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Neuromobilization vs. Conventional Physical Therapy for Lumbar Radiculopathy

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Neuromobilization vs. Conventional Physical Therapy for Lumbar Radiculopathy

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Abstract	2
Background and Purpose	3-4
Case Description	5
Discussion	6-8
Conclusion	8
Article Summaries	9-16
Appendix	17-74
Analyses of Articles	17-70
Article Summaries Chart	71-73
Literature Search Strategy	74
References	75-76

PICO Question

In patients with severe, chronic lumbar radiculopathy and lower extremity weakness, are conventional physical therapy approaches more effective than neuromobilization?

Abstract

Background: Lumbar radiculopathy is the result of a multitude of biomechanical and musculoskeletal factors. Symptoms usually range from central pain in the lumbar region to the ipsilateral buttock, but can also travel down the leg. The pain is usually described with numbness and tingling along with weakness on that same side. Treatment of this condition can range from being very simple if symptoms are mild to moderate to extremely difficult if symptoms are persistent and severe. It is extremely critical to be able to determine the type of intervention a patient will find most beneficial to alleviate their symptoms and achieve a more functional lifestyle.

Purpose: The purpose of this literature review is to discuss the effectiveness of conventional therapy approaches (therapeutic exercise/manual therapy/physical agents) versus neuromobilizations in patients with severe, chronic lumbar radiculopathy.

Case Description: The patient is a 47 y/o female referred to PT with a diagnosis of lumbar radiculopathy, L4 disk herniation, and sacroiliac joint dysfunction. The patient has been suffering with her symptoms consistently for about 14 years after she fell down a flight of stairs. Prior PT treatment exacerbated her symptoms, with patient-reported interventions of therapeutic exercise and TENS units. Neuromobilization was not attempted at any time during her prior bouts of therapy.

Outcomes: Overall, nerve mobilization seems to be beneficial when used as an adjunct to other forms of intervention like therapeutic, physical agents, and manual therapy.

Discussion: Nerve mobilization is a multifaceted approach focused on improving bloodflow to peripheral nerves and indirectly decreasing tension and relieving ischemia in perineural tissues. From the eight articles that were analyzed in depth, all the results had a common theme: neuromobilization is effective when combined with other forms of therapy. Granted, there were only a couple of articles that had intervention groups where neuromobilization was the sole intervention utilized. However, other groups where nerve mobilization was implemented with other therapy showed a greater alleviation of pain and an improvement in overall function.

Background and Purpose

Lumbar radiculopathy, commonly called “sciatica”, refers to symptoms of pain, numbness, and tingling that usually travel down one (or both) legs. Usually, it is the result of irritation of the spinal nerve as it exists the intervertebral foramen. Compression of the nerve at this location occurs secondary to a number of pathologies including disk herniations, spinal stenosis, and foraminal stenosis. It is usually described as a burning feeling down the extremity usually accompanied with secondary weakness (Efstahiou, 2015). As a result of proximal degenerative changes and spinal instability, peripheral nerve sensitivity is negatively affected. Consequently, this causes pathophysiological and pathomechanical changes to the perineural tissue (David et al, 2002). This increased mechanical tension on the nerve root (from aforementioned pathologies) and peripheral nerves causes irritation and is responsible for many of the symptoms that patients with lumbar radiculopathy complain of.

Nerve irritation is an extremely important concept that describes a broad scheme in the etiology of lumbar radiculopathy. Essentially, mechanical effects on the spine, whether that be due to a disk herniation, stenosis, or weakness and instability, have a physiological effect on the nerve root and the distal peripheral nerve. Physiological changes occur with increased pressure on the neuronal structures leading to obstruction in conduction, decrease in axonal flow, and vascular problems (Topp et al, 2006). The formation of edema, due to increase in permeability of the microvascular structures that supply the nerve, enhance fibroblast deposits and create adhesions that detrimentally affect the elasticity and mobility of the dural membrane and nerve roots (Kobayashi et al, 1993). In order for an extremity to move through a painfree range of motion, normal biomechanics of the spine and surrounding mechanical structures need to be achieved. Mechanical structures, such as muscular tissue, articular tissue, and ligamentous tissue, begin to increase in tone and decrease in elasticity, potentially contributing to the already compromised neural structures (Gracies, 2005).

Nerve mobilization (or neuromobilization) is a broad area of intervention used to promote optimal mobility of peripheral nerves and the spinal cord by addressing neurodynamic function. Neurodynamics refers to the integrated biomechanical, physiological, and morphological functions seen in the nervous system (citation). Normal neurodynamics involves the ability of nerves to adapt to normal stresses and withstand distinct mechanical occurrences such as elongation, compression, and sliding. Neuromobilization aims to reestablish balance between

irritated nervous tissues and surrounding perineural interfaces and thereby restore normal neurodynamics and foster optimal physiological and mechanical function (Ellis, 2008).

Restoration of optimal nerve mobility involves a thorough understanding of gross anatomy as well as basic biomechanical principles concerning the relationship between proximal and distal joints and the effect that movement has on the respective muscular, nervous, and ligamentous tissues. Essentially, establishing normal nerve mobility involves tensioning specific portions of a peripheral nerve (in this case, the sciatic nerve and its branches) and attempting to facilitate normal sliding along the perineural tissues through movement of the adjacent joints (Ellis, 2016). Specific types of mobilization include neural gliding and neural tensioning. Nerve gliding relates to the idea of performing joint movements that attempt to promote “sliding” of a peripheral nerve. These joint movements are different at each joint, utilizing combinations of movements that elongate the nerve at one joint and reduce the length of the nerve at an adjacent joint to result in an increased longitudinal excursion of the nerve with minimal increase in strain (Coppieters, 2008). Usually, these techniques are used with more acute symptoms. Nerve tensioning, on the other hand, involves the idea that increased tension on a nerve increases the intraneuronal pressure. Sustaining this increased pressure in a dynamic fashion can decrease the amount of intraneuronal edema and decrease symptoms (Burke, 2003). The tensioning of the nerve is not sustained, but is more oscillatory, the goal being to revive the nerve tissue’s physical potentials to tolerate movements that involve nerve elongation. These techniques are generally used with patient who present with minimal irritability. (Talebi, 2010).

Conventional physical therapy approaches, which includes interventions such as therapeutic exercise, physical agents, and manual therapy, are typically used by physical therapists to treat lumbar radiculopathy (Efstathiou, 2015). The intention is to facilitate spinal stability and increase abdominal strength, as well as increasing flexibility in the lower extremity tissues to decrease overall mechanical tension and reduce symptoms. Nerve mobilization can sometimes be omitted due to the nature of PT treatment being “impairment-based” and focusing on addressing surrounding mechanical issues to enhance overall mobility. The purpose of this literature review is to analyze different articles to determine if there is a superior method to implement into a plan of care and answer the clinical question, “in patients with severe, chronic lumbar radiculopathy and lower extremity weakness, are conventional physical therapy approaches more effective than neuromobilization?”

Case Description

Patient was a 47-year-old woman who presented to PT with a diagnosis of lumbar radiculopathy, L4 disk herniation, and sacroiliac joint dysfunction. The patient reported that she had an accident in 2002 where she slipped on a step and fell down a flight of stairs. She said that her symptoms had gradually worsened since the incident. She reported consistent neurological symptoms, such as tingling and numbness that occur in prolonged positions like sitting, standing, and walking. She reported that her pain is mainly on the right buttock region with intermittent referral down the right extremity. She described her pain as sharp, especially as soon as she wakes up in the morning. This issue was a daily occurrence and she had learned to cope, but stated that it does affect her emotionally every day. Working, travelling, or even spending time with her friends had become a challenge, and she didn't even get excited to enjoy aspects of life that any typical person frequents. The only position that was comfortable for her was to lie on her back in a hook-lying position. Also, she reports minimal relief when she was in the hot tub, using a TENS unit, or when she used lidocaine cream.

She reported that she has had physical therapy before for her current issues. She stated that her symptoms were severely exacerbated with the interventions that they were performing. They mainly focused on therapeutic exercise, electrical modalities, and some manual joint mobilization. Aquatic therapy was also incorporated into her regimen, which was the only treatment that seemed to minimally alleviate her symptoms while she was attending the therapy. After discharge, she reported the same increase in pain. She stated she does self-stretching and strengthening with different yoga poses at home, which she also uses for pain management.

During examination, the patient could not get into a comfortable position, even while the therapist was taking the history. Upon examination, it was difficult for the patient to perform many of the range of motion tests, especially lumbar ROM and hip ROM. Dermatomes and reflexes were within normal limits. Lumbar extension and right rotation reproduced her radicular symptoms, and she had trouble returning back to a neutral position during much of the testing. Hip strength (flexion, abduction, and adduction) was a 3/5, also exacerbating her symptoms. Palpation proved difficult secondary to extreme sensitivity by the patient who immediately needed to change positions for symptom eradication.

Discussion

Lumbar radiculopathy can present itself numerous different ways. There are so many factors that need to be taken into consideration when treating a patient with this diagnosis. Some of these include age, gender, chronicity, severity, trauma vs. insidious onset, and symptom manifestation. Along these same lines, treating this issue takes just as many factors into play. These factors include treating mechanical issues such as instability or hypo/hypermobility in the lumbar spine, addressing increased tension in distal soft tissue responsible for peripheral nerve irritation, considering degenerative changes in the spine such as stenosis, and focusing on trauma to the spine such as a disc herniation or fracture. A 20-year-old male with instability in the lumbar spine, weak abdominals, and a piriformis with increased tension will present differently and needs to be treated differently than a 60-year-old female with degeneration in her spine and osteophyte formation along the intervertebral foramen that's placing excess pressure on a nerve root.

The purpose of this review was to look at how beneficial it is to utilize neuromobilization to provide pain relief in patients with severe, chronic lumbar radiculopathy. The primary intent was to discover articles in which neuromobilization was the sole modality utilized in the intervention group, with conventional physical therapy being performed in the control group. Unfortunately, this was not the case. Most of the articles I analyzed had nerve mobilization as an adjunct to conventional therapy in the intervention group, with the control group performing only the conventional therapy. In addition, other factors that had an effect on my perception and faith in implementation of the mobilization nerve mobilization dealt with the evidence itself. The main issues that I had with the vast heterogeneity of the articles I analyzed were: lack of specification on type of nerve mobilization, differences in patient demographics and chronicity of lumbar radiculopathy throughout the different studies, duration of the study, follow-up time after the conclusion of the study, and whether or not the groups were blinded and randomized. All of these factors played a big role in whether or not I thought it would be a beneficial intervention to give to my patient, given her history. Also, the outcome measures used in 5/8 studies were the subjective National Pain Rating Scale and Visual Analog Pain Scale (Yamin et al 2016; Talebi et al, 2010; Kaur et al, 2011; Gupta, 2012; Su et al, 2016). While these seem like they would be beneficial due to the fact that they were given to each patient before and after the study, there is still a large area of interpretation that can negatively affect the external validity of the outcome.

Overall, after completing detailed analyses of eight articles, there was a common theme that I noticed and that makes a big difference to me in thinking about how I would address lumbar radiculopathy with my patients. This theme was that nerve mobilization is a great intervention when it is utilized in combination with other forms of therapy. The thought was that the diagnosis itself wasn't the result of the nerve, but of the tissues and joints that have detrimental mobility due to degeneration, trauma or instability, and mobility issues (Kaur et al, 2011). These problems result in improper biomechanics that effect the nerve roots and the distal peripheral nerves. If these issues are not addressed, the nerve mobilization in isolation is only palliative care for the patients (Jeong et al, 2016). Out of the eight articles that were analyzed, only one systematic review and one RCT talked about studies that had intervention groups using neuromobilization as the only treatment. In the systematic review, the result was not statistically significant for a reduction in pain (Su et al, 2016). The RCT study utilized a Passive Straight Leg Raise nerve mobilization in the experimental group with patient education and exercise being used in the control group. The results of this study were a statistically significant improvement in pain, SLR ROM, and Modified Oswestry Score. However, they did state that the improvement was greater in the experimental group (Kaur et al, 2011)). One article did analyze the implementation of spinal manipulation and mobilization on patients with lumbar radiculopathy and found that it was not indicated for patients with these symptoms (Leininger, 2011).

The specificity of the type of nerve mobilization used was a big issue when it comes to how to formulate a plan of care on an individualized basis. Some patients may need a nerve mobilization to bias the sciatic nerve more proximally using the SLR, while others may benefit more from a more distal mobilization, biasing the tibial and fibular nerves (Gupta, 2012). Throughout the studies that were analyzed, different methods of mobilization were applied with patients with differing symptom presentations and chronicity of lumbar radiculopathy being included throughout the studies. Only two of the studies dealt with chronic pain (Su et al, 2016; Ali et al, 2015), and in both of those studies, neuromobilization as an adjunct to conventional therapy seemed to be more beneficial than conventional PT alone. Along with biasing different nerves, there was also very little detail about the type of nerve mobilization that was focused on during treatment. Only one article goes into depth about the "gliding vs. tensioning" nerve

mobilizations (Talebi et al, 2010), but the evidence was not sufficient to answer my clinical question.

A lot more research needs to be conducted to sufficiently answer my clinical question for my specific patient. More detail needs to be provided throughout the articles, not just on the etiology of lumbar radiculopathy, but on the differences in the types of nerve mobilizations and how they addressed that in the course of their study. Being able to supply that information is important for clinicians, as it addresses how they can most accurately combine this intervention with conventional therapy for patients with differing presentations of lumbar radiculopathy. There is a vast variety of differing information on how to most appropriately perform treatment due to the diagnosis itself. However, I feel that the general message of combining nerve mobilization with conventional physical therapy being the most beneficial for most patients is seen throughout majority of the articles and SRs.

Conclusion

Overall, treatment for lumbar radiculopathy is dependent on a wide variety of factors. It is difficult to state whether a certain type of neuromobilization or other intervention is more beneficial than another due to the extensive array of symptom presentations and the numerous techniques used to alleviate them. From all the research that I analyzed, the one common idea that was presented through most of the articles was that nerve mobilization is only an effective intervention when it is implemented as an adjunct to conventional physical therapy. The idea is that the issue is not with the nerve itself, but of the tissues and joints surrounding the nerve that have a negative effect due to improper biomechanics and increased perineural tension.

My patient is unique in the sense that conventional therapy would only exacerbate her symptoms and she would be unable to perform any of the exercises. Since this is the case, I would implement manual therapy such as soft tissue mobilization for ischemic release of musculature, as well as light gliding neuromobilization to hopefully help her achieve an increased pain-free range of motion. This will allow her to hopefully perform some of the stabilization and strengthening exercises in the future and address the mechanical issues that she has and allow her to perform more activities without pain limiting her participation in her life.

Spinal Manipulation or Mobilization for Radiculopathy: A Systematic Review

Leininger, B., Bronfort, G., Evans, R., & Reiter, T. (2011). *Physical Medicine and Rehabilitation Clinics of North America*, 22(1), 105-125. doi:10.1016/j.pmr.2010.11.002

Level of Evidence: 1a

Purpose: To provide a comprehensive and “up-to-date” systematic review of the literature as it relates to the efficacy and effectiveness of SMT (spinal manipulative therapy) and MOB (mobilization) in management of cervical, thoracic, and lumbar-related extremity pain.

Methods: Researchers gathered randomized controlled trials published before August 10, 2010 with no restrictions on methodological quality. Inclusion criteria consisted of studies that listed spine-related symptoms, used a spine-related extremity-specific outcome measure, or specifically reporting results for patients with spine-related extremity symptoms. Also, SMT and/or MOB needed to be the primary form of therapy in at least one intervention group. Acceptable comparison groups included no treatment, placebo, or any other type of active intervention. Studies needed to perform a between-group analysis to be included in the review. Studies were then analyzed for quality using the GRADE approach and assessed for heterogeneity between the studies.

Results: 16 randomized trials that met the inclusion criteria were included in the review. SMT was used in 9 studies, MOB was used in 5 studies, and a combination of SMT/MOB in 2 studies. Studies on patients with acute symptoms, chronic symptoms, and a mixture of acute and chronic symptoms. Overall the quality of the studies was poor, with only one study meeting the criteria for having a low risk of bias. The results were convoluted, some focused on the effect of cervical spine-related extremity symptoms and some on lumbar. SMT was found to be superior to traction, exercise, corset, and chemonucleolysis for short term. MOB was found to be superior to exercise in the short term. SMT was found to be superior to sham SMT for acute radiculopathy in the long and short term. However, this is based on low-quality evidence.

Critique/Bottom Line: Due to the nature of the articles that were used and how they were obtained, the extreme heterogeneity of the articles included in the review, and the quality of evidence in those articles, it is difficult to establish a conclusion as the effectiveness of SMT and MOB in patients with radiculopathy symptoms. Applying this evidence clinically would be extremely unethical and potentially harmful to patients due to weak evidence and biased research. I don't feel that this evidence that can be used to answer my clinical question.

Efficacy of Sciatic Nerve Mobilization in Lumbar Radiculopathy due to Prolapsed Intervertebral Disc

Yamin, F., Musharraf, H., Rehman, A. U., & Aziz, S. (2016). Indian Journal of Physiotherapy and Occupational Therapy - An International Journal, 10(1), 37. doi:10.5958/0973-5674.2016.00009.5

Level of Evidence: 2b

Purpose: To evaluate the efficacy of sciatic nerve mobilization in patients with lumbar radiculopathy due to prolapsed intervertebral disc.

Methods: A total of 44 participants participated in the study. There were 22 females and 22 males. The average ages of all the participants was 41.89 years. They were required to have symptoms that referred distal to the buttocks, thigh, or leg and have a positive SLR test. Other inclusion criteria included patients within the age range of 25-65 years, prolapsed intervertebral disc without physical disabilities, and currently not taking any medications. Each patient filled out the Numeric Pain Rating Scale (NPRS) and assessment form before the intervention (pre-test) and after the intervention (post-test). A paired sample t-test was performed with a level of significance of 5%.

Results: The paired t-test was used in scoring of the NPRS, the mean and standard deviation before the treatment was 6.95 ± 1.18 and after the treatment reduced to 1.86 ± 2.03 . This was significant with a p-value < 0.001 .

Critique/Bottom Line: Upon first gazing at these results, it seems like utilizing sciatic nerve mobilizations during treatment of this patient population can lead to a greater reduction in pain. However, when looking deeper into the study at things such as study design, internal validity threats, outcome measures, and subjectivity, it can be detrimental to accept the results at face value. Due to the lack of a control/intervention group, it is difficult to determine whether sciatic nerve mobilizations are better than no treatment or any other type of treatment. I think that there is a benefit to utilizing this type of intervention clinically, but it is better to be aware of the various limitations of this study when performing this treatment.

The effects of self-mobilization techniques for the sciatic nerves on physical functions and health of low back pain patients with lower limb radiating pain

Jeong, U., Kim, C., Park, Y., Hwang-Bo, G., & Nam, C. (2016). Journal of Physical Therapy Science, 28(1), 46-50. doi:10.1589/jpts.28.46

Level of Evidence: 1b

PEDro: 3/10

Purpose: The purpose of this study was to examine the effects of self-mobilization techniques for the sciatic nerves on the quality of life in patients with chronic low back pain in the limbs accompanied by radiating pain.

Methods: A total of 30 subject visiting J oriental hospital and S hospital (located in proximity of the study) were gathered. Subjects needed to have a pain index of 3 or higher (out of 10), an Oswestry Disability Index score of more than 20%, and a positive SLR test between 30 and 70 degrees. Subjects were divided into two groups, one group receiving lumbar segmental stabilization exercise training and the other receiving this same treatment with the addition of sciatic nerve mobilization techniques. Physical Function (PF) and General Health (GH) were both analyzed via the Short-Form 36 Health Survey (SF-36) given before and after intervention. Treatment was conducted three times per week for six weeks. Statistical analysis consisted of an independent t-test between groups and a paired t-test within groups.

Results:

		Before	After
SSNMG	PF	17.7±3.5	25.1±3.3
	GH	12.6±3.0	19.0±4.1
LSEG	PF	17.3±5.3	20.3±6.5
	GH	15.8±2.8	16.6±3.4

SSNMG: self-mobilization of the sciatic nerve group

LSEG: lumbar stabilization exercise group

Differences were significant for SSNMG>LSEG ($p<0.05$)

There was a statistically significant difference in measurement results between the groups before and after the intervention.

Critique/Bottom Line: The results of this study demonstrate that there is a great benefit for implementing nerve mobilization (in this case sciatic nerve) into conventional treatment. I think the biggest take away from the results was that the nerve mobilizations were used as an adjunct treatment to exercise. The researchers pointed out a very crucial issue in answering my PICO question. Even though there are benefits to addressing the mobility and overall health of the nerve, mobilizing it in isolation may only be palliative. Addressing the other musculoskeletal impairments is crucial when treating these patients with chronic low back pain and radicular symptoms. That is why exercising addressing these impairments need to be included in the patient's plan of care.

Treatment of chronic radiculopathy of the first sacral nerve root using neuromobilization techniques: A case study

Talebi, G. A., Taghipour-Darzi, M., & Norouzi-Fashkhami, A. (2010). Journal of Back and Musculoskeletal Rehabilitation, 23(3), 151-159. doi:10.3233/bmr-2010-0260

Level of Evidence: 3b

Purpose: The purpose of this study was to introduce a case with abnormal neurodynamic responses following repetitive and chronic damages to L5-S1 intervertebral disc as well as providing treatment strategies based on neuro-biomechanical principles, and analytical evaluations to eradicate abnormal tension on the nervous system.

Methods: This article was a case report that analyzed a 36 year-old man with chronic lumbar radiculopathy. He had previously attended physical therapy where they performed modalities including TENS, ultrasound, and Mackenzie exercises. For this article, he was still complaining of pain in the same areas, albeit less severe than before. After physical examination, physical therapy was initiated. The first 3 weeks of treatment focused on “traditional” physical therapy with TENS, hot packs, stretching, and exercises. The next 6 weeks focused on neuromobilization therapy. Before using neuromobilization techniques, mechanical interface structures (joints, muscle stiffness) were treated. After this, gliding neuromobilization techniques were used followed by tensile loading neuromobilization techniques.

Results: After the first 3 weeks of traditional physical therapy, there was no improvement in daily life activities and his VAS was still a 5/10. After vertebral mobilization and piriformis relief, pain was still at a 5/10 and no improvement in Slump test pain was reported, but SLR pain and tenderness to palpation of piriformis was reduced a bit. After performing gliding neuromobilization techniques, pain had subsided to a 3/10, SLR pain was reduced considerably, but Slump test pain was still not improved. Following implementation of tensile loading neuromobilization techniques, pain severity was reduced to 0 and there was no pain with SLR, piriformis palpation, or Slump test provocation.

Critique/Bottom Line: The main concern that I have with this study is the fact that it is a case report with very low external validity. The article even states that one of the biggest limitations is that the differences in demographic information, severity, and other musculoskeletal parameters limit generalizing the results to a greater group of people. In addition, there was subjectivity with the only outcome measure mentioned (pain) and a lack of statistical analysis to gauge and significant improvement in the patient. However, the researchers explained lumbar radiculopathy and management so eloquently, that I feel it provides great information in how to approach treatment of my patient. Mentioning how it is important to address the musculoskeletal system before implementing any specific neuromobilization technique to achieve optimal results is crucial.

Effect of passive straight leg raise sciatic nerve mobilization on low back pain of neurogenic origin

Kaur, G., & Sharma, S. (2011). J Phys Occup Ther, 5, 179-84.

Level of Evidence: 1b

PEDro: 4/10

Purpose: The purpose of the study was to compare to effectiveness of neural mobilization and conventional therapy in patients with neurogenic back pain.

Methods: The study had 27 subjects aged 18-45 randomly assigned into either the experimental group or the conventional group. The inclusion criteria for the subjects was a history of mild to moderate pain (VAS>6), an Oswestry Disability Index score greater than 40%, and be in the subacute (2-12 weeks) phase of neurogenic low back pain. Neurogenic back pain was defined as pain below the lumbar region with or without radiation to the lower limb. Patients needed to have a positive SLR test, with dorsiflexion acting as the sensitizing maneuver (Braggard's). The experimental group received sciatic nerve mobilizations in the SLR test position consisting of passive dorsi and plantar flexion 3 sets of 10 repetitions each session. Improvement in hip flexion ROM, VAS, and Modified Oswestry Disability Index was assessed pre and post intervention. The conventional group intervention consisted of performing exercises and following advice on correct posture during certain activities. The exercises consisted of pelvic tilting exercises, back extension exercises, and cat and camel exercises. The same outcome measures were assessed pre and post intervention.

Results: Within group analysis using Wilcoxin Signed Ranks test and between-group analysis was done using Mann Whitney U-Test. Both are non-parametric static measures (test of differences).

- Pre-intervention data points of dependent variables (VAS, Hip ROM, and MODI) demonstrated homogeneity at baseline.
- There was significant improvement ($p<0.05$) in all variables for both groups pre and post intervention.

Between group analysis of all the variables demonstrated a significant post-intervention difference ($p<0.05$) in VAS, hip flexion ROM, and MODI. A comparison of median value of the variables demonstrated a greater improvement in the experimental group compared to the control group.

Critique/Bottom Line: To me, this study signified that it is important to be specific and address certain symptoms (like sciatic pain referral with neuromobilizations). However, it is still equally important to address the other musculoskeletal issues that can be contributing to the symptoms. After all, unless it is a specific neurological disease, the etiology of the symptoms is not a result of the nerve itself, but rather degenerative and biomechanical changes that are negatively influencing the nerve/nerve roots. Promoting spinal mobility, extensor strength, and pelvic mobility exercises allows optimal nerve mobility and ultimately can be attributed to a reduction in the patients symptoms.

Effectiveness of nerve mobilization in the management of sciatica

Gupta, M. (2012).. Indian Journal of, 6(2), 74-76.

Level of Evidence: 1b

PE德罗: 4/10

Purpose: The purpose of the study was to find out whether nerve mobilization techniques enhance patient outcomes in the management of sciatica when added to standard care.

Methods: There were 30 patients, both men and women with a diagnosis of sciatica. Their mean age was 52.8 ± 7.34 years. Patients were referred from PT department at G.B. Pant Hospital. Subjects were randomized via sealed envelope placing them into the control group (conventional PT) and the experimental group (conventional PT and nerve mobilization). Exclusion criteria included there were "red flags" for a more serious spinal condition, prior surgery, use of epidural steroids, or history of major psychiatric or systemic illness. Outcome measures included the NPRS pain scale and the SF-12 Functional score given before and after the intervention. Experimental group received sciatic nerve mobilization via SLR with tibial or peroneal nerve bias in addition to conventional PT. Graded neural tissue mobilization was based on irritability and severity of the condition. The control group received flexion or extension exercises based on presentation and 4-channel TENS for 30 minutes. Both groups received treatment 3 days a week for 2 weeks.

Results: Results showed that there was a significant difference in pain and functional status scores as indicated by the significance obtained in their respective p-values. The article states that non-parametric tests were used including Wilcoxon ranked sum and Mann Whitney U Test. However, no specific p-values were reported in the article.

Critique/Bottom Line: There were two big issues that I had with this study. The first was that there were no formal statistical values presented on the effectiveness of the intervention in favor of the experimental group. It is hard to be confident in what the researchers are stating in the article without this information. The second issue I had was with the fact that only tibial and peroneal nerve mobilizations were implemented for nerve mobilization treatments. No other components of the sciatic nerve were addressed. All in all, I still think this study shows that the implementation of neural mobilization to conventional therapy plan of care is beneficial to patients. An additional component to tissues that are stressed during movement (nerve tissue) is being addressed, which may be the reason patients experienced a decrease in pain and increase in function more than the control group.

Does Evidence Support the Use of Neural Tissue Management to Reduce Pain and Disability in Nerve-related Chronic Musculoskeletal Pain?

Su, Y., & Lim, E. C. W. (2016). *The Clinical Journal of Pain*, 32(11), 991-1004.

Level of Evidence: 1a

Purpose: The aim of this review was to compare pain and disability in individuals with nerve-related chronic MS pain who were treated with neural tissue management with those who received minimal or other treatment approaches.

Methods: This article was a systematic review with meta-analysis. 8 major databases were searched including MEDLINE, CINAHL, Cochrane Library, Embase, PEDro, Scopus, and Google Scholar were searched for randomized controlled trials that matched specific inclusion criteria mentioned in the article. Quality of the articles was then assessed and rated using the PEDro scale. To account for differing outcome scales used among studies, standardized mean differences (SMD) for pain and disability scores (the two outcomes measured in this study) were calculated along with 95% CI and heterogeneity scores. Trials were broken down into neural tissue management (NTM) vs “minimal intervention” or “other forms of intervention”.

Results: Overall, a decrease in pain was reported as statistically significant in the analysis of groups that received neural tissue management over minimal intervention (exercise, general PT in both groups). However, the use of neural tissue management vs other forms of intervention (NTM only for intervention group) for pain was not significant. For the use of NTM vs. minimal intervention and other forms of intervention for disability, the results were not statistically significant. Specific values of SMD and heterogeneity included in article.

Critique/Bottom Line: I think overall I understood the complexity of evaluating the effectiveness of neural mobilizations given that there are a multitude of approaches that can be done with such a vast amount of different types of lumbar patients. Taking the results of this study verbatim and utilizing them clinically in an attempt to treat all my patients would be unethical and potentially ineffective. The biggest takeaway I determined from the results was that neural mobilization is not effective on its own. When combined with conventional physical therapy, it is extremely beneficial on the pain that a patient experiences. However, it shouldn't be done in isolation. Even though the articles in this review differed significantly in methods, outcome measures, patient presentations, and methods of neural mobilization, I still think it may be beneficial (according to the results) to implement them into a plan of care in addition to other forms of intervention.

Effectiveness of slump neural mobilization technique for the management of chronic radicular low back pain

Ali, M., Ur Rehman, S. S., Ahmad, S., & Farooq, M. N. (2015). Rawal Med J, 40(1), 41-3.

Level of Evidence: 1b

PEDro: 4/10

Purpose: The objective of the study was to determine the effectiveness of the slump neural mobilization technique (SNMT) compared with lumbar stabilization exercise (LSE) and shortwave diathermy (SWD) in physical therapy management of chronic radicular low back pain (CRLBP).

Methods: 40 subjects from an outpatient physical therapy department in Pakistan were gathered for the study. The age range from the study was 20-60 years old. Participants needed to have chronic radicular low back pain with a reproduction of symptoms with the slump test. Some exclusion criteria were symptoms consistent with spinal infection, neoplasm, osteoporosis, spinal fracture, hard neurological findings, were pregnant, or had a history of spinal surgery. Subjects completed the Numeric Pain Rating Scale (0-4) and the modified Oswestry disability questionnaire. There were two groups that the subjects were randomly assigned to. Group A received slump slider neural mobilization, lumbar stabilization exercise, and shortwave diathermy. Group B only received the stabilization exercise and the diathermy. The study lasted for 3 weeks

Results: Both groups showed a significant improvement in pain score (3 to 1 in experimental group and 3 to 2 in control group). Function was also improved in both groups (52 to 14 in experimental and 29 to 20 in control)

Group A (neuromob group)

- Pain Score
 - Std. Dev: 0.858 ± 0.183
 - P-value: <0.001
- ODI Score
 - Std. Dev: 1.490 ± 0.318
 - P-value: <0.001

Group B

- Pain Score
 - Std. Dev: 1.305 ± 0.308
 - P-value: 0.003
- ODI Score
 - Std. Dev: 2.910 ± 0.686
 - P-value: 0.163

Critique/Bottom Line: Overall, this research article stated that nerve mobilizations are beneficial when combined with conventional stabilization exercise and potentially modalities. Nerve mobilizations weren't specifically isolated in terms of biasing specific portions of the sciatic nerve. I believe that promoting nerve mobility is only part of the process. Unless other factors are addressed, the benefits of neuromobilization are drastically decreased. This study was poor in the sense that the methodology of nerve mobilization was explained effectively. Also, there are great threats to the validity of the study with the lack of blinding of the investigators and the participants. In addition, the participants in this study were extremely isolated with the large amount of exclusion criteria, which poses a threat to the external validity of the research study.

Article 1: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Leininger, B., Bronfort, G., Evans, R., & Reiter, T. (2011). Spinal Manipulation or Mobilization for Radiculopathy: A Systematic Review. *Physical Medicine and Rehabilitation Clinics of North America*, 22(1), 105-125.
doi:10.1016/j.pmr.2010.11.002

Level of Evidence (Oxford): 1a

Does the design follow the Cochrane method?	
Appraisal Criterion	Reader's Comments
<p>Step 1 – formulating the question</p> <ul style="list-style-type: none"> • Do the authors identify the focus of the review • A clearly defined question should specify the types of: <ul style="list-style-type: none"> ○ people (participants), ○ interventions or exposures, ○ outcomes that are of interest ○ studies that are relevant to answering the question 	<p>Yes, the authors identify the focus of the review. The purpose of this SR is to provide a comprehensive and “up-to-date” systematic review of the literature as it relates to the efficacy and effectiveness of SMT (spinal manipulative therapy) and MOB (mobilization) in management of cervical, thoracic, and lumbar-related extremity pain.</p>
<p>Step 2 – locating studies</p> <ul style="list-style-type: none"> • Should identify ALL relevant literature • Did they include multiple databases? • Was the search strategy defined and include: <ul style="list-style-type: none"> ○ Bibliographic databases used as well as hand searching ○ Terms (key words and index terms) ○ Citation searching: reference lists ○ Contact with ‘experts’ to identify ‘grey’ literature (body of materials that cannot be found easily through conventional channels such as publishers) ○ Sources for ‘grey literature’ 	<p>The SR provides sufficient information to how studies were located, including inclusion/exclusion criteria for each article. Multiple databases (CINAHL, Medline, Mantis, PEDro) were used for articles. The SR states that the search strategy was developed by the Cochrane Back Group. No search terms of reference lists were listed. No mention of grey literature</p>
<p>Part 3: Critical Appraisal/Criteria for Inclusion</p> <ul style="list-style-type: none"> • Were criteria for selection specified? <ul style="list-style-type: none"> ○ Did more than one author assess the relevance of each report ○ Were decisions concerning relevance described; completed by non- experts, or both? 	<p>Inclusion criteria were specified and studies were assessed for quality by 2 reviewers using the risk-of-bias assessment. No decisions concerning relevance were</p>

<ul style="list-style-type: none"> ○ Did the people assessing the relevance of studies know the names of the authors, institutions, journal of publication and results when they apply the inclusion criteria? Or is it blind? 	<p>described, only analyzing the risk of bias in each of the studies. The article does not mention whether or not the reviewers were aware of the information on individual articles.</p>
<p>Part 3 – Critically appraise for bias:</p> <ul style="list-style-type: none"> • Selection – <ul style="list-style-type: none"> ○ Were the groups in the study selected differently? ○ Random? Concealed? • Performance- <ul style="list-style-type: none"> ○ Did the groups in the study receive different treatment? ○ Was there blinding? • Attrition – <ul style="list-style-type: none"> ○ Were the groups similar at the end of the study? ○ Account for drop outs? • Detection – <ul style="list-style-type: none"> ○ Did the study selectively report the results? ○ Is there missing data? 	<p>Because of the complexity in blinding manual treatments, the 6 domains recommended by Cochrane (randomization, allocation, concealment, blinding, incomplete outcome data, selective outcome reporting) were looked at in each article. Either they were, they weren't, or it was unclear.</p> <p>Selection: 6/16 studies described an adequate random generation, The remaining 10 were unclear. 3/16 studies had allocation concealment.</p> <p>Performance: There were many different intervention groups specified in different studies. One group was always either SMT, MOB, or both. Control groups/other intervention groups received medication, no treatment, traction, exercise, heat, chemonucleolysis, sham SMT, and massage.</p> <p>Attrition: SR does not mention whether studies accounted for dropouts.</p> <p>Detection: Results for individual studies were listed on a table.</p>
<p>Part 4 – Collection of the data</p> <ul style="list-style-type: none"> • Was a collection data form used and is it included? • Are the studies coded and is the data coding easy to follow? • Were studies identified that were excluded & did they give reasons why (i.e., which criteria they failed) 	<p>Yes, there was a collection data form that listed the groups, types of treatment and the results for each of the 16 individual studies. The listed studies were easy to follow. The excluded studies with reasons as to why they weren't included were listed.</p>

Are the results of this SR valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> • Is this a SR of randomized trials? Did they limit this to high quality studies at the top of the hierarchies 	<p>This SR included randomized clinical trials published before August 2010 with no restrictions on methodological quality.</p>

<ul style="list-style-type: none"> ○ If not, what types of studies were included? ○ What are the potential consequences of including these studies for this review's results? 	<p>Studies were selected based on inclusion/exclusion criteria. The consequences for the lack of restriction on quality is that there is a detrimental effect on several baseline characteristics and study design. These include randomization, whether or not there was blinding, and different sources of outcome data that can result in a poor outcome of results.</p>
<ul style="list-style-type: none"> • Did this study follow the Cochrane methods selection process and did it identify all relevant trials? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>Yes, from searching for articles to assessing the quality of articles, Cochrane methods were implemented. They were analyzed based on the 6 domains recommended by Cochrane and given a bias ranking: low, moderate, high.</p>
<ul style="list-style-type: none"> • Do the methods describe the processes and tools used to assess the quality of individual studies? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>Yes, as mentioned before, they use the 6 domains (randomization, allocation concealment, blinding, incomplete outcome data, and selective outcome reporting) to analyze bias in the studies. There were several criteria that the studies had to meet to be classified as low bias and moderate bias. All studies that were not low or moderate were classified as high bias.</p> <p>The quality of the evidence was also analyzed using the GRADE approach. Using this approach, high quality evidence was defined as RCTs with low risk of bias. The quality was reduced by 1 level for each of the 6 domains not met (study design, risk of bias, consistency of results, directness, precision, publication bias).</p>
<ul style="list-style-type: none"> • What was the quality of the individual studies included? Were the results consistent from study to study? Did the investigators provide details about the research validity or 	<p>Yes, the quality of individual studies was included. The results were not consistent from study to study. Each study focused on either a different approach or different type of spine-related extremity symptoms. Researchers did provide details about quality</p>

<p>quality of the studies included in review?</p>	<p>of the studies and validity was analyzed via the GRADE approach.</p>
<ul style="list-style-type: none"> • Did the investigators address publication bias? 	<p>See GRADE approach above.</p>

<p>Are the results of this SR important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<ul style="list-style-type: none"> • Were the results homogenous from study to study? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>After analysis of the articles, most were rated as having poor quality evidence. Results between each of the 16 studies addressed either cervical-related extremity symptoms or lumbar-related extremity symptoms (no research was found for thoracic symptoms). Due to the nature of the differences between the intervention groups vs. the control groups, the results were not homogenous. The consequences of these results is detrimental to answer my research question due to the abundance of control groups in the different studies. Some studies found STM/MOB beneficial under very specific circumstances and others showed this type of treatment approach to be inferior to others. Again, due to the variety of other approaches in other control groups, it is difficult to ascertain consistency between these results.</p>
<ul style="list-style-type: none"> • If the paper is a meta-analysis did they report the statistical results? Did they include a forest plot? What other statistics do they include? Are there CIs? 	<p>Statistical results were reported. Continuous outcomes were analyzed using mean differences and dichotomous outcomes were analyzed using odds ratios. Statistical heterogeneity between studies was assessed using the χ^2 and I^2 statistic. Direction of effect was reported as superior or inferior if the results were statistically significant.</p>

<ul style="list-style-type: none"> From the findings, is it apparent what the cumulative weight of the evidence is? 	<p>No, the results are extremely variable from low-quality resources.</p>
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Can you apply this valid, important evidence from this SR in caring for your patient/client? What is the external validity?

<i>a. Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> Is your patient different from this in the SR? 	<p>My patient is similar to some of the lumbar-related studies that focused on participants with chronic lumbar-related symptoms. Only 7/16 studies that were analyzed included this type of patient.</p>
<ul style="list-style-type: none"> Is the treatment feasible in your setting? Do you have the facilities, skill set, time, 3rd party coverage to provide this treatment? 	<p>Yes, SMT and MOB approaches can easily be performed at outpatient orthopedic clinical settings. This is dependent on the skill set of the therapist on the techniques, but it is extremely feasible and can be included in the "manual therapy" portion of billing.</p>
<ul style="list-style-type: none"> Does the intervention fit within your patient/client's stated values or expectations? <ul style="list-style-type: none"> If not, what will you do now? 	<p>My client had endured many therapists who gave her therapeutic exercise to potentially alleviate her symptoms. These had little to no effect on my client. Trying this different approach might produce different results than what she has previously seen in the past.</p>

What is the bottom line?

<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> Summarize your findings and relate this back to clinical significance? 	<p>Overall, I realize that this systematic review is at the lower end as far as quality of evidence goes. Yes, there was an extensive search with specific inclusion/exclusion criteria. However, the articles that were chosen and analyzed were poor in quality and the results were extremely heterogeneous in nature. Had the articles been more specific and more similar</p>

to each other, this would've been far more effective in how I approach treating my patient. However, due to the variety in the results/methods, high bias in most of the included articles, and the poor quality of the articles, I realize that incorporating this type of evidence would be unethical and potentially ineffective in dealing with my client. This article does mention that with chronic lumbar-related spine extremity symptoms, the SMT/MOB approach may be a viable option for patients that are open to trying new approaches to ease their symptoms, but this is based on low-quality evidence. That is a clinical decision that one would need to come to when the time is right.

Article 2: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Yamin, F., Musharraf, H., Rehman, A. U., & Aziz, S. (2016). Efficacy of Sciatic Nerve Mobilization in Lumbar Radiculopathy due to Prolapsed Intervertebral Disc. *Indian Journal of Physiotherapy and Occupational Therapy - An International Journal*, 10(1), 37. doi:10.5958/0973-5674.2016.00009.5

Level of Evidence: 2b

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>The purpose of the study is really not mentioned in the introduction, but is stated clearly in the abstract. The introduction provides more history and definition as to what the study is going to consist of. The purpose of the study is to evaluate the efficacy of sciatic nerve mobilization in patients with lumbar radiculopathy due to a prolapsed intervertebral disc.</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>The researchers present relevant background information about the etiology, demographic statistics, typical management, and common symptoms of lumbar radiculopathy. The concept of neural mobilization is introduced and stressed as a treatment technique that needs to be addressed and potentially implemented to a greater extent.</p>
Does the research design have internal validity?	
Appraisal Criterion	Reader's Comments

- **Discuss possible threats to internal validity in the research design.**
Include:
- **Assignment**
- **Attrition**
- **History**
- **Instrumentation**
- **Maturation**
- **Testing**
- **Compensatory Equalization of treatments**
- **Compensatory rivalry**
- **Statistical Regression**

Assignment: There were a total of 44 participants in this study: 22 females and 22 males. The average age of the participants was 41.89 years and all participants met the inclusion criteria. As this was a quasi-experimental design, there was no random assignment.

Attrition: There were no drop outs during the course of the study.

History: The article does not mention whether the patients were receiving any additional treatments. They were only required to participate in the three sessions per week for 3 weeks.

Instrumentation: The Numeric Pain Rating Scale (NPRS) was utilized to assess the outcome of the intervention. This, of course, is a subjective measurement from the patient.

Maturation: Since this intervention is treating a neurologic problem, it is difficult to determine whether or not there was spontaneous recovery in the patients, as the duration of the problem was not mentioned. However, since one of the inclusion criteria was evidence of a prolapsed intervertebral disc, it shouldn't not be a problem for internal validity.

Testing: The only testing that was done was asking the patient how they would rate their pain on the NPRS scale. This subjective information can potentially be a problem for internal validity.

Compensatory Equalization of Treatments: There was not control group in this study.

Compensatory Rivalry: Each participant received the same intervention.

Statistical Regression: There was no statistically significant difference in the severity of the pain, as reported in the article.

Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>2. Did the investigators randomly assign subjects to treatment groups?</p> <p>a. If no, describe what was done</p> <p>b. What are the potential consequences of this assignment process for the study's results?</p>	<p>a. No, this was a quasi-experimental design with purposive sampling. Participants needed to meet the inclusion criteria to be included in the study. There was not control group, all participants received the same intervention.</p> <p>b. Since there is no control group, it is difficult to determine if this intervention is more effective than no intervention or another type of intervention, which might prove detrimental to my PICO question.</p>
<p>3. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p>a. If they were not similar – what differences existed?</p>	<p>a. There was no blinding. Demographics of the study groups were reported. The only differences that existed were the ages and the severity of radicular symptoms.</p>
<p>4. Did the subjects know to which treatment group they were assign?</p> <p>a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>a. Yes, there was only 1 intervention group.</p>
<p>5. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p>a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>a. Yes. There was only one intervention group. Consequences are similar to what is listed in box number 1.</p>
<p>6. Were the groups managed equally, apart from the actual experimental treatment?</p> <p>a. If not, what are the potential consequences of this</p>	<p>a. Each participant was managed equally, receiving the same sciatic nerve mobilization treatment three times a week for 3 weeks.</p>

<p>knowledge for the study's results?</p>	
<p>7. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>a. The study lasted 3 weeks, at which time a post-test evaluating NPRS score was assessed. There was no follow-up after the conclusion of the study.</p>
<p>8. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it was handled with respect to the study's findings?</p>	<p>a. Yes, all subjects completed the study.</p>
<p>9. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <p>a. If not, what did the authors do with the data from these subjects?</p> <p>b. If the data were excluded, what are the potential consequences for this study's results?</p>	<p>a. There was no attrition in the study.</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>10. What were the statistical findings of this study?</p> <p>a. When appropriate use the calculation forms below to determine these values</p> <p>b. Include: tests of differences? With p-values and CI</p> <p>c. Include effect size with p-values and CI</p>	<p>a, c, d, e = N/A</p> <p>b. A paired t-test was used between the pre and post treatment scoring of NPRS. The mean and SD before the treatment was 6.95±1.18, after the treatment reduced to 1.86±2.03. This was significant at a 5% level of significance with the p-value being <0.001.</p>

<p>d. Include ARR/ABI and RRR/RBI with p-values and CI</p> <p>e. Include NNT and CI</p>	
<p>11. What is the meaning of these statistical findings for your patient/client’s case? What does this mean to your practice?</p>	<p>For my patient, since she does have a history of prolapsed intervertebral disc resulting in majority of her symptoms, I don’t think that this type of intervention is necessarily detrimental. Sure, this was a quasi-experimental study design with no randomization, blinding, or control group, but the pain level did improve significantly in each patient.</p>
<p>12. Do these findings exceed a minimally important difference?</p> <p>a. If not, will you still use this evidence?</p>	<p>The minimally important difference was not brought up or discussed due to the outcome measure being subjective. Again, since there was consistency in the decrease of pain level, I will definitely consider using this evidence.</p>
<p>Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader’s Comments</i></p>
<p>13. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?</p>	<p>Yes, I think this type of intervention is definitely appropriate for use in the outpatient orthopedic setting. It is a type of manual therapy that can be billed for via insurance or Medicaid.</p>
<p>14. Are the study subjects similar to your patient/ client?</p>	<p>Yes, my client meets all of the inclusion criteria except for the fact that she was on</p>

<p>a. If not, how different? Can you use this intervention in spite of the differences?</p>	<p>multiple medications to treat her severe symptoms.</p>
<p>15. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?</p>	<p>Yes, there may be significant benefits for implementing neural mobilization techniques on my client, who reported only having therapeutic exercise to address her issues.</p>
<p>16. Does the intervention fit within your patient/client's stated values or expectations? a. If not, what will you do now?</p>	<p>Yes. This is a chronic issue that has only been addressed with medication and therapeutic exercise.</p>
<p>17. Are there any threats to external validity in this study?</p>	<p>No threats.</p>

<p>What is the bottom line</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>PEDro score</p>	<p>N/A</p>
<p>Summarize your findings and relate them back to clinical significance</p>	<p>The results of this study show that there is a significant improvement in the NPRS in all of the participants. By reading this initially, it seems like sciatic nerve mobilizations can potentially lead to greater improvement in pain reduction in patients with a prolapsed disc. However, as I delve deeper into the study and look at things such as study design, threats to internal validity, outcome measures, and subjectivity, I err on the side of caution for result interpretation. Since there was no control group/other intervention group, it is difficult to conclude whether neural mobilizations are better than anything else. Also, due to the subjective nature of the outcome measure and</p>

	<p>confusing baseline characteristics within the participants, the results can be misconstrued as effective when they may not be.</p> <p>Overall, I think that there is a benefit to sciatic nerve mobilizations in this patient population. I don't see any unfavorable consequences for implementing this into my patient's plan of care. I would just be cognizant to the aforementioned issues when treating.</p>
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Article 3: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Jeong, U., Kim, C., Park, Y., Hwang-Bo, G., & Nam, C. (2016). The effects of self-mobilization techniques for the sciatic nerves on physical functions and health of low back pain patients with lower limb radiating pain. *Journal of Physical Therapy Science*, 28(1), 46-50. doi:10.1589/jpts.28.46

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>Yes, it is clearly stated, both in the abstract and the introductory paragraph. The purpose of the study was to examine the effects of self-mobilization techniques for the sciatic nerves on the quality of life in patients with chronic low back pain in the limbs, accompanied by radiating pain.</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>Yes, relevant background information was presented, mentioning the prevalence of this condition, as well as etiology and consequences if the condition persists without treatment. There is little mention of prior research in the introduction, with the researchers only mentioning that there is a "lack of research". However, in the discussion, several articles are presented with results addressing the clinical question.</p>

Does the research design have internal validity?	
Appraisal Criterion	Reader's Comments
<p>➤ Discuss possible threats to internal validity in the research design. Include:</p>	<p>Assignment: Groups were randomly assigned. There were 8 males and 7 females in each group. There was no significant</p>

- **Assignment**
- **Attrition**
- **History**
- **Instrumentation**
- **Maturation**
- **Testing**
- **Compensatory Equalization of treatments**
- **Compensatory rivalry**
- **Statistical Regression**

difference in baseline characteristics. All participants met the mentioned inclusion criteria.

Attrition: There were not drop outs during the course of the study.

History: The article does not mention whether patients were receiving additional treatment or performing an exercise regimen outside of the study environment, only that they consented to perform the intervention 3 days per week.

Instrumentation: The Short-Form 36 Health Survey (SF-36) was used to evaluate the subjects. This has previously been used as an inclusive measure of disability, including damage to physical function and structure, limitation of activities, and satisfaction felt by patients.

Maturation: It is difficult to determine any spontaneous recovery within patients, due to the nature of a neurological problem. Age was not a factor for the duration of the study.

Testing: The SF-36 was given to the participants before the intervention and after the intervention. No other methods of testing were performed.

Compensatory Equalization of Treatments: Due to the fact that there was no blinding of the investigators mentioned, this could pose as a threat to the internal validity of the study.

Compensatory Rivalry: Since the participants were not blinded (or at least it wasn't mentioned), there may have been motivation for the group receiving only lumbar spine exercises to work harder than normal, resulting in a lack of internal validity.

Statistical Regression: There was no statistically significant difference in physical functioning (PF) and general health (GH) between the groups prior to intervention.

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Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>18. Did the investigators randomly assign subjects to treatment groups?</p> <p style="margin-left: 20px;">a. If no, describe what was done</p> <p style="margin-left: 20px;">b. What are the potential consequences of this assignment process for the study's results?</p>	<p>Yes, subjects were randomly assigned. There are no detrimental consequences due to random assignment.</p>
<p>19. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p style="margin-left: 20px;">a. If they were not similar – what differences existed?</p>	<p>Yes, groups were similar at the start of the study.</p>
<p>20. Did the subjects know to which treatment group they were assign?</p> <p style="margin-left: 20px;">a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>It doesn't mention that the subjects didn't know, so its better to err on the side of caution and say that they might've known. There are several consequences and threats to internal validity, which may affect the results and ability to apply them</p>
<p>21. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p style="margin-left: 20px;">a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>The article doesn't mention that the investigators were blinded, only that the exercises were performed under the supervision of a skilled therapist. This can pose negative consequences for the study as a whole and the usefulness in answering my clinical question.</p>
<p>22. Were the groups managed equally, apart from the actual experimental treatment?</p> <p style="margin-left: 20px;">a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>Yes, apart from one group receiving sciatic nerve mobilizations, they were both managed equally.</p>

<p>23. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>There was no follow-up reported after the post-intervention SF-36 form. This can be detrimental because results may be negatively affected if the patient is not continuously performing their exercises.</p>
<p>24. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it was handled with respect to the study's findings?</p>	<p>All subjects enrolled completed the study.</p>
<p>25. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <p>a. If not, what did the authors do with the data from these subjects?</p> <p>b. If the data were excluded, what are the potential consequences for this study's results?</p>	<p>All subjects completed the study, no ITT analysis was performed.</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>26. What were the statistical findings of this study?</p> <p>a. When appropriate use the calculation forms below to determine these values</p> <p>b. Include: tests of differences? With p-values and CI</p> <p>c. Include effect size with p-values and CI</p> <p>d. Include ARR/ABI and RRR/RBI with p-values and CI</p> <p>e. Include NNT and CI</p>	<p>a,c,d,e: N/A</p> <p>SSNMG: self-mobilization of the sciatic nerve group LSEG: lumbar stabilization exercise group</p> <p>b. Independent t-test between groups and paired t-test within groups were used.</p> <p>SSNMG PF pre: 17.7±3.5 SSNMG PF post: 25.1±3.3 LSEG PF pre: 17.3±5.3</p>

	<p>LSEG PF post: 20,3±6.5</p> <p>Differences were significant. (p<0.05)</p> <p>SSNMG GH pre: 12.6±3.0 SSNMG GH post: 19.0±4.1 LSEG GH pre: 15.8±2.8 LSEG GH post: 16.6±3.4</p> <p>Differences were significant (p<0.05)</p> <p>There was a statistically significant difference in measurement results between the groups before and after the intervention.</p>
<p>27. What is the meaning of these statistical findings for your patient/client’s case? What does this mean to your practice?</p>	<p>These results speak greatly to my case. Even with the threats to internal validity posing the risk that there wouldn’t be a difference between both groups, there was a significant difference between the control group (LSEG) and the intervention group (SSNMG) in both physical function and general health. This means that it is still crucial to implement normal conventional methods of treatment, but there is a benefit to reap for implementing neuromobilization treatments into the patient’s plan of care.</p>
<p>28. Do these findings exceed a minimally important difference? a. If not, will you still use this evidence?</p>	<p>This isn’t mentioned in this article. Statistical significance was assessed, which is all that is relevant for this particular study,</p>
<p>Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader’s Comments</i></p>

<p>29. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?</p>	<p>Yes, this type of intervention can easily be implemented in an outpatient orthopedic clinic. It is also affordable and able to be covered by insurance, being billed as manual therapy and therapeutic exercise.</p>
<p>30. Are the study subjects similar to your patient/ client? a. If not, how different? Can you use this intervention in spite of the differences?</p>	<p>Yes, my client had chronic low back pain, had a low score on the Oswestry Disability Index, and a positive result on the SLR. The only difference is the fact that my client had a history of surgery, which was part of the exclusion criteria in this study. Nonetheless, it is still an approach that can be attempted to see if there is alleviation of her symptoms.</p>
<p>31. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?</p>	<p>The benefits outweigh the risks in this case. Promoting nerve mobility with the intention of stimulating the nervous system and reducing NS-induced muscle tension, promoting blood flow to the nerve, and decrease sensitivity is extremely important in these patients,</p>
<p>32. Does the intervention fit within your patient/client's stated values or expectations? a. If not, what will you do now?</p>	<p>Yes, my client's main goal is to be able to live a functional life with a drastic decrease in her symptoms. Given that this intervention showed improved physical function and general health, I think it is extremely viable for my client.</p>
<p>33. Are there any threats to external validity in this study?</p>	<p>Yes, a lot of patients with severe low back pain with radicular symptoms have had surgery to attempt to alleviate the issue. The patient's in this study were required not to have surgery. This technique may work differently in these patients.</p>

<p>What is the bottom line</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>PEdro score</p>	<p>3/10</p>

Summarize your findings and relate them back to clinical significance

Using the SF-36, this study analyzed how physical function and general health changed for two different groups over a six-week course. There was a statistically significant difference in both of these categories, with the group receiving nerve mobilizations improving more. Due to the fact that the SF-36 has been studied for validity and reliability and is an effective measure for gauging improvements in physical health, social functioning, mental health and vitality, it is an effective measure to demonstrate improvements in the subjects in this study. The only severe limitation I see in this study is the fact that the investigators and the subjects weren't blinded to which group they were in. This may have resulted in some compensatory equalization of treatment or compensatory rivalry. Even so, the results don't necessarily indicate that this was an issue since the intervention group improved significantly more.

This study tells me that nerve mobilizations are effective as an adjunct treatment method to traditional exercise and mobilization. Since we still want to address the biomechanical issues of the musculoskeletal system, nerve mobilization should be used in addition to exercise.

Article 4: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Talebi, G. A., Taghipour-Darzi, M., & Norouzi-Fashkhami, A. (2010). Treatment of chronic radiculopathy of the first sacral nerve root using neuromobilization techniques: A case study. *Journal of Back and Musculoskeletal Rehabilitation*, 23(3), 151-159. doi:10.3233/bmr-2010-0260

Level of Evidence: 3b

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>Yes, the purpose of the study is clearly stated. The purpose of this study was to introduce a case with abnormal neurodynamic responses following repetitive and chronic damages to L5-S1 intervertebral disc as well as providing treatment strategies based on neuro-biomechanical principles, and analytical evaluations to eradicate abnormal tension on the nervous system.</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>Yes, relevant background information is presented. The information mainly focuses on the etiology of symptoms resulting from nerve root pathologies as well as pathomechanical and pathophysiological problems that arise from this. The information then focuses on S1 nerve root involvement specifically and goes into detail about the prevalence and the symptoms and how neuromobilization techniques can be helpful. The researchers also mention the amount of researchers that is lacking regarding this treatment technique but don't cite any specific articles in the introduction.</p>

Does the research design have internal validity?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> ➤ Discuss possible threats to internal validity in the research design. Include: ➤ Assignment ➤ Attrition ➤ History ➤ Instrumentation ➤ Maturation ➤ Testing ➤ Compensatory Equalization of treatments ➤ Compensatory rivalry ➤ Statistical Regression 	<p>As this was a case report, most of these threats to internal validity do not apply to the article. Some that do include:</p> <p>Instrumentation: The only measures for measuring effectiveness of the neuromobilization and other techniques used in the study were: pain level (based on the VAS scale, pain alleviation SLR position, tenderness/pain upon deep piriformis palpation, pain with sustained lumbar flexion at end range in a standing position, and pain with the Slump test.</p> <p>Maturation: Due to the chronic nature of the condition of this particular patient, and the fact that he had undergone prior visits to physical therapy, it is safe to assume that spontaneous recovery was not an issue for this neurologic pathology.</p> <p>Testing: Most of this was subjective information (except for the VAS scale for maximum pain).</p>

Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>34. Did the investigators randomly assign subjects to treatment groups?</p> <ul style="list-style-type: none"> a. If no, describe what was done b. What are the potential consequences of this assignment process for the study's results? 	<p>No random assignment as this was an individual case report.</p>

<p>35. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p>a. If they were not similar – what differences existed?</p>	<p>N/A</p>
<p>36. Did the subjects know to which treatment group they were assign?</p> <p>a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>N/A</p>
<p>37. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p>a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>N/A</p>
<p>38. Were the groups managed equally, apart from the actual experimental treatment?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>N/A</p>
<p>39. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>According to the study, there was a follow up 2 months after the conclusion of the study. At this point, the patient reported a total eradication of his initial symptoms.</p>
<p>40. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it</p>	<p>N/A</p>

<p>was handled with respect to the study's findings?</p>	
<p>41. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <ul style="list-style-type: none"> a. If not, what did the authors do with the data from these subjects? b. If the data were excluded, what are the potential consequences for this study's results? 	<p>N/A</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>42. What were the statistical findings of this study?</p> <ul style="list-style-type: none"> a. When appropriate use the calculation forms below to determine these values b. Include: tests of differences? With p-values and CI c. Include effect size with p-values and CI d. Include ARR/ABI and RRR/RBI with p-values and CI e. Include NNT and CI 	<p>No statistical analysis was performed.</p>
<p>43. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?</p>	<p>N/A</p>
<p>44. Do these findings exceed a minimally important difference?</p> <ul style="list-style-type: none"> a. If not, will you still use this evidence? 	<p>N/A</p>

Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
45. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes, these interventions are appropriate for an outpatient orthopedic clinical setting. It is also affordable, and all treatment methods used in this article can be billed for under "Manual Therapy".
46. Are the study subjects similar to your patient/ client? a. If not, how different? Can you use this intervention in spite of the differences?	For the most part, the patient in the case report is similar to the patient I had in clinic. The major differences are that my patient was ten years older, had been suffering with this issue for about 10 years (as opposed to 6 months), and was in more severe pain than the patient in the article. I believe that this intervention can be used in spite of the differences between my patient and this patient in the study. The intent of neuromobilization is still the same and can be implemented if there are no contraindications in a specific patient (hip replacement, etc.)
47. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	I believe the benefits outweigh the risks in this instance. This intervention is merely promoting nerve mobility by reviving the nervous system via gliding and tensile techniques (not in the range of pain) to improve intraneural circulation, axoplasmic current, and connective tissue elasticity to have positive impact on the symptoms.
48. Does the intervention fit within your patient/client's stated values or expectations? a. If not, what will you do now?	Yes, my client has previously attended physical therapy with the focus being on therapeutic exercise and modality treatment. No neuro-specific approach has been tried with her.
49. Are there any threats to external validity in this study?	Yes. This is a case report that looks at neuromobilization approaches to improve symptoms in one individual. There are numerous parameters including differences in demographic information, severity of

	radiculopathy and disc damage, and pain severity that make it very difficult to apply to other patients.
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What is the bottom line	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
PEDro score	N/A
Summarize your findings and relate them back to clinical significance	<p>Even though this study provided a low level of evidence to answer my clinical question, the approaches that were taken and the way the researchers explained the etiology of lumbar radiculopathy and specificity in management of this problem makes me confident in neuromobilization as an effective treatment technique. One of the biggest limitations of this article was the subjectivity of the outcome measure (pain) and the lack of statistical analysis to gauge any significant improvement. In my opinion, that is a crucial part of any research design as it provides external validity and more objective results. Analyzing the article as a whole, I feel that the treatment approach makes sense, going from a more musculoskeletal approach and mobilizing the vertebra and promoting flexibility of the piriformis muscle to facilitate optimal nerve movement before it is addressed in isolation. Addressing these mechanical interfaces allows researchers (and therapists) to rule out musculoskeletal involvement in the creation of symptoms and allows them to focus more on the mobility of the nerve to see if there is alleviation of symptoms.</p>

Article 5: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Kaur, G., & Sharma, S. (2011). Effect of passive straight leg raise sciatic nerve mobilization on low back pain of neurogenic origin. *J Phys Occup Ther*, 5, 179-84.

Level of Evidence: 1b

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>Yes, the purpose of the study is clearly stated. The purpose of the study was to compare to effectiveness of neural mobilization and conventional therapy in patients with neurogenic back pain.</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>Yes, relevant background information was presented. The researchers stated that neuro mobilization has been studied and has been revealed as a good adjunct to conventional therapy, but the PSLR mobilization has not yet been studied. Other research about conventional therapy being effective and also lack of evidence was also mentioned in the introduction. This study aimed to examine a particular type of neuro mobilization as opposed to what researchers have done in the past.</p>
Does the research design have internal validity?	
Appraisal Criterion	Reader's Comments

<ul style="list-style-type: none"> ➤ Discuss possible threats to internal validity in the research design. Include: ➤ Assignment ➤ Attrition ➤ History ➤ Instrumentation ➤ Maturation ➤ Testing ➤ Compensatory Equalization of treatments ➤ Compensatory rivalry ➤ Statistical Regression 	<p>Assignment: Groups were randomly assigned. There were 12 subjects in the experimental group and 15 subjects in the conventional group. There was no significant difference in baseline characteristics between the groups, and all participants met the inclusion criteria.</p> <p>Attrition: There were no drop outs during the course of the study.</p> <p>History: The article does mention that the conventional groups was instructed to “stay as active as possible” outside the course of the study. This may or may not have an impact as the experimental group was only receiving PSLR mobilization treatment,</p> <p>Instrumentation: Pain Visual Analog Scale (VAS), hip flexion ROM (goniometer), symptom distribution (Werneke’s Overlay Template), and disability (Modified Oswestry Disability Index) were used to measure outcomes.</p> <p>Maturation: As this is pain of neurogenic origin, it is difficult to ascertain whether spontaneous recovery occurred in some patients. Age was not a factor during the study.</p> <p>Testing: VAS, ROM, Overlay Template, and Oswestry were the tools used to measure outcomes. The only potential threat to internal validity is the ROM, but it was performed by the same therapist pre and post intervention.</p> <p>Compensatory Equalization of Treatments: The study doesn’t mention whether the investigators were blinded. This could potentially pose as a threat to internal validity.</p> <p>Compensatory Rivalry: The study also doesn’t mention whether the participants were blinded to which group there were placed in. This can be detrimental to the internal validity of the study.</p> <p>Statistical Regression: There was a random assignment for the control and intervention</p>
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	groups. There was no statistically significant difference between the outcome measures prior to the conduction of the study.
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Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>50. Did the investigators randomly assign subjects to treatment groups?</p> <p>a. If no, describe what was done</p> <p>b. What are the potential consequences of this assignment process for the study's results?</p>	<p>Yes, the subjects were randomly assigned. No detrimental consequences would result due to random random assignment.</p>
<p>51. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p>a. If they were not similar – what differences existed?</p>	<p>Yes, the groups were similar at the start of the study.</p>
<p>52. Did the subjects know to which treatment group they were assign?</p> <p>a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>The study does not mention whether the subjects knew which group they were in, so it's best to assume that they might have known. This poses a threat to internal validity, which might affect the results.</p>
<p>53. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p>a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>The article doesn't mention if the investigators were blinded, only that each participant was either assigned the experimental or controlled treatment. This can result in negative consequences for the results of the study.</p>
<p>54. Were the groups managed equally, apart from the actual experimental treatment?</p> <p>a. If not, what are the potential consequences of this</p>	<p>Yes, the only difference between the groups was the treatment that they received, but they reported the same outcome measures.</p>

<p>knowledge for the study's results?</p>	
<p>55. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>There was no follow-up to see whether there were long-term benefits for the sciatic nerve mobilizations. The authors stated that clinical studies with adequate follow up should be undertaken to assess the carry over effects of these techniques.</p>
<p>56. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it was handled with respect to the study's findings?</p>	<p>All subjects enrolled completed the study.</p>
<p>57. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <p>a. If not, what did the authors do with the data from these subjects?</p> <p>b. If the data were excluded, what are the potential consequences for this study's results?</p>	<p>All subjects completed the study, no ITT analysis was performed.</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>58. What were the statistical findings of this study?</p> <p>a. When appropriate use the calculation forms below to determine these values</p> <p>b. Include: tests of differences? With p-values and CI</p> <p>c. Include effect size with p-values and CI</p>	<p>a,c,d,e: N/A</p> <p>b. Within group analysis using Wilcoxin Signed Ranks test and between-group analysis was done using Mann Whitney U-Test. Both are non-parametric static measures (test of differences).</p> <p>- Pre-intervention data points of dependent variables (VAS, Hip ROM,</p>

<p>d. Include ARR/ABI and RRR/RBI with p-values and CI</p> <p>e. Include NNT and CI</p>	<p>and MODI) demonstrated homogeneity at baseline.</p> <ul style="list-style-type: none"> - There was significant improvement ($p < 0.05$) in all variables for both groups pre and post intervention. - Between group analysis of all the variables demonstrated a significant post-intervention difference ($p < 0.05$) in VAS, hip flexion ROM, and MODI. A comparison of median value of the variables demonstrated a greater improvement in the experimental group compared to the control group.
<p>59. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?</p>	<p>These results speak greatly to my case. Even though the patients in this study had different onset of symptoms and severity of symptoms, the concept of treatment can be applied to my patient. Neuromobilizations are helpful, as the results of the study suggest. However, these neuromobilizations need to be done with other forms of treatment as well. Neuromobilization might not be good if done in isolation.</p>
<p>60. Do these findings exceed a minimally important difference?</p> <p>a. If not, will you still use this evidence?</p>	<p>This isn't mentioned in the article. Nonparametric statistical significance was assessed, which is what is relevant in this study.</p>
<p>Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>61. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?</p>	<p>Yes, this type of intervention can easily be carried out in an outpatient orthopedic orthopedic clinic. It is also affordable and able to be covered by insurance, being billed as manual therapy and therapeutic exercise.</p>

<p>62. Are the study subjects similar to your patient/ client? a. If not, how different? Can you use this intervention in spite of the differences?</p>	<p>The subjects aren't similar to my patient. These subjects had to have low back pain and radiculopathy being referred in a sciatic distribution. My client was a chronic LBP patient with severe radiculopathy in more than just a sciatic nerve distribution. Standing and sitting for a certain period of time was difficult for her. As mentioned before, I think the intervention is still applicable to my patient because it speaks to the necessity of conventional therapy in addition to the neuromobilizations.</p>
<p>63. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?</p>	<p>I believe that the benefits outweigh the risks in this case. Promoting normal nerve mobility while trying to promote normal spinal mobility and addressing the other biomechanical factors that can be contributing to the symptoms is extremely important. There really is no risks unless a specific patient had certain orthopedic contraindications.</p>
<p>64. Does the intervention fit within your patient/client's stated values or expectations? a. If not, what will you do now?</p>	<p>Yes, my patient was tired of the symptoms down her leg, which prevented her from performing certain activities and living a "normal" life. It wouldn't be a bad idea to address nerve health and mobility as part of her treatment to see if there is improved function and a reduction in symptoms.</p>
<p>65. Are there any threats to external validity in this study?</p>	<p>Yes. The inclusion criteria alone make it difficult to apply to every patient with neurological symptoms. Again, it is not a bad idea to attempt this intervention in the plan of care, but the same results may not be seen, depending on the patient and their individual symptoms.</p>

What is the bottom line	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>PEDro score</p>	<p>4/10</p>

Summarize your findings and relate them back to clinical significance	<p>This study analyzed improvement in pain, hip flexion ROM (with the passive SLR), and Modified Oswestry Disability Index improvement. The results of the study suggest that both the experimental and control groups had an improvement in all these outcome measures, with the experimental group showing showing a greater improvement (statistically). Overall, my takeaway from this study is that it is beneficial to attempt different interventions (such as neuromobilization) to treat specific symptoms, but it is also extremely important to not neglect restoring normal biomechanics elsewhere with strengthening and mobility exercises.</p>

Article 6: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Gupta, M. (2012). Effectiveness of nerve mobilization in the management of sciatica. Indian Journal of, 6(2), 74-76.

Level of Evidence: 1b

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>Yes, the purpose of the study is clearly stated in the abstract of the paper. The purpose of the study was to find out whether nerve mobilization techniques enhance patient outcomes in the management of sciatica when added to standard care.</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>Yes, relevant background information and literature was presented. Essentially, the etiology of sciatica and the background of neuromobilization and how it can be beneficial was the core of information. There was also mention of the fact that there is a lack of evidence for the use of traction, exercise therapy, and drug therapy in the management of sciatica.</p>

Does the research design have internal validity?	
Appraisal Criterion	Reader's Comments
<ul style="list-style-type: none"> ➤ Discuss possible threats to internal validity in the research design. Include: ➤ Assignment ➤ Attrition 	<p>Assignment: Groups were randomly assigned by each subject selecting a sealed envelope to determine which group they were in. There were a total of 30 participants, each group consisting of 15 patients.</p>

<ul style="list-style-type: none"> ➤ History ➤ Instrumentation ➤ Maturation ➤ Testing ➤ Compensatory Equalization of treatments ➤ Compensatory rivalry ➤ Statistical Regression 	<p>Attrition: There were no drop outs in the course of the study.</p> <p>History: The article doesn't mention whether the subjects were receiving any other treatment for their condition. It also doesn't mention whether patients were given specific instructions not to do anything else other than their treatment.</p> <p>Instrumentation: The National Pain Rating Scale (NPRS) and the SF-12 Functional Assessment were used to measure improvement in patients. The article doesn't go into specifics as to the reliability and validity of these outcome measures.</p> <p>Maturation: Due to the nature of sciatica being neurological, it is difficult to determine whether there was any spontaneous recovery between patients. Also, age was not a factor for the 2-week duration of the study.</p> <p>Testing: The NPRS and the SF-12 was given to the patients before and after completion of the intervention.</p> <p>Compensatory Equalization of Treatments: The study doesn't mention whether the investigators were blinded. It just mentions that there were two separate groups and they were administered in consensus with the head of the physical therapy department at the hospital.</p> <p>Compensatory Rivalry: The article doesn't mention whether the participants were blinded. It does mention that randomization occurred, but doesn't talk about whether the participants knew the difference between the two groups, creating potential for working harder to improve in the control group.</p> <p>Statistical Regression: There was no statistically significant difference between both groups prior to the start of the study.</p>
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Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>66. Did the investigators randomly assign subjects to treatment groups?</p> <p>a. If no, describe what was done</p> <p>b. What are the potential consequences of this assignment process for the study's results?</p>	<p>Yes, the subjects were randomly assigned. They each chose a sealed envelope letting them know which group they were in. No detrimental consequences can result from this.</p>
<p>67. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p>a. If they were not similar – what differences existed?</p>	<p>Yes, the groups were similar at the start of the trial.</p>
<p>68. Did the subjects know to which treatment group they were assign?</p> <p>a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>Yes, after choosing the envelope, they knew what group they were in. However, the study doesn't delve into specifics of what the subjects were aware of. Perhaps the sealed envelope only mentioned that they were in a specific group and not the particulars of the other group. If they were aware of the specifics of both groups in the study, that creates a threat to internal validity, which may detrimentally affect the results.</p>
<p>69. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p>a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>The article doesn't mention if the investigators were blinded to which participants were in what group. It does state that the head of the PT department at the hospital was aware, but not individual therapists. If they were not blinded, that also threatens the validity of the study and negatively affects its usefulness in answering my clinical question.</p>
<p>70. Were the groups managed equally, apart from the actual experimental treatment?</p> <p>a. If not, what are the potential consequences of this</p>	<p>Yes, apart from one group receiving nerve mobilizations, both groups were managed equally.</p>

<p>knowledge for the study's results?</p>	
<p>71. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>There was no follow-up reported after the conclusion of the study (2 weeks). This can be detrimental to the results because it only gives a small time frame into how well the intervention worked. It doesn't mention whether this was sustained.</p>
<p>72. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it was handled with respect to the study's findings?</p>	<p>All subjects completed the study.</p>
<p>73. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <p>a. If not, what did the authors do with the data from these subjects?</p> <p>b. If the data were excluded, what are the potential consequences for this study's results?</p>	<p>All subjects completed the study, no ITT analysis was performed.</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>74. What were the statistical findings of this study?</p> <p>a. When appropriate use the calculation forms below to determine these values</p> <p>b. Include: tests of differences? With p-values and CI</p> <p>c. Include effect size with p-values and CI</p>	<p>a, c, d, e = N/A</p> <p>b. The article states that non-parametric statistics were used to compare the mean statistical difference between both groups. This was done with Wilcoxin signed ranks and Mann Whitney U. However, in the results section of the article, specific p values aren't mentioned, only that there was a</p>

<p>d. Include ARR/ABI and RRR/RBI with p-values and CI e. Include NNT and CI</p>	<p>statistically significant difference in pain and functional scores in the intervention group.</p>
<p>75. What is the meaning of these statistical findings for your patient/client’s case? What does this mean to your practice?</p>	<p>This article is unique in that the abstract mentions that statistical analyses were used when comparing both groups, and even mentions the types of tests used. However, there is no formal declaration of the p-values and no tables in the article. Therefore, I need to base the statistical findings off of their statement alone. For my practice, this means that nerve mobilization isn’t a detrimental. The only specification that this article mentioned is the bias of the tibial and peroneal nerve, and not anything more proximal (knee and hip).</p>
<p>76. Do these findings exceed a minimally important difference? a. If not, will you still use this evidence?</p>	<p>The minimally important difference was not brought up or discussed. As previously mentioned, non-parametric statistical tests were used, by which no specific p-value was ever mentioned.</p>
<p>Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader’s Comments</i></p>
<p>77. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?</p>	<p>Definitely. It can be carried out fairly easily in an outpatient orthopedic clinic and can be billed as “manual therapy and therapeutic exercise”.</p>
<p>78. Are the study subjects similar to your patient/ client? a. If not, how different? Can you use this intervention in spite of the differences?</p>	<p>The subjects aren’t similar to my patient. The symptoms of these patients was fairly acute, while my patient was in excruciating chronic pain. Also, one of the exclusion criterion was that the subjects needed to not have surgery in the past, which my patient had. I still believe that this intervention can be appropriate for my patient based on the fact that her pain is due to a problem with</p>

	perineural tissue being influenced by the lack of optimal nerve mobility. Any decrease in neural tension could prove beneficial to my patient.
79. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	I believe that the benefits definitely outweigh the risks in this case. Addressing the neural mobilization issue while still participating in therapeutic exercise seems like the patient will receive benefits from both types of therapeutic interventions. Without specific contraindications, it seems beneficial.
80. Does the intervention fit within your patient/client’s stated values or expectations? a. If not, what will you do now?	Absolutely. My patient was willing to try anything, as long as it wasn’t just “exercise” as that’s all she had been given in the past. Given the severity of her symptoms, it would be wise to address this primarily and then address the negative affects on any other perineural structures.
81. Are there any threats to external validity in this study?	Definitely. The inclusion and exclusion criteria was very specific and doesn’t fit a lot of the patient population with the diagnosis of “sciatica”.

What is the bottom line	
<i>Appraisal Criterion</i>	<i>Reader’s Comments</i>
PEDro score	4/10
Summarize your findings and relate them back to clinical significance	The study analyzed the effects that sciatic nerve mobilization had on participants with sciatica. Outcome measures included the NPRS and Sf-12 which were given before and after the intervention. The study states that non-parametric statistics were used for between group and within group analyses, however, no formal values were presented. They did conclude that neural mobilization techniques enhanced patient outcomes

	<p>when added to standard care in comparison to conventional physical therapy alone. Overall, I feel like this study addressed the issue of decreased nerve mobility, but didn't address specific areas of potential nerve entrapment. Only the tibial and peroneal nerve were biased during nerve mobilizations, which every subject may or may not have needed.</p>
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Article 7: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Su, Y., & Lim, E. C. W. (2016). Does Evidence Support the Use of Neural Tissue Management to Reduce Pain and Disability in Nerve-related Chronic Musculoskeletal Pain?. *The Clinical journal of pain*, 32(11), 991-1004.

Level of Evidence: 1a

Does the design follow the Cochrane method?	
Appraisal Criterion	Reader's Comments
<p>Step 1 – formulating the question</p> <ul style="list-style-type: none"> • Do the authors identify the focus of the review • A clearly defined question should specify the types of: <ul style="list-style-type: none"> ○ people (participants), ○ interventions or exposures, ○ outcomes that are of interest ○ studies that are relevant to answering the question 	<p>Yes, the authors identify the focus of the review. The aim of this review was to compare pain and disability in individuals with nerve-related chronic MS pain who were treated with neural tissue management with those who received minimal or other treatment approaches. A secondary objective was to review the “treatment dosage” and investigate whether these factors influence the variability of pain and disability outcomes.</p>
<p>Step 2 – locating studies</p> <ul style="list-style-type: none"> • Should identify ALL relevant literature • Did they include multiple databases? • Was the search strategy defined and include: <ul style="list-style-type: none"> ○ Bibliographic databases used as well as hand searching ○ Terms (key words and index terms) ○ Citation searching: reference lists ○ Contact with ‘experts’ to identify ‘grey’ literature (body of materials that cannot be found easily through conventional channels such as publishers) ○ Sources for ‘grey literature’ 	<p>The SR provides detailed information about how the studies were located in addition to the determination of the quality of those studies. Multiple databases (including MEDLINE, CINAHL, Embase, Cochrane Library, PEDro, Scopus, Google Scholar) were searched for research articles. The authors also listed the inclusion/exclusion criteria. They included search terms such as neural mobilization, nerve flossing, etc. Manuscripts were assessed for eligibility by 2 reviewers.</p>
<p>Part 3: Critical Appraisal/Criteria for Inclusion</p> <ul style="list-style-type: none"> • Were criteria for selection specified? <ul style="list-style-type: none"> ○ Did more than one author assess the relevance of each report 	<p>Yes, criteria for inclusion was specified. As previously stated, the articles were assessed</p>

<ul style="list-style-type: none"> ○ Were decisions concerning relevance described; completed by non- experts, or both? ○ Did the people assessing the relevance of studies know the names of the authors, institutions, journal of publication and results when they apply the inclusion criteria? Or is it blind? 	<p>for eligibility by 2 different reviewers, who also assessed the quality of the studies. Disagreement between reviewers about relevance was resolved by consensus. The article doesn't mention whether the reviews were aware of the authors when assessing relevance, however, it does state that when there was inadequate information in a study, the authors of those studies were contacted by the reviewers.</p>
<p>Part 3 – Critically appraise for bias:</p> <ul style="list-style-type: none"> • Selection – <ul style="list-style-type: none"> ○ Were the groups in the study selected differently? ○ Random? Concealed? • Performance- <ul style="list-style-type: none"> ○ Did the groups in the study receive different treatment? ○ Was there blinding? • Attrition – <ul style="list-style-type: none"> ○ Were the groups similar at the end of the study? ○ Account for drop outs? • Detection – <ul style="list-style-type: none"> ○ Did the study selectively report the results? ○ Is there missing data? 	<p>Selection: The study doesn't mention specifics about selection, but does state that criteria that commonly wasn't met among the selected studies was concealment of allocation and blinding of treating therapists and patients.</p> <p>Performance: There were a multitude of different intervention groups performing different types of different types of neural mobilizations. Some specified treatment for lumbar radiculopathy, carpal tunnel, and cervical radiculopathy. The commonality between the studies was that there was always a group receiving some form of neural mobilization and the other group(s) receiving either conventional PT, sham treatment, or no treatment.</p> <p>Attrition: SR does not mention whether studies accounted for dropouts.</p> <p>Detection: Results for individual studies were listed on a table, giving the reference, groups, age, sex, duration of the study, detail of intervention, outcome measure and results, and PEDro score (average: 6.15).</p>
<p>Part 4 – Collection of the data</p> <ul style="list-style-type: none"> • Was a collection data form used and is it included? • Are the studies coded and is the data coding easy to follow? • Were studies identified that were excluded & did they give reasons why (i.e., which criteria they failed) 	<p>A collection data form was included. A table for the selection process that the reviewers performed that described why certain studies weren't included, but no specific articles were mentioned. The only studies that were listed were the included studies, which were easy to follow.</p>

Are the results of this SR valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> • Is this a SR of randomized trials? Did they limit this to high quality studies at the top of the hierarchies <ul style="list-style-type: none"> ○ If not, what types of studies were included? ○ What are the potential consequences of including these studies for this review's results? 	<p>This SR included only randomized controlled trials. The methodological quality of the trials was assessed using the PEDro scale. As stated previously, the quality of the studies was assessed by 2 independent reviewers. They evaluated domains of population, treatment allocation, blinding, prognostic comparability, and analysis. Of all the 16 articles included, the average PEDro score was 6.15. Since there were no criteria for how low the PEDro score should be, it is difficult to determine the reliability of the articles used in the SR, especially one with differing outcome measures and diagnoses.</p>
<ul style="list-style-type: none"> • Did this study follow the Cochrane methods selection process and did it identify all relevant trials? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>No. The Cochrane method was not mentioned as being used during the selection process. The method the reviewers used was determining whether or not articles met the inclusion criteria. The potentially negative consequences include the fact that bias is not being taken into consideration, which could be unfavorable when analyzing the articles and performing statistical tests to answer the clinical question.</p>
<ul style="list-style-type: none"> • Do the methods describe the processes and tools used to assess the quality of individual studies? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>Yes, as mentioned previously, the methodological quality of the articles was assessed using the PEDro scale. They evaluated domains of population, treatment allocation, blinding, prognostic comparability, and analysis. Participants, details of intervention, pre/post outcome measures were extracted from each trial. The score was then determined from this information,</p>

<ul style="list-style-type: none"> • What was the quality of the individual studies included? Were the results consistent from study to study? Did the investigators provide details about the research validity or quality of the studies included in review? 	<p>Yes, the quality of individual studies was included. In the table that listed all of the the included studies, a PEDro score was listed for each study. The results were not consistent from study to study. However, to account for differing outcome measures among studies, standardized mean differences (SMD) for pain and disability scores, 95% confidence intervals, and heterogeneity tests were calculated. No information was provided was far as research validity, but the PEDro score indirectly provides that information.</p>
<ul style="list-style-type: none"> • Did the investigators address publication bias? 	<p>Yes, publication bias was assessed using a funnel plot, plotting SMD vs. variability. They stated that publication bias may have had an influence on the observed results.</p>

Are the results of this SR important?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<ul style="list-style-type: none"> • Were the results homogenous from study to study? <ul style="list-style-type: none"> ○ If not, what are the consequences for this review's results? 	<p>There were many reports on heterogeneity between the different studies. This is because there was many different things analyzed. Pain and disability was assessed for neural tissue management versus minimal and other forms of intervention. In all these analyses, heterogeneity was high (>83%) before post-hoc sensitivity analyses or removal of trials that were "outliers". The article mentions that the high level of heterogeneity among trails posed a challenge in this review. Even though measures were taken to account for the vast differences among the different articles (different diagnoses, outcome measure, intervention), it is difficult to not have a high level of heterogeneity, which can affect the statistical results about the effectiveness of utilizing neural mobilization on these patients.</p>

<ul style="list-style-type: none"> • If the paper is a meta-analysis did they report the statistical results? Did they include a forest plot? What other statistics do they include? Are there CIs? 	<p>Statistical results were reported. A forest plot was included. Included in the forest plot was effect size and 95% confidence interval. Since the primary outcome measure was the standard mean difference, that was included in the forest plot.</p> <p>Overall, a decrease in pain was reported as statistically significant in the analysis of groups that received neural tissue management over minimal intervention (exercise, general PT in both groups). However, the use of neural tissue management vs other forms of intervention (NTM only for intervention group) for pain was not significant. For the use of NTM vs. minimal intervention and other forms of intervention for disability, the results were not statistically significant.</p> <p>A funnel plot was also included in the article.</p>
<ul style="list-style-type: none"> • From the findings, is it apparent what the cumulative weight of the evidence is? 	<p>Since the results are so scattered and there were several post-hoc analyses performed on the different results for pain and disability that were analyzed between the different groups, it is difficult to ascertain the cumulative weight of the evidence retrieved.</p>
<p>Can you apply this valid, important evidence from this SR in caring for your patient/client? What is the external validity?</p>	
<p><i>a. Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<ul style="list-style-type: none"> • Is your patient different from this in the SR? 	<p>My patient is similar to some of the lumbar-related studies. Only 7/16 studies focused on patients with lumbar radiculopathy/sciatica.</p>
<ul style="list-style-type: none"> • Is the treatment feasible in your setting? Do you have the facilities, skill set, time, 3rd party coverage to provide this treatment? 	<p>Yes, the different types of nerve mobilization approaches (nerve gliding/flossing, lumbar stabilization) can easily be performed at outpatient orthopedic clinical settings. This is</p>

	<p>dependent on the skill set of the therapist on the techniques, but it is extremely feasible and can be included in the “manual therapy” portion of billing.</p>
<ul style="list-style-type: none"> • Does the intervention fit within your patient/client’s stated values or expectations? <ul style="list-style-type: none"> ○ If not, what will you do now? 	<p>My client had endured many therapists who gave her therapeutic exercise to potentially alleviate her symptoms. These had little to no effect on my client. When she first came to the clinic, she was nervous to move and perform the evaluation tests. A big focus was to not perform what the therapists had done with her in the past, and to try something different to help her with her chronic pain.</p>
<p>What is the bottom line?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader’s Comments</i></p>
<ul style="list-style-type: none"> • Summarize your findings and relate this back to clinical significance? 	<p>This systematic review was well organized, well thought out, and presented clearly. Although I had to review several statistical terms, I think overall I understood the complexity of evaluating the effectiveness of neural mobilizations given that there are a multitude of approaches that can be done with such a vast amount of different types of lumbar patients. Some of the articles were low-quality, and heterogeneity was extremely high. Taking these results verbatim and utilizing them clinically in an attempt to treat all my patients would be unethical and potentially ineffective. The biggest takeaway I determined from the results was that neural mobilization is not effective on its own. When combined with conventional physical therapy, it is extremely beneficial on the pain that a patient experiences, but it shouldn’t be done in isolation. Even though the articles in this review differed significantly in methods, outcome measures, patient presentations, and methods of neural mobilization, I still think it may be beneficial</p>

	(according to the results) to implement them into a plan of care in addition to other forms of intervention.
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Article 8: Evidence Appraisal Worksheet

The questions on this checklist are an attempt to help identify problems of bias, confounding, low power and poor validity. During your critical appraisal you should also consider whether the intervention/ treatment is as effective as the comparison one or one that you are currently providing.

Citation: Ali, M., Ur Rehman, S. S., Ahmad, S., & Farooq, M. N. (2015). Effectiveness of slump neural mobilization technique for the management of chronic radicular low back pain. *Rawal Med J*, 40(1), 41-3.

Level of Evidence: 1b

PEDro: 4/10

Is the purpose and background information sufficient?	
Appraisal Criterion	Reader's Comments
<p>Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?</p>	<p>Yes, the purpose of this study was clearly stated in the abstract and introduction of the article. The objective of the study was to determine the effectiveness of the slump neural mobilization technique (SNMT) compared with lumbar stabilization exercise (LSE) and shortwave diathermy (SWD) in physical therapy management of chronic radicular low back pain (CRLBP)</p>
<p>Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study</p>	<p>Yes, relevant background information was presented. The authors stated that there is evidence on the role and effectiveness of neural mobilization techniques but no comparison was found on the combination of other physical therapy techniques with and without neuromobilization techniques.</p>

Does the research design have internal validity?	
Appraisal Criterion	Reader's Comments

- **Discuss possible threats to internal validity in the research design.**
Include:
- **Assignment**
- **Attrition**
- **History**
- **Instrumentation**
- **Maturation**
- **Testing**
- **Compensatory Equalization of treatments**
- **Compensatory rivalry**
- **Statistical Regression**

Assignment: Subjects were randomized into two groups (control and intervention). Details on how they were randomly assigned were not provided. A total of 40 participants were randomized.

Attrition: There were not dropouts in the course of the study.

History: The article only mentions that the sample was obtained from the outpatient PT department in a general hospital in Pakistan. It doesn't state that the subjects were receiving or doing any other activity other than their treatment.

Instrumentation: Perceived disability was assessed using the Modified Oswestry (ODI) and pain was assessed using the Numeric Pain Rating Scale (NPRS). The article doesn't go into specifics of the reliability and validity of these outcome measures.

Maturation: Due to the neurological nature of radicular symptoms, it is difficult to ascertain whether there was any spontaneous recovery with patients. The age range being 20-60 can be a possible threat due to the vast difference in physiological recovery in the younger population.

Testing: The NPRS and Modified ODI was given to patients before and after completion of the intervention.

Compensatory Equalization of Treatments: The article doesn't mention whether the investigators were blinded. In fact, it alludes that the same therapist might have provided the treatment for all the subjects.

Compensatory Rivalry: The article doesn't mention whether the participants were blinded, only that they were randomized. This creates the potential for the control group to work harder and potentially exaggerate the results of their outcome measures.

Statistical Regression: There was no statistically significant difference between both groups prior to the start of the study.

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Are the results of this therapeutic trial valid?	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
<p>82. Did the investigators randomly assign subjects to treatment groups?</p> <p>a. If no, describe what was done</p> <p>b. What are the potential consequences of this assignment process for the study's results?</p>	<p>Yes, the subjects were randomly assigned. The article does not specify the method used to randomize the subjects. No detrimental consequences would result.</p>
<p>83. Were the groups similar at the start of the trial? Did they report the demographics of the study groups?</p> <p>a. If they were not similar – what differences existed?</p>	<p>Yes, the groups were similar at the start of the trial.</p>
<p>84. Did the subjects know to which treatment group they were assigned?</p> <p>a. If yes, what are the potential consequences of the subjects' knowledge for this study's results</p>	<p>The article doesn't mention if the participants knew of the group that they were assigned to. If they were aware of which group they were assigned to, that can greatly affect the validity of the study.</p>
<p>85. Did the investigators know who was being assigned to which group prior to the allocation?</p> <p>a. If they were not blind, what are the potential consequences of this knowledge for the study's results?</p>	<p>Again, the article doesn't mention if the investigators were blinded. As stated previously, it seems like the same therapist was treating all of the participants in the study. If the investigators were not blinded, that poses a threat to the validity and reliability of the research study, which can negatively affect the efficacy in helping to answer my clinical question.</p>
<p>86. Were the groups managed equally, apart from the actual experimental treatment?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>Yes, the groups were managed equally.</p>

<p>87. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?</p> <p>a. If not, what are the potential consequences of this knowledge for the study's results?</p>	<p>The article actually mentions that the long term effects of the neuromobilization techniques used in the study is uncertain because no follow-up has been reported beyond one week.</p>
<p>88. Did all the subjects originally enrolled complete the study?</p> <p>a. If not how many subjects were lost?</p> <p>b. What, if anything, did the authors do about this attrition?</p> <p>c. What are the implications of the attrition and the way it was handled with respect to the study's findings?</p>	<p>All subjects completed the study.</p>
<p>89. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)?</p> <p>a. If not, what did the authors do with the data from these subjects?</p> <p>b. If the data were excluded, what are the potential consequences for this study's results?</p>	<p>All patients completed the study, no ITT analysis was performed.</p>
<p>Are the valid results of this RCT important?</p>	
<p><i>Appraisal Criterion</i></p>	<p><i>Reader's Comments</i></p>
<p>90. What were the statistical findings of this study?</p> <p>a. When appropriate use the calculation forms below to determine these values</p> <p>b. Include: tests of differences? With p-values and CI</p> <p>c. Include effect size with p-values and CI</p> <p>d. Include ARR/ABI and RRR/RBI with p-values and CI</p> <p>e. Include NNT and CI</p>	<p>a, c, d, e = N/A</p> <p>b. Both groups showed a significant improvement in pain score (3 to 1 in experimental group and 3 to 2 in control group). Function was also improved in both groups (52 to 14 in experimental and 29 to 20 in control)</p> <p>Group A (neuromob group)</p> <ul style="list-style-type: none"> - Pain Score <ul style="list-style-type: none"> o Std. Dev: 0.858 ± 0.183

	<ul style="list-style-type: none"> ○ P-value: <0.001 - ODI Score <ul style="list-style-type: none"> ○ Std. Dev: 1.490 ± 0.318 ○ P-value: <0.001 <p>Group B</p> <ul style="list-style-type: none"> - Pain Score <ul style="list-style-type: none"> ○ Std. Dev: 1.305 ± 0.308 ○ P-value: 0.003 - ODI Score <ul style="list-style-type: none"> ○ Std. Dev: 2.910 ± 0.686 ○ P-value: 0.163
91. What is the meaning of these statistical findings for your patient/client’s case? What does this mean to your practice?	A common theme is that neuromobilization is a great adjunct to conventional physical therapy. Both groups improved in their pain and disability scores, but the group that received the nerve mobilizations improved just a little bit more. These statistics tell me that it’s important to consider using this type of intervention with patients that have chronic radicular low back pain.
92. Do these findings exceed a minimally important difference? a. If not, will you still use this evidence?	The minimally important difference was not brought up or discussed.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
<i>Appraisal Criterion</i>	<i>Reader’s Comments</i>
93. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Yes. This intervention can be carried out in any outpatient orthopedic facility or home health care. It can be billed under “manual therapy and therapeutic exercise”
94. Are the study subjects similar to your patient/ client? a. If not, how different? Can you use this intervention in spite of the differences?	For the most part, the subjects in this study are similar to my patient. My patient was in her 40s and the age range for the subjects in the study was 20-60. Also, my patient suffered from chronic low back pain with radicular symptoms, which was an inclusion criterion for the participants. The differing factor is the fact that my patient had a history of spinal surgery, which was an exclusion criterion. However, I still believe that it is appropriate to perform this

	intervention based on the physiological changes associated with nerve mobilization and the fact that there are minimal risks.
95. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	I definitely believe that the benefits outweigh the risks. As previously stated, promoting normal nerve mobility at its most basic level involves making changes to the perineural tissue in hopes of increasing vascular supply to the nerve and hopefully alleviating pain. Unless there were specific contraindications to addressing these tissues, I see minimal risk.
96. Does the intervention fit within your patient/client's stated values or expectations? a. If not, what will you do now?	Definitely. She had gone through PT for her issue before and had been taken through the classic PT formula of strengthening and stretching. She wanted to try something new, which I believe neuromobilization addresses.
97. Are there any threats to external validity in this study?	Yes. The inclusion and exclusion criteria was specific and doesn't address many of the issues with patients who suffer from lumbar radiculopathy.

What is the bottom line	
<i>Appraisal Criterion</i>	<i>Reader's Comments</i>
PE德罗 score	4/10
Summarize your findings and relate them back to clinical significance	Overall, this research article stated that nerve mobilizations are beneficial when combined with conventional stabilization exercise and potentially modalities. Nerve mobilizations aren't specifically isolated in terms of treatment. I believe that promoting nerve mobility is only part of the process. Unless other factors are addressed, the benefits of neuromobilization are drastically decreased. This study was poor in the sense that the methodology of nerve mobilization was

	<p>explained effectively. Also, there are great threats to the validity of the study with the lack of blinding of the investigators and the participants. In addition, the participants in this study were extremely isolated with the large amount of exclusion criteria, which poses a threat to the external validity of the research study.</p>
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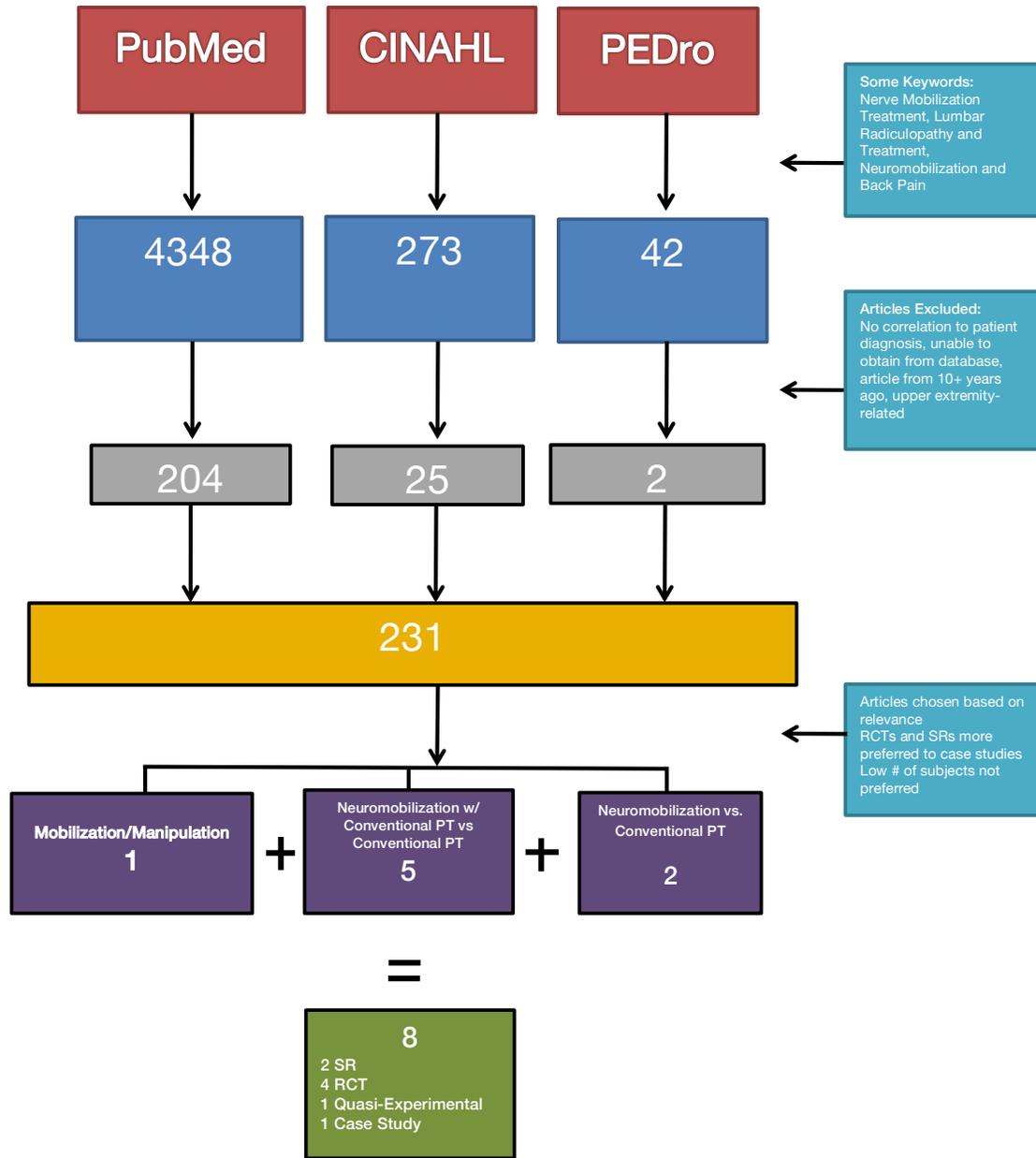
Article Summaries Table

	Study & Origin	Oxford Level	PE德罗 Score	Purpose of Study	Outcome Measures	Results	Accept Results to Answer Clinical Question
1	Leininger et al. US	1a	N/A	To provide a comprehensive and “up-to-date” systematic review of the literature as it relates to the efficacy and effectiveness of SMT and MOB In management of cervical, thoracic, and lumbar-related extremity pain	Spine-related extremity specific outcome measure, specifically reported results from patients, analyzed using mean differences and odds ratios.	SMT > traction, exercise, corset, heat, chemonucleolysis in short term MOB > passive modalities MOB = exercise short term: various results SMT > sham SMT for acute leg and back pain Based on low quality evidence. Thus, conclusions cannot be made.	No
2	Yamin et al. India	2b	N/A	To evaluate the efficacy of sciatic nerve mobilization in patients with lumbar radiculopathy due to prolapsed intervertebral disc.	Numeric Pain Rating Scale (NPRS) and assessment form.	Paired t-test used in scoring NPRS Pre-test: 6.95±1.18 Post-test: 1.86±2.03 Level of significance: 5% p-value < 0.001	Yes
3	Jeong et al. Korea	1b	3/10	To examine the effects of self-mobilization techniques on the quality of life in patients with chronic low back pain in limbs accompanied by radiating pain.	SF-36 (evaluating Physical Function and General Health)	Independent t-test between groups and paired t-test within groups were used. SSNMG PF pre: 17.7±3.5 SSNMG PF post: 25.1±3.3 LSEG PF pre: 17.3±5.3 LSEG PF post: 20,3±6.5 SSNMG GH pre: 12.6±3.0 SSNMG GH post: 19.0±4.1 LSEG GH pre: 15.8±2.8 LSEG GH post: 16.6±3.4 Differences were significant (p<0.05) There was a statistically significant difference in measurement results between the groups before and after the intervention. SSNMG: self-mobilization of the sciatic nerve group LSEG: lumbar stabilization exercise group	Yes

4	Talebi et al. Iran	3b	N/A	To introduce a case with abnormal neurodynamic responses following repetitive and chronic damages to L5-S1 intervertebral disc as well as providing treatment strategies based on neuro-biomechanical principles, and analytical evaluations to eradicate abnormal tension on the nervous system.	VAS scale for overall pain Subjective pain relief for specific provocation measures	<p>After 3 weeks traditional PT:</p> <ul style="list-style-type: none"> - No overall pain relief <p>After vertebral mobs and piriformis release:</p> <ul style="list-style-type: none"> - No overall pain relief - No improvement in Slump test pain - Improvements in SLR/piriformis pain <p>After gliding neuromobs:</p> <ul style="list-style-type: none"> - Pain reduced to 3/10 - SLR pain reduced considerably - Slump pain not reduced <p>After tensile neuromobs</p> <ul style="list-style-type: none"> - Pain reduced to 0/10 - No SLR, piriformis, or Slump pain 	Yes
5	Gurpeet et al. India	1b	4/10	The purpose of the study was to compare to effectiveness of neural mobilization and conventional therapy in patients with neurogenic back pain.	Pain (VAS) Hip Flexion ROM Disability (Modified Oswestry Disability Index)	<p>Wilcoxin Signed Ranks (within group) and Mann Whitney U (between group)</p> <p>Within-group</p> <ul style="list-style-type: none"> - Significant improvement in all variables pre and post intervention ($p < 0.05$) <p>Between group</p> <ul style="list-style-type: none"> - Significant post-intervention difference ($p < 0.05$) in VAS, hip flexion ROM, and MODI 	Yes
6	Gupta, M. India	1b	4/10	The purpose of the study was to find out whether nerve mobilization techniques enhance patient outcomes in the management of sciatica when added to standard care.	Pain (NPRS) SF-12	Results showed that there was a significant difference in pain and functional status scores as indicated by the significance obtained in their respective p-values. Non-parametric tests were used including Wilcoxon ranked sum (within-group) and Mann Whitney U Test (between-group). However, no specific p-values were reported in the article.	Yes
7	Su, Y. Singapore	1a	N/A	The aim of this review was to compare pain and disability in individuals with nerve-related chronic MS pain who were treated with neural tissue management with those who received minimal or other treatment approaches.	SMD (standardized mean differences) SE (variability)	Decrease in pain was reported as statistically significant in the analysis of groups that received neural tissue management (NTM) over minimal intervention. NTM vs other forms of intervention (NTM only for intervention group) for pain was not significant.	Yes

						NTM vs. minimal intervention and other forms of intervention for disability : results were not statistically significant.	
8	Ali, M. Pakistan	1b	4/10	The objective of the study was to determine the effectiveness of the slump neural mobilization technique (SNMT) compared with lumbar stabilization exercise (LSE) and shortwave diathermy (SWD) in physical therapy management of chronic radicular low back pain (CRLBP).	Numeric Pain Rating Scale (NPRS) Modified Oswestry Disability Index (ODI)	<p>Both groups showed a significant improvement in pain score (3 to 1 in experimental group and 3 to 2 in control group). Function was also improved in both groups (52 to 14 in experimental and 29 to 20 in control)</p> <p>Group A (neuromob group)</p> <ul style="list-style-type: none"> • Pain Score <ul style="list-style-type: none"> ○ Std. Dev: 0.858 ± 0.183 ○ P-value: <0.001 • ODI Score <ul style="list-style-type: none"> ○ Std. Dev: 1.490 ± 0.318 ○ P-value: <0.001 <p>Group B</p> <ul style="list-style-type: none"> • Pain Score <ul style="list-style-type: none"> ○ Std. Dev: 1.305 ± 0.308 ○ P-value: 0.003 • ODI Score <ul style="list-style-type: none"> ○ Std. Dev: 2.910 ± 0.686 	Yes

Literature Search Strategy



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