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The Alexander technique vs. the McKenzie method in the treatment of lumbosacral radiculopathy

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Introduction

Low back pain (LBP) is the most common musculoskeletal problem worldwide. Up to 85% of people will experience low back pain during their lifetime.¹ LBP has a great impact on quality of life, lifestyle, and work-related disability. Each year, the costs of LBP in the United States exceed \$100 billion.²

Lumbosacral, referring to the lumbar and sacral region of the spinal cord, radiculopathy, meaning a disorder of the nerve root, is sometimes referred to as sciatica and is a condition in which a disease process affects the function of one or more lumbosacral nerve roots. The most common cause is structural – disc herniation – leading to root compression.

Intervertebral discs are located between vertebrae in the spinal column to supply cushion, absorb physical shock to the spinal column, and protect the nerves traveling the center of the spine. Intervertebral discs are composed of two different tissue layers, an interior layer called the nucleus pulposus, and an exterior layer called the annulus fibrosus. The nucleus pulposus is a gel-like layer that can absorb force due to its fluid nature and the annulus fibrosus has multiple layers of fibrocartilage that encompasses the nucleus pulposus and keeps it inside the disc.³

The annulus fibrosus is able to withstand a lot of pressure but can rupture due to age or from significant pressure being exerted on it from the nucleus pulposus. A bulging disc results if some, but not all, of the layers of the annulus fibrosus rupture and cause a portion of the nucleus pulposus to protrude into the annulus fibrosus. A herniated disc results if the nucleus pulposus bursts through all the layers of the annulus fibrosus and begins to leak into the spinal column.³ Lumbar nerve roots branch out from the spinal cord via the intervertebral foramen. A bulging or herniated intervertebral disc can put pressure on these nerves creating various symptoms including pain, tingling, sensory loss, or partial paralysis of affected muscles along the dermatome of the affected nerve.³

The aim of this review is to discuss the prognosis and treatment of lumbosacral radiculopathy. This review will also limit itself to non-operative, non-neoplastic, and non-infectious causes of lumbosacral radiculopathy.

Methods of Diagnosing

Lumbar disc herniation and radiculopathy can be diagnosed through a multitude of tests ranging in cost and reliability. Three of the most common tests used to diagnose lumbar disc herniation and radiculopathy are manual muscle testing, thermal quantitative sensory testing and the supine straight leg raise, also known as the Lasegue test.⁴ These tests provide the patient the most efficient diagnosis possible without performing an operation or receiving an MRI or CT scan, which is desirable for many patients due to the physical and economic stresses these would impose on them.

Manual muscle testing is used to determine if there is a lumbar herniation by testing the strength of specific muscles in the patient's legs or feet. To determine the location of

herniation in the patient's spine, the physician will test the function of the Achilles reflex, the strength of ankle plantar flexion and, most importantly, the strength of extension of the extensor hallucis longus. An impaired Achilles reflex or partial paralysis in the muscles of the leg and/or foot is a strong indication of a possible pinched nerve due to lumbar disc herniation.⁴ The common order of testing by the physician is first the patellar tendon reflex, then the Achilles tendon reflex, then the strength of dorsiflexion of the foot, and finally the strength of the extensor hallucis longus. To test the strength of dorsiflexion of the foot and the extensor hallucis longus, consistent manual force is applied perpendicularly to the surface of the skin at specific anatomical locations. For strength testing of dorsiflexion of the foot, manual force is applied near the medial and intermediate cuneiform bones of the metatarsals. For strength testing of the extensor hallucis longus, manual force is applied at the base of the great toe. These tests are performed on both sides, and the affected side is compared with the normal side.

The presence of a weakened extensor hallucis longus provides 86% reliability that the level of the ruptured disc is L5.⁴ The partial paralysis of the affected side as compared to the pathologically normal side is a great indicator of the extent of the herniation at that specific level of the spine.

It is critical that the physician apply as close to equal pressure as possible to each side of the patient to eliminate as much human error as possible. It is also critical that the physician does not do more damage to the patient by repeatedly performing manual muscles tests in a short period of time, as well as hold a manual muscle test for longer than needed to determine the approximate weakness of the patient.

The Lasegue test, also known as the straight leg raise test, can be used to test for a lumbar disc herniation at the L5-S1 junction, which is one of the more common locations of disc herniation in the lumbar spine. In this test, the patient lies in a supine position and the physician lifts the patient's leg, causing passive flexion of the hip with the knee fully extended. The physician should lift the leg between 30° and 70° off the table while looking for a pain response in the sciatic nerve distribution of the leg. The sciatic nerve distribution of the leg is the lower extremity, ankle and foot. This test is very sensitive but not very specific. To alleviate this problem with the test, the crossed leg Lasegue test can be performed. In this test, the patient's other leg is raised between 30° and 70° and a pain response is looked for in the patient's originally tested leg. If the patient shows a pain response, this is an indicator of an L5-S1 disc herniation. The Lasegue test and crossed leg Lasegue was positive in 94% of patients with lumbar disc herniation.⁴

A result of lumbosacral radiculopathy is an impairment of sensory function along the affected nerves. Thermal quantitative sensory testing allows for the assessment of A-δ nerve fibers and C-fibers. A-δ nerve fibers are wrapped in a thin myelin sheath and are used to conduct the sensory response of coldness. C-fibers are unmyelinated and are used in the conduction of heat and pain sensation.⁵ Thermal quantitative sensory testing has been most predominantly used in cases of traumatic neural injury, but is appropriate for use in the diagnosis of lumbar disc herniations.⁵

In the thermal quantitative sensory test, a thermode is applied to the specific anatomical region of the patient that is innervated by the estimated pinched nerve. The thermode has a rectangular surface about the size of a traditional postage stamp and can make its surface hot or cold. The patient is instructed to indicate by use of a switch when he

or she perceives a hot or cold sensation. These results are compared with the results from the patient's other leg, which has no compressed nerve roots. If the patient experiences sensory dysfunction between the knee joint and ankle joint, it is hypothesized they have a lumbar disc herniation at the L4-L5 junction in their spinal cord. If the patient experiences sensory dysfunction on the dorsolateral aspect of the foot, it is hypothesized they have a lumbar disc herniation at the L5-S1 junction of the spinal cord.⁵

Sensory testing is effective in separating physiological normal dermatomes from symptomatic dermatomes. This is helpful in determining the presence of a lumbar disc herniation, however, it is ineffective at determining the precise location of the lumbar herniation. One study found the effectiveness of determining the presence of a disc herniation, and the side of disc herniation, to be 90% and the effectiveness of determining the correct spinal level of herniation to be 50%.⁶

While none of these tests are definitive on their own in determining the presence and location of a lumbosacral herniation, when used in combination they are quite effective. These tests provide the patient the most efficient diagnosis possible without actually performing an operation or receiving an MRI or CT scan.

Phases of Lumbosacral Radiculopathy

The three generally accepted time frames used to classify lower back pain are the acute period (up to four weeks), the subacute period (4-12 weeks), and chronic (>12 weeks).⁷

While acute lumbosacral radiculopathy is often exquisitely painful, the likelihood of spontaneous improvement is high when the cause is disc herniation or lumbar spinal

stenosis due to degenerative arthritis. The main objectives of treatment in the acute phase are to decrease pain, and to address the specific underlying process if necessary. Exercise and manual therapy are often tried for patients with persistent symptoms that are mild or moderate in nature. In contrast to the limited evidence of benefit from exercise for acute lumbosacral radiculopathy, exercise therapy has been shown to have modest benefits in patients with subacute (4-12 weeks) and chronic (>12 weeks) lower back pain lumbosacral radiculopathy.⁸ Exercise therapy improves short-term pain relief and function in patients with chronic lumbosacral radiculopathy. In addition, the improvements associated with exercise therapy may be long lasting ($\geq 1-3$ years).⁷

In both subacute and chronic lumbosacral radiculopathy, exercise therapy is particularly beneficial when the exercise approach includes aerobic activity and is accompanied by biopsychosocial based approaches that include cognitive behavioral strategies facilitating a graded exercise regimen.⁸

Exercise therapy and manual therapy are both very vague statements and are inadequate definitions on their own. There are numerous options for exercise therapy and these options include combinations of core strengthening (predominantly abdominal and trunk extensor), flexion/extension movements, directional preference, mind-body exercises, general physical fitness, aerobic exercise, and functional restoration programs. With all these options available to treat lumbosacral radiculopathy, it can be a challenge to choose the best option for each patient.

There are two methods of treatment for lumbosacral radiculopathy that draw a lot of attention in the medical field, the Alexander technique and the McKenzie method. These two methods of treatment will be discussed in depth for the remainder of the paper.

Alexander Technique for Treatment

Similar to many notable medical discoveries of the past, the Alexander technique was developed unintentionally. As a young man, Frederick Mathius Alexander was in the performing arts as a reciter of Shakespeare, but had recurring laryngitis after his performances. Alexander was able to produce a powerful voice by moving his head backwards and downwards, resulting in a lot of strain on his neck and larynx. After no physician could fix his problem, Frederick began developing his own cure. He hypothesized if he could remove the strain on his neck, and decompress his spine, he would be cured. Alexander was correct and soon became a prominent figure in the performing arts due to his powerful and attractive voice. A physician approached Alexander to learn about his incredible improvement that no one could resolve before. After learning from Alexander, the physician applied the same technique to one of his patients with a back problem and the back problem was completely eliminated.⁹

The Alexander technique has evolved since its first application at the end of the 19th century. It is now an individualized, hands-on instruction to improve balance, strengthen postural muscles, improve coordination, improve flexibility, limit back spasms, decompress the spine, and recognize harmful habitual muscle use when stationary and in movement to avoid painful movements. Alexander technique instructors refer to the treatment as 'kinesthetic reeducation'. The prefix 're' is used because children are perfectly educated. They are able to move their head freely without placing strain on their neck, and their back lengthens and widens with straining movements, which is the optimal physiological movement for human anatomy.⁹ As stated by Michael Gelb, an advocator and teacher of the

Alexander technique, “the Alexander technique is the experience of gradually freeing oneself from the domination of fixed habits.”¹⁰ An essential aspect of the Alexander technique is focusing on the elimination of strain on the head, neck, and spine in all aspects of everyday life through verbal and physical education. This is what makes the Alexander technique entirely unique from chiropractic, manipulation, back schools, and traditional physiotherapy.¹⁰⁻¹¹

A very encouraging clinical trial was performed in England involving 64 general practices and 152 Alexander technique teachers and massage therapists. The qualifying data to be involved in the clinical trial was record of back pain in the past five years, scoring 4 or more on the Roland disability scale, and currently suffering from pain for more than three weeks. The Roland Morris disability scale is a standardized measure of categorizing all patients on a similar scale of how many activities are impaired from pain and how long they have been suffering from it. The Roland disability scale is a highly recognized standardized scale and is one of the best ways to analyze a patient through self-report measures.¹³⁻¹⁴

The 579 subjects were randomized into eight groups as described by **Table 1**. Subjects reported the status of their current back pain through mail-in questionnaires at baseline, three months, and one year after the beginning of the clinical trial.

Table 1 | Trial groups for patients with chronic or recurrent back pain

Intervention	No exercise	Exercise*
Normal care	Group 1 (control)	Group 5
Therapeutic massage (6 sessions)†	Group 2	Group 6
Alexander technique lessons (n=6)‡	Group 3	Group 7
Alexander technique lessons (n=24)§	Group 4	Group 8

*Doctor prescription and up to three sessions of behavioural counselling with practice nurse. Doctor exercise prescription was scheduled six weeks into trial to allow groups 7 and 8 to have some Alexander technique lessons before starting exercise but not to delay any further the start for group 5.

†One session a week for six weeks.

‡Two lessons a week for two weeks then one lesson a week for two weeks.

§Twenty two lessons over five months, initially two a week for six weeks, one a week for six weeks, one fortnightly for eight weeks, and one revision lesson at seven months and one at nine months.¹⁵

At three months, there was minimal difference between all the treatments as they were all similarly successful in improving the subjects Roland disability scale and days in pain.

At one year, the group of subjects who received 24 lessons in the Alexander technique experienced the greatest decrease on the Roland disability scale and days in pain. There was a 42% decrease in the Roland disability score and an 86% decrease in pain compared to the control group.¹⁵ The group that received six lessons in the Alexander technique experienced a 17% decrease in their Roland disability score and a 48% decrease in days in pain. Exercise resulted in a 17% decrease as well on the Roland disability scale but had no effect on days in pain. The therapeutic massage group had no change in their Roland disability score but had a 33% decrease in days in pain. The group that received 24 lessons in the Alexander technique experienced a significant improvement in other outcomes, the group that received 6 lessons and a similar but decreased improvement, and the therapeutic massage group had no significant change in other outcomes but perceived

they had improved in regards to their back pain and overall satisfaction.¹⁵

The combination of the group receiving 24 lessons in the Alexander technique with exercise experienced no more improvement than merely receiving 24 lessons in Alexander technique. However, when combining the group receiving 6 lessons in the Alexander technique with exercise, the outcome was 72% as good as receiving 24 lessons in the Alexander technique.¹⁵ The combination of the beneficial effects from the 24 lessons in the Alexander technique and exercise is less than the sum of the parts. This is a very important fact for physicians to remember and apply to other treatments. Just because two different studies are advocating for how beneficial a certain treatment is for a specific disease or injury, combining the two treatments will not necessarily be even better.

Analysis of this clinical trial shows the long-term benefits of using the Alexander technique to treat individuals suffering from lower back pain, a common side effect of lumbosacral radiculopathy. Six sessions of basic massage therapy was found to be beneficial in the short term but have no lasting benefits in the long term, whereas six sessions in the Alexander technique had lasting benefits at one year.¹⁵

McKenzie Method for Treatment

Just as the Alexander technique was developed unintentionally, the same is true of the McKenzie method for treatment of patients with lumbosacral radiculopathy causing low back pain. Mr. Smith, a patient of Dr. McKenzie, came in because of radiating pain going down the side of his leg for the past three weeks. McKenzie inadvertently had Mr. Smith lay on his stomach on an inclined exam table in lumbar extension. After 10 minutes of this, Mr. Smith informed the flabbergasted Dr. McKenzie that his leg had not felt this good in weeks!

This encounter began McKenzie down a path that ultimately led to his development of the McKenzie method.¹⁶

The McKenzie method for treatment of lumbosacral radiculopathy causing lower back pain and inhibited movement is based on directional preference in which patients are taught to perform exercises that focus low back and/or radiating pain toward the spinal midline, using repeated movements or sustained postures. This method can efficiently reverse the damage done by the patient to their intervertebral discs and nerves by simply performing patient-generated forces in the prescribed direction.¹⁷

The mechanism by which this method works is similar to that of a tube of toothpaste. The toothpaste is representing the intervertebral gel-like substance that resists compression called the nucleus pulposus, and the toothpaste tube is representing the surrounding structure made up of collagen fibers and lamellae called the annulus fibrosus. If you squeeze the lower portion of a full tube of toothpaste, eventually the toothpaste will burst out the top of the tube. To return the toothpaste to an even distribution inside the tube, one must squeeze the top of the tube to push the toothpaste back towards the bottom. The same is true of the intervertebral discs. To offset the damage already done, often due to lumbar flexion, lumbar extension is prescribed to apply an opposing force on the displaced nucleus pulposus to return it back to its normal physiological location.¹⁷

McKenzie first described centralization of pain in 1980. Centralization of pain is the movement of pain that may be in the buttock, thigh, knee or foot, and eventually transitioning it towards the low back where it ultimately is eliminated (**Figure 1**). If the individual is experiencing pain in their foot, the pain will move proximally towards their knee after they begin the appropriate exercises. This pain will then continue moving

proximally through the thigh, buttock, low back, and eventually it will be completely eliminated. The extension of the spine from the exercises causes a decompression of the spine and a decrease of nerve root impingement. This lessening of impingement allows the affected nerve to progressively return to its normal physiological status. As the nerve is healing, the pain the patient is experiencing is gradually moving proximally up their leg. Patients that are receiving treatment via the McKenzie method must understand this fact in order to ensure completion of the treatment. A patient that develops pain in their knee after having severe pain in their foot for a long period time may be quick to bail on the McKenzie method of treatment due to the new pain.¹⁷

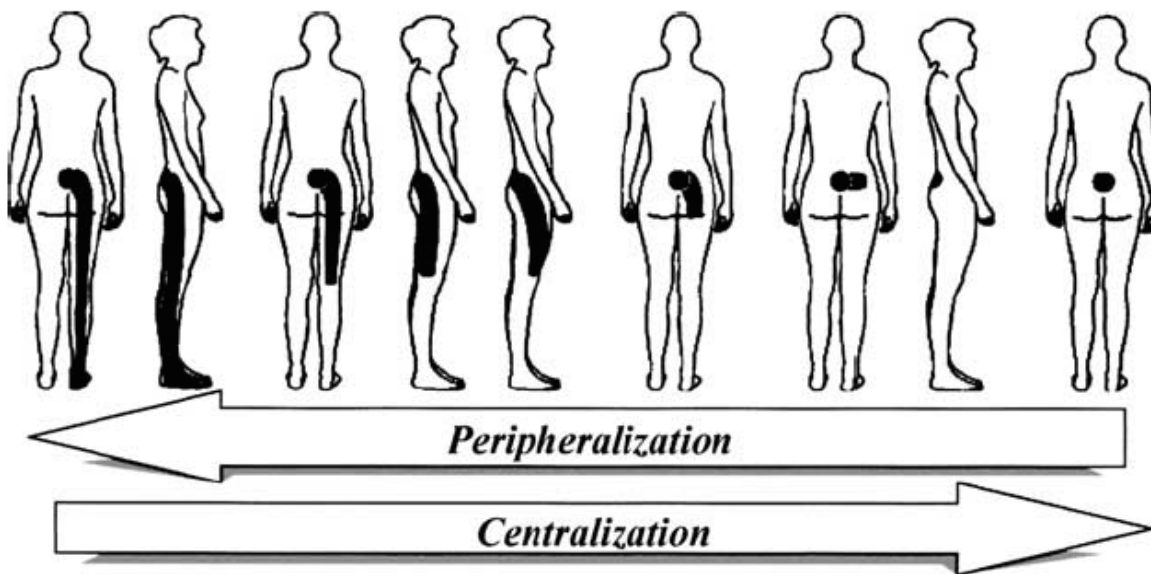


Figure 1. “Centralization” is the progressive retreat of pain arising from the lumbar spine in a proximal direction, retreating back toward or completely to the lumbar midline. Centralization is indicative of improving the underlying pain source, and peripheralization indicates it is being aggravated further.¹⁷

A large focus of the medical community is how to not only alleviate the pain associated with pain generating disc pathologies, but also completely cure the issue by reversing the symptoms. It is important to note that this is a reversible condition, not a

permanent neurocompression. The McKenzie method seeks to accomplish this goal of reversing the symptoms through a series of spinal movements to first diagnose the patient, and then to cure them. Following the McKenzie method to treat disc pathologies, a patient with disc pathology has his or her spine manipulated to elicit either a peripheralization or centralization of his or her pain. This is done through directional lumbar test movements to determine the patient's directional preference. The movements that are performed are flexion, extension, and lateral movement of the spine. These are outlined in **Figure 2**. These movements are performed to determine which one alleviates, or centralizes, the pain and which one elicits, or peripheralizes, the pain. Lumbar flexion results in anterior disc loading, which causes posterior migration of nucleus pulposus. The opposite, lumbar extension, results in posterior disc loading causing anterior migration of nucleus pulposus.³ It is important to note that only performing the directional movements once has no diagnostic value to it and must be repeated multiple times to end-range until ease of movement is achieved. If done correctly, the benefits experienced during end-range movements will persist after completion of the movements, resulting in a treatment modality.¹⁶ It is also important to note that there is no general McKenzie method exercise that can be applied to every patient, the McKenzie method is first an assessment tool, and then second a treatment plan tailored to each patient.

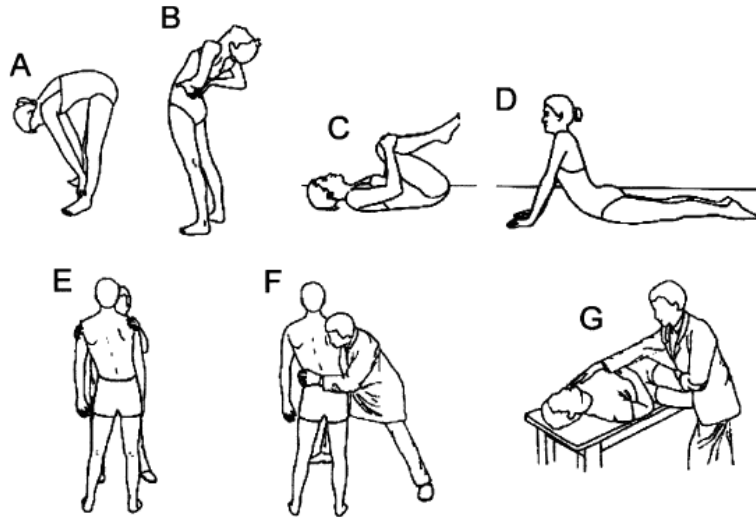


Figure 2: Standing and recumbent directional lumbar test movements performed repeatedly to the patient's available end range to identify a directional "preference": (A) Standing flexion. (B) Standing extension. (C) Lying flexion. (D) Lying extension. (E) Standing side glide. (F) Overpressure standing side glide. (G) Overpressure flexion rotation.¹⁶

Four randomized controlled trials were successful in confirming and expanding upon the McKenzie method. The first randomized control trial concluded that the more distally the pain was radiating down a patient's leg, the worse the disc herniation.¹⁸

The second randomized controlled trial concluded that patients are at a greater risk of posterior prolapse of the nucleus pulposus in the morning immediately after waking up. The increased fluid in the nucleus pulposus allows for less force needed from flexion loading of the spine to cause the nucleus pulposus to rip through the annulus fibrosis.¹⁹ This trial went on to test how much improvement would be achieved by avoiding slouching, lifting with flexion of the spine and hunching over. After one year, there was a dramatic improvement by reduction of pain and increased strength. After three years, 62% of subjects reported they had continued to avoid flexion of the spine in the morning and had experienced even greater improvement in strength and elimination of pain. It was the

authors prediction that avoiding flexion of the spine decreased the amount of stimulation to the posterior annulus fibrosis.¹⁹

The third randomized controlled trial analyzed the correlation between sitting posture and low back and leg pain. Subjects were placed in two groups, one a lordotic posture and the other a kyphotic posture (**Figure 3**). Those in the lordotic group experienced significant improvement in their pain in their low back and leg, as well as centralization of their pain. The truly amazing aspect of this study was that many subjects had their pain abolished, or at least centralized, from just 48 hours of lordotic sitting posture.²⁰

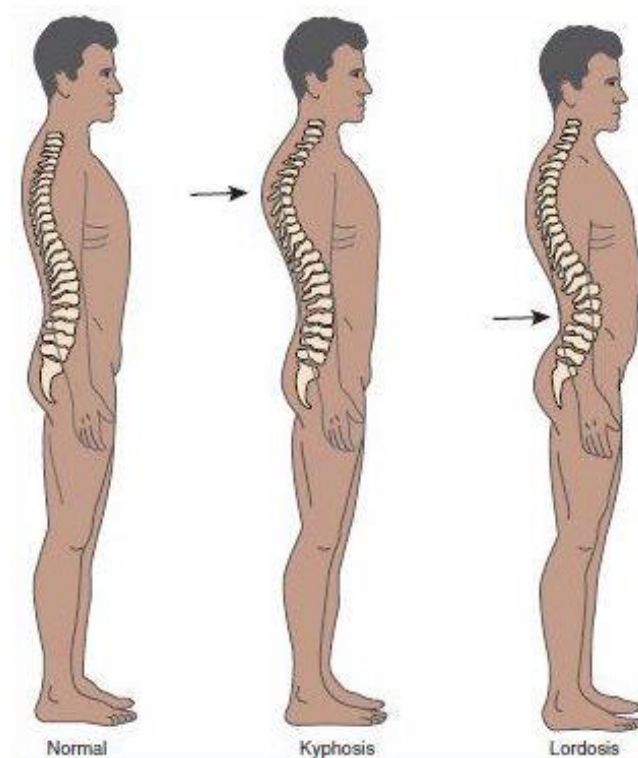


Figure 3. Normal, kyphotic and lordotic standing posture.

The fourth randomized controlled trial analyzed 145 subjects with “nonspecific low back pain” and/or peripheral leg pain. These subjects had both flexion and extension of

their spine to elicit a pain response. 85% of subjects experienced an unmistakable decrease in both central and peripheral pain following extension of the spine and increased pain following flexion of the spine.¹⁷

The process to becoming an official McKenzie method clinician is four postgraduate courses followed by passing a licensing exam. For more rigorous training, one can take a course, a clinical mentorship, and a licensing exam to be acknowledged as a McKenzie Diplomat. Every physician and McKenzie clinician is highly encouraged to apply the McKenzie method in an attempt to avoid surgery as much as possible for patients with lumbosacral radiculopathy. This was demonstrated in an observational study of 67 military personnel experiencing peripheral pain running down their leg to their calf or foot and limited extension range of leg and, more specifically, their extensor hallucis longus. All 67 were admitted to the hospital for a potential surgery due to the intensity of their pain. All were tested according to the McKenzie method and prescribed a specific end-range movement (**Figure 2**) to perform as often as possible over the ensuing days. 35 of the 67 (52%) were prescribed extension exercises and 34 of those 35 (97%) recovered in less than five days. The extension exercise they performed was the same one demonstrated in **Figure 2D**. All 35 were successful in avoiding surgery. All but two of those who did not respond to the McKenzie method of determining which exercise to perform (N=32) received disc surgery (91%).¹⁷

It is important to note in this study that all were in a tremendous amount of pain and 100% of those who actively did extension exercises were able to avoid surgery, and very rapidly as well. These subjects had strong indications of nonrecovering compressive disc disease, yet were able to alleviate the pain and increase range of motion. Expanding

from this study, as well as using logic, it is easy to conclude that patients who experience centralization from the McKenzie method are able to reverse their symptoms non-surgically, and therefore should rarely be considered for surgery. According to a literature review, it can be concluded that if a patient can undergo centralization, they have a high likelihood of a good treatment outcome if they follow the McKenzie method closely.¹⁷ Also, if a patient experiences increased pain while sitting or bending, and then subsequently loses that pain when walking or moving, they would be a great candidate to receive treatment via the McKenzie method.¹⁶

Overall, the McKenzie method has proven itself as an invaluable diagnostic, therapeutic, and prognostic tool for clinicians to use for their patients with lumbosacral radiculopathy. It helps the clinician to decipher between two groups of individuals, the large group of individuals who will successfully progress through self-treatment measures and the smaller group of individuals who will not respond and will require a more involved, if not surgical, approach. A specific aspect of the McKenzie method that was so impactful on the musculoskeletal medicine community when it was developed, and still to this day, is the repetition of prolonged therapeutic postures to induce healing. The McKenzie method seeks to teach patients self-management of their body to respond to symptoms quickly and efficiently in regards to pain caused by lumbosacral radiculopathies.

Conclusion

The Alexander technique and the McKenzie method are two very effective, non-invasive, treatments for lumbosacral radiculopathy and a variety of low back pains. Both stress the importance of self-treatment through decompression of the spine and

maintaining a healthy posture. There is a significant reservation that is withholding the advancement of the Alexander technique. Currently there are no procedural terminology codes for the Alexander technique so clinicians that use this technique will only be reimbursed for a generic examination and manual or exercise therapy. This makes it very difficult for this strong treatment plan to be used widespread because it will be rare a medical professional will invest the time and money to be trained in a treatment plan that brings no benefit to them personally. A potential method to combat this issue would be to provide bonuses to physicians for being able to successfully keep patients with low back pain out of the hospital.

The Alexander technique has proven to be more effective in the long term (12 months) as opposed to the short term (3 months), so if this treatment is being used as the primary form of treatment, it should be paired with another treatment that is effective in the short term. On the contrary, the McKenzie method produces results immediately and can eliminate the symptoms permanently if the method is continued.

With all things being considered, I believe the McKenzie method to be superior to the Alexander technique right now for patients with lumbosacral radiculopathy that would like to avoid invasive treatments in their future. It places the patient in the driver seat to control his or her quality of life by doing daily stretching in their 'preferred direction', as well as maintaining healthy back posturing throughout their daily lives. A patient committed to healing themselves from lumbosacral radiculopathy will be successful a large majority of the time, and only rarely will surgery be required so long as they closely adhere to the McKenzie method treatment plan.

For future studies regarding the treatment of lumbosacral radiculopathy and low back pain, an area of focus should be on the long-term impact of repeated treatment via the McKenzie method or the Alexander technique. Repeated injury and manipulation of the intervertebral discs may have an impact on the integrity of the nucleus pulposus and/or the annulus fibrosus. The amount of fluid in the nucleus pulposus may diminish with each consecutive lumbosacral injury causing a greater likelihood of repeat injury. Research should also focus on how treating lumbosacral radiculopathy in this way affects different age groups. Overall, more research would be beneficial on the treatment of lumbosacral radiculopathy to find the most comprehensive treatment available to patients who are looking to avoid invasive treatment.

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