low back pain and a directional preference. J Ortho Sports Phys Ther. 2016;46(7):514-522.

5. Delitto A, George SZ, Dillen LV, et al. Low back pain: clinical practice guidelines linked to the internal classification of functioning, disability, and health from the orthopaedic section of the american physical therapy association. *J Orthop Sports Phys Ther.* 2012;42(4):A1-A57. doi.10.2519/jospt.2012.42.4.A1

6. Yang H, Liu H, Li Z, Zhang K, Wang J, Wang H, et al. Low back pain associated with lumbar disc herniation: role of moderately degenerative disc and annulus fibrous tears. *Int J Clin Exp Med.* 2015;8(2):1634-1644.

7. Moon HJ, Choi KH, Kim DH, et al. Effect of lumbar stabilization and dynamic lumbar strengthening exercises in patients with chronic low back pain. Ann Rehabil Med. 2013;37(1):110-117. http://dx.doi.org/10.5535/arm.2013.37.1.110

8. Biyani A, Andersson GB. Low back pain: pathophysiology and management. *J Am Acad Orthop Surg.* 2004;12(2):106-115.

9. Lumbar Multifidus. Physiopedia. Accessed April 12, 2021. https://www.physio-pedia.com/Lumbar_Multifidus

10. Shipton EA. Physical Therapy Approaches in the Treatment of Low Back Pain. *Pain Ther*. 2018;7(2):127-137. doi:10.1007/s40122-018-0105-x

11. Riley SP, Swanson BT, Dyer E. Are movement-based classification systems more effective than therapeutic exercise or guideline based care in improving outcomes for patients with chronic low back pain? A systematic review. *J Man Manip Ther.* 2019;27(1):5-14. https://doi.org/10/1080/10669817.2018.1532693

12. Krismer M. Low back pain (non-specific). *Best Pract Res Clin Rheumatol.* 2007;21(1):77-91. doi.10.1016/j.berh.2006.08.004

13. Ah Young Lee, Seung Ok Baek, Yun Woo Cho, Tae Hong Lim, Rodney Jones, Sang Ho Ahn. Pelvic floor muscle contraction and abdominal hollowing during walking can selectively activate local trunk stabilizing muscles. *Journal of Back & Musculoskeletal Rehabilitation*. 2016;29(4):731-739. Accessed April 13, 2021

14. Halliday MH, Pappas E, Hancock MJ, et al. A randomized controlled trial comparing the mckenzie method to motor control exercises in people with chronic low back pain and a directional preference. J Ortho Sports Phys Ther. 2016;46(7):514-522.

15. Hosseinifar M, Akbari M, Behtash H, Amiri M, Sarrafzadeh. The effects of stabilization and mckenzie exercises on transverse abdominis and multifidus thickness, pain, and disability: a randomized controlled trial in nonspecific chronic low back pain. J Phys Ther Sci. 2013;25(12):1541-1545. doi: 10.1589/jpts.25.1541.

16. Apeldoorn AT, Helvoirt HV, Meihuizen H, Tempelman H, Vandeput D, Knol DL, et al. The influence of centralization and directional preference on spinal control in patients with nonspecific low back pain. *J Orthop Sports Phys Ther.* 2016;46(4):258-269.

17. Meadow Head Physiotherapy. Accessed March 20, 2021. http://www.meadowheadphysiotherapy.co.uk/blog/back-pain-core-muscles-and-breathing/

18. Van K, Hides JA, Richardson CA. The use of real-time ultrasound imaging for biofeedback of lumbar multifidus muscle contraction in healthy subjects. *Orthop Sports Phys Ther.* 2006;36(12):920-925. doi.10.2519/jospt.2006.2304

19. Schultz JR. Multifidus muscle: an important spinal stabilizer. April 1, 2018. Accessed March 25, 2021. https://centenoschultz.com/multifidus-muscle-spinal-stabilizer/

20. Goubert D, Oosterwijck JV, Meeus M, Danneels L. Structural changes of lumbar muscles in non-specific low back pain. *Pain Physician.* 2016;19:E985-E1000

21. Could your back pain result from degenerative disc disease? Virginia Spine Specialists. Accessed March 25, 2021. https://www.virginiaspinespecialists.com/degenerative-disc-disease

22. Cervical disc herniation. Upswing Health. Accessed March 25, 2021. https://upswinghealth.com/conditions/cervical-disc-herniation/#/

23. Ramos LA, Franca FJ, Callegari B, Burke TN, Magalhaes MO, Marques AP. Are lumbar multifidus fatigue and transversus abdominis activation similar in patients with lumbar disc herniation and healthy controls? A case control study. *Eur Spine J.* 2016;25(5):1435-1442. doi. 10.1007/s00586-015-4375-2

24. Gugliotta M, da Costa BR, Dabis E, et al. Surgical versus conservative treatment for lumbar disc herniation: a prospective cohort study. *BMJ Open*. 2016;6(12):e012938. Published 2016 Dec 21. doi:10.1136/bmjopen-2016-012938

25. What is the McKenzie Method? The McKenzie Institute International®. Accessed March 15, 2021. https://mckenzieinstitute.org/patients/what-is-the-mckenzie-method/

26. Akhtar MW, Karimi H, Gilani SA. Effectiveness of core stabilization exercises. Pak J Med Sci. 2017;33(4):1002-1006. doi.10.12669/pjms.334.12664

27. Busanich BM, Verscheure SD. Does mckenzie therapy improve outcomes for back pain? *J Athl Train*. 2006; 41(1):117-119.

28. Lumbar Multifidus. Physiopedia. Accessed April 12, 2021. https://www.physio-pedia.com/Lumbar_Multifidus

29. Ah Young Lee, Seung Ok Baek, Yun Woo Cho, Tae Hong Lim, Rodney Jones, Sang Ho Ahn. Pelvic floor muscle contraction and abdominal hollowing during walking can selectively activate local trunk stabilizing muscles. *Journal of Back & Musculoskeletal Rehabilitation*. 2016;29(4):731-739. Accessed April 13, 2021

30. Smeets R, Koke A, Lin CW, Ferreira M, Demoulin C. Measures of function in low back pain/disorders. *Arthritis Care Res.* 2011;63(11):158-173. doi.10.1002/acr.20542

31. Delgado DA, Lambert BS, Boutris N. Validation of digital visual analog scale pain scoring with a traditional paper-based analog scale in adults. *J Am Acad Orthop Surg Glob Res Rev.* 2018;2(3):1-6. doi. 10.5435/JAAOSGlobal-D-17-00088

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

33. Jacques E. 10 common types of pain scales. Verywell health. Accessed April 3, 2021. https://www.verywellhealth.com/pain-scales-assessment-tools-4020329

34. Chiarotto A, Maxwell LJ, Terwee CB, Wells GA, Tugwell P, Ostelo RW. Roland-morris disability questionnaire and oswestry disability index: which has better measurement properties for measuring physical functioning in nonspecific low back pain? Systematic review and meta-analysis. *Physical Therapy*. 2016;96(10):1620-1637. https://doi.org/10.2522/ptj.20150420

35. Lam OT, Strenger DM, Chan-fee, Pham PT, Preuss RA, Robins SM. Effectiveness of the mckenzie method of mechanical diagnosis and therapy for treating low back pain: literature review with meta-analysis. *J Orthop Sports Phys Ther.* 2018;48(6):476-490.

36. Roland & morris disability questionnaire RMDQ. OMT. Published July 15, 2018. Accessed April 7, 2021. https://www.omtae.org/forum/_omtc/roland-morris-disability-questionnaire-rmdq

37. Oswestry disability index. Shirley Ryan Ability Lab. Updated November 27, 2013. Accessed April 7, 2021. https://www.sralab.org/rehabilitation-measures/oswestry-disability-index

Appendix A. Visual Analog and Numeric Rating Scale[30]

1. No pain ——————————————— Pain as bad as it could be

Appendix B. McGill Pain Questionnaire[33]

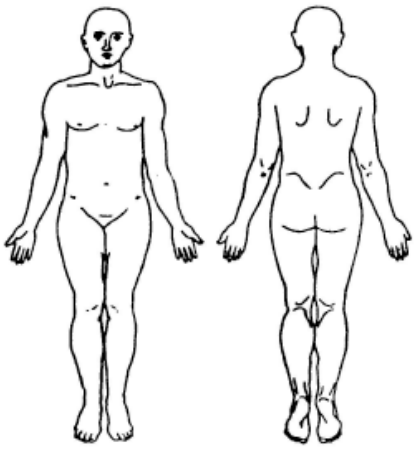
McGill Pain Questionnaire

Patient's Name _____ Date _____ Time _____ am/pm

PRI: S _____ (1-10) A _____ (11-15) E _____ (16) M _____ (17-20) PRI(T) _____ (1-20) PPI _____

1 FLICKERING	11 TIRING	
QUIVERING	EXHAUSTING	
PULSING	12 SICKENING	
THROBBING	SUFFOCATING	
BEATING	13 FEARFUL	
POUNDING	FRIGHTFUL	
2 JUMPING	TERRIFYING	
FLASHING	14 PUNISHING	
SHOOTING	GRUELLING	
3 PRICKING	CRUEL	
BORING	VICIOUS	
DRILLING	KILLING	
STABBING	15 WRETCHED	
LANCINATING	BLINDING	
4 SHARP	16 ANNOYING	
CUTTING	TROUBLESOME	
LACERATING	MISERABLE	
5 PINCHING	INTENSE	
PRESSING	UNBEARABLE	
GNAWING	17 SPREADING	
CRAMPING	RADIATING	
CRUSHING	PENETRATING	
6 TUGGING	PIERCING	
PULLING	18 TIGHT	
WRENCHING	NUMB	
7 HOT	DRAWING	
BURNING	SQUEEZING	
SCALDING	TEARING	
SEARING	19 COOL	
8 TINGLING	COLD	
ITCHY	FREEZING	
SMARTING	20 NAGGING	
STINGING	NAUSEATING	
9 DULL	AGONIZING	
SORE	DREADFUL	
HURTING	TORTURING	
ACHING	PPI	
HEAVY	0 NO PAIN	
10 TENDER	1 MILD	
TAUT	2 DISCOMFORTING	
RASPING	3 DISTRESSING	
SPLITTING	4 HORRIBLE	
	5 EXCRUCIATING	

BRIEF	RHYTHMIC	CONTINUOUS
MOMENTARY	PERIODIC	STEADY
TRANSIENT	INTERMITTENT	CONSTANT



E = EXTERNAL
I = INTERNAL

COMMENTS:

Appendix C. Roland-Morris Disability Questionnaire (RMDQ)[36]

Roland-Morris Low Back Pain and Disability Questionnaire (RMQ)

Instructions

Patient name:_____ File #:_____ Date:_____

Please read instructions: When your back hurts, you may find it difficult to do some of the things you normally do. Mark only the sentences that describe you today.

- ☐ I stay at home most of the time because of my back.
- ☐ I change position frequently to try to get my back comfortable.
- ☐ I walk more slowly than usual because of my back.
- ☐ Because of my back, I am not doing any jobs that I usually do around the house.
- ☐ Because of my back, I use a handrail to get upstairs.
- ☐ Because of my back, I lie down to rest more often.
- ☐ Because of my back, I have to hold on to something to get out of an easy chair.
- ☐ Because of my back, I try to get other people to do things for me.
- ☐ I get dressed more slowly than usual because of my back.
- ☐ I only stand up for short periods of time because of my back.
- ☐ Because of my back, I try not to bend or kneel down.
- ☐ I find it difficult to get out of a chair because of my back.
- ☐ My back is painful almost all of the time.
- ☐ I find it difficult to turn over in bed because of my back.
- ☐ My appetite is not very good because of my back.
- ☐ I have trouble putting on my socks (or stockings) because of the pain in my back.
- ☐ I can only walk short distances because of my back pain.
- ☐ I sleep less well because of my back.
- ☐ Because of my back pain, I get dressed with the help of someone else.
- ☐ I sit down for most of the day because of my back.
- ☐ I avoid heavy jobs around the house because of my back.
- ☐ Because of back pain, I am more irritable and bad tempered with people than usual.
- ☐ Because of my back, I go upstairs more slowly than usual.
- ☐ I stay in bed most of the time because of my back.

Page 2

Appendix D. Oswestry Disability Index/Questionnaire[37]

Oswestry Disability Index

This questionnaire has been designed to give the doctor information as to how your pain or condition has affected your ability to manage everyday life. Please answer every section and circle in each section **only the ONE number** that applies to you. We realize that you may consider that two of the statements in any one section relate to you, but please just circle the number that most closely describes your problem.

Section 1: Pain Intensity

0. The pain comes and goes and is very mild.
1. The pain is mild and does not vary much.
2. The pain comes and goes and is moderate.
3. The pain is moderate and does not vary much.
4. The pain comes and goes and is very severe.
5. The pain is severe and does not vary much.

Section 2: Personal Care

0. I would not have to change my way of washing or dressing in order to avoid pain.
1. I do not normally change my way of washing or dressing even though it causes some pain.
2. Washing and dressing increases the pain, but I manage not to change my way of doing it.
3. Washing and dressing increases the pain and I find it necessary to change my way of doing it.
4. Because of the pain, I am unable to do some washing and dressing without help.
5. Because of the pain, I am unable to do any washing and dressing without help.

Section 3: Lifting

0. I can lift heavy weights without extra pain.
1. I can lift heavy weights, but it causes extra pain.
2. Pain prevents me from lifting heavy weights off the floor, but I manage if they are conveniently positioned (e.g., on a table).
3. Pain prevents me from lifting heavy weights off the floor.
4. Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
5. I can only lift very light weights at the most.

Section 4: Walking

0. I have no pain on walking.
1. I have some pain on walking, but it does not increase with distance.
2. I cannot walk more than one mile without increasing pain.
3. I cannot walk more than 1/2 mile without increasing pain.
4. I cannot walk more than 1/4 mile without increasing pain.
5. I cannot walk at all without increasing pain.

Section 5: Sitting

0. I can sit in any chair as long as I like.
1. I can only sit in my favorite chair as long as I like.
2. Pain prevents me from sitting more than one hour.
3. Pain prevents me from sitting more than 1/2 hour
4. Pain prevents me from sitting more 10 minutes.
5. I avoid sitting because it increases pain right away.

0-10 Minimal disability
11-20 Moderate disability
21-30 Severe disability
31-40 Crippled (incapacitated)
40-50 Bed-bound

Section 6: Standing

0. I can stand as long as I want without pain.
1. I have some pain on standing, but it does not increase with time.
2. I cannot stand for longer than one hour without increasing pain.
3. I cannot stand for longer than 1/2 hour without increasing pain.
4. I cannot stand for longer than 10 minutes without increasing pain.
5. I avoid standing because it increases the pain right away.

Section 7: Sleeping

0. I get no pain in bed.
1. I get pain in bed, but it does not prevent me from sleeping well.
2. Because of pain, my normal night's sleep is reduced by less than 1/4.
3. Because of pain, my normal night's sleep is reduced by less than 1/2.
4. Because of pain, my normal night's sleep is reduced by less than 3/4.
5. Pain prevents me from sleeping at all.

Section 8: Social Life

0. My social life is normal and gives me no pain.
1. My social life is normal, but increases the degree of pain.
2. Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g., dancing, etc.
3. Pain has restricted my social life and I do not go out very often.
4. Pain has restricted my social life to my home.
5. I have hardly any social life because of the pain.

Section 9: Traveling

0. I get no pain while travelling.
1. I get some pain while travelling, but none of my usual forms of travel makes it any worse.
2. I get extra pain while travelling, but it does not compel me to seek alternative forms of travel.
3. I get extra pain while travelling, which compels me to seek alternative forms of travel.
4. Pain restricts all forms of travel.
5. Pain prevents all forms of travel except that done lying down.

Section 10: Changing Degree of Pain

0. My pain is rapidly getting better.
1. My pain fluctuates, but is definitively getting better.
2. My pain seems to be getting better, but improvement is slow at present.
3. My pain is neither getting better nor worse.
4. My pain is gradually worsening.
5. My pain is rapidly worsening.

Patient's Signature:

_____

Date:_____