

Effect of Mulligan Spinal Mobilization with Leg Movement and Shacklock Neural Tissue Mobilization in Lumbar Radiculopathy: A Randomised Controlled Trial

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Abstract

Background: Lumbar radiculopathy is a benign, often self-limiting condition, commonly managed by rest, pharmacotherapy, physical therapy or alternate medicine options. It is characterised by low back pain radiating into one or both lower limbs. Conventional physical therapy comprises electrotherapeutic devices, hot water fomentation and standard spinal exercises. Studies carried out in patients diagnosed with chronic low back pain reveal inhibition of the multifidii and transversus abdominis muscles. Some studies direct the probable causes of radicular symptoms towards adhesions along the mechanical interface of neural tissue, or presence of a positional fault at the corresponding vertebral level. In conjunction to electrotherapy, various methods of manual therapy are known to help alleviate pain, ie, mobilising the vertebra involved, or correcting pathomechanics of the neural tissue. However, studies establishing their effectiveness are scarce.

Purpose of the study: To assess which of the two methods of manual therapy- Mulligan's Spinal Mobilization With Leg Movements (SMWLMs) and Shacklock Neural Tissue Mobilization (NTM) is more effective in improving low back pain (VAS), radiating limb pain (SLR), lumbar spine stiffness (lumbar range of motion assessment with a dual inclinometer) and disability (ODI) in patients with Lumbar Radiculopathy.

Method: A Randomised Controlled Trial will be performed on 102 patients with lumbar radiculopathy. Both groups will receive conventional treatment in the form of hot packs, Lumbar core activation exercises and ergonomic advice. In addition, Group A will receive Mulligan's SMWLMs and group B will receive Shacklock NTMs, through randomised sampling by chit method. 3 sessions will be carried out in the first week on alternate days followed by two days in the next week, on alternate basis. At the end of 2 weeks, the follow-up assessment will be documented. A home-based exercise program will be given for further strengthening of the lumbar core stabilizers for the next two weeks and the patients must be assessed again at the end of 4 weeks. Outcome measures included Visual Analog Scale scores, Lumbar range of motion (ROM) assessment using dual inclinometer, Goniometric measurement of angle of the Straight Leg Raise and Oswestry Disability Index.

Results: Both groups show a significant improvement in VAS, spinal ROM, SLR range and ODI scores. However, SLR improves to a greater degree in the SMWLM group. Inter-group comparison of ODI scores will not show significant difference. Group A shows consistent pain relief on follow up at the end of 4 weeks.

Conclusion: Patients treated with Spinal Mobilization with Leg Movement technique produce more significant improvement than those treated with Shacklock Neural Tissue Mobilization in leg pain intensity, lumbar range of motion and back specific disability.

Keywords: Shacklock Neural Tissue Mobilization, Mulligan Spinal Mobilization with Leg Movement, Lumbar Radiculopathy, low back pain.

THESIS SUMMARY

Introduction

Low back pain is neither a disease nor a diagnostic entity of any sort. In India, the incidence of low back pain has been reported to be 23.09% and has a lifetime prevalence of 60-85%. [4], [5]

Causes of lower back pain are numerous, with or without accompanying radicular symptoms, constituting idiopathic, degenerative, traumatic, inflammatory, congenital, neoplastic, metabolic, postural and gynaecological, rectal or rectal systemic pathologies. [6] Lumbar radiculopathy may be described as pain originating in the lower back region, and radiating into one or both lower limbs. It usually follows a specific dermatomal distribution, indicating the level of spinal nerve root involvement. Sensory symptoms are pain, typically accompanied with paraesthesias, numbness; motor symptoms include muscle weakness, reduced deep tendon jerks. The pain may demonstrate multiple pathogenesis. Degenerative spondyloarthropathies form the principal underlying cause of radicular symptoms [1], [2] due to disc herniations, and facet hypertrophy that may compress the nerve root at the lateral foraminal exit [3]. Other causes constitute idiopathic, traumatic, inflammatory, congenital, neoplastic, metabolic, postural and gynaecological, rectal or rectal systemic pathology. [6]

Lumbosacral radiculopathy secondary to disc herniation forms one of the most common health related complaints [7]. Lumbar disc herniation with radiculopathy may be defined as localized displacement of disc material beyond the normal margins of the intervertebral disc space resulting in low back pain, and/or weakness, paraesthesiae or numbness in a myotomal or dermatomal distribution. [5]. Sciatica refers to radiculitis or radiculopathy of the lumbosacral spine.

The Mulligan concept has its foundation built on Kaltenborn's principles of restoring the accessory component of physiological joint movement. Mulligan proposed that injuries or sprains might result in a minor positional fault to a joint, thus altering the biomechanics at the joint, causing restrictions in physiological movement. Mobilization of the spine maybe done in the functional, weight bearing position by applying the force parallel to the spinal facet planes. It maybe oscillatory (Natural Apophyseal Glides-NAGs) or a sustained glide maintained coupled with the patient performing the offending spinal movement (Sustained NAGs-SNAGs).

In 1990, Brian Mulligan introduced a technique known as: spinal mobilisations with limb movements (SMWLMs). Here, a sustained transverse glide is applied to the spinous process of a vertebra while the restricted peripheral upper or lower limb movement is performed, actively or passively. The foremost emphasis remains that the mobilization must result in symptom-free movement. Mulligan proposed that utilization of these mobilization techniques was indicated when peripheral joint limitation of movement is spinal in origin. [8]

Neuromobilization is a set of techniques designed to restore plasticity of the nervous system, it may be defined as the ability of the nerve, its sheath and structures surrounding it to shift in relation to other such structures [7]. The goal of mobilization is to increase the flexibility of collagen that maintains the integrity of the nerve, thereby improving movement of the nerve in relation to its interface. Shacklock's method of Neurodynamics is based on The Sliding Principle, which consists of an alternation of combined movements

of at least two joints, wherein one movement lengthens the nerve bed thus increasing tension in the nerve, while the other movement decreases the length of the nerve bed which unloads the nerve, keeping it in its slack position thereby reducing intraneural pressure. These techniques aim to mobilise a nerve with a minimal increase in tension and are thought to result in a larger longitudinal excursion than techniques which simply elongate the nerve bed, such as tensioning techniques [8].

Conventional method of treatment of low back pain with lumbar radiculopathy involves rest, pharmacotherapy in the form of NSAIDs, and physical therapy using a combination of intermittent lumbar traction, core stability exercises, TENS, superficial and deep heating modalities, manual therapy, neural mobilization principles, orthotics, ergonomics etc. [9] However, not always are these methods directed towards treating the primary cause of sciatica and the patient usually returns with residual symptoms.

Neural tissue mobilization targets breaking adhesions in the structures present along the course of the nerve, at the mechanical interface, thereby improving the gliding of the nerve by eliminating the cause of symptom-causing obstruction; while the Mulligan concept involves correcting the positional fault at the spinal level along with performing the offending physiological movement (here, the Straight Leg Raise). The clinical appropriateness and effectiveness of this technique is based on the immediate reduction in pain and increase in mobility [10].

Studies have been conducted to prove the significance of neural mobilization in treating patients with radiating neural symptoms. The Straight Leg Raise (SLR) test is a useful tool in assessing severity of symptoms. Improving the range of SLR has a beneficial effect in alleviating sensory symptoms, thereby restoring normal physiological spinal movements and reducing the degree of impairment due to low back dysfunction.

Need For Study

Studies have been conducted measuring the efficacy of Shacklock NTMs, showing the beneficial effects. However, data regarding the effects of SMWLM is scarce. This study aims to gain data regarding the effectiveness of Mulligan SMWLM and to obtain a comparison between the effects of the both techniques, thereby providing clinical therapists an evidence-based better choice of treatment.

Hypothesis

The study aims to assess and compare the effects of neurodynamics, and spinal mobilization with limb movement on the pain, lumbar spine range of motion, and level of disability of a patient diagnosed with lumbar radiculopathy, so as to draw a conclusion, regarding which technique yields better alleviation of symptoms and improves function

It is hypothesized that there will be a difference in results of both treatment techniques, one yielding better outcomes than the other.

In this study, subjects will be screened as per the inclusion and exclusion criteria and allocated in either Group A or B using chit method of randomisation.

Group A: Spinal Mobilization With Leg Movement (SMWLM) & conventional therapy.

Group B: Shacklock neural tissue mobilization (NTM) & conventional therapy.

Pre-treatment evaluation will be carried out on the first day. A follow up evaluation will be done at the end of one week, two weeks and four weeks.

The data obtained will be recorded and statistically analysed with the Repeated Measures ANOVA test for SLR and spinal mobility readings; and Friedman's ANOVA test for VAS and ODI scales within each group. The Unpaired 'T' test will be used to analyse SLR and spinal mobility readings; Mann Whitney U test for VAS and ODI readings, for inter-group comparison.

Technique for Mulligan SMWLMs: 2 therapist method.

Let us assume, on evaluation, there is an L4-5 lesion with symptoms in the right leg.

The patient is taken in left side lying position.

The affected leg is abducted to approximately 10 degree and supported by the second therapist or an assistant.

The therapist places the thumb on the right side of the L4 spinous process and applies a downward glide, causing side flexion at that level, and rotation on the vertebra below.

The patient performs an active leg raise simultaneously. The motion must be pain free. As progress occurs, overpressure maybe applied.

[11]

DOSAGE: Rule of 3, 3 days a week, for 2 weeks. (Rule of 3, i.e., 3 sets of 7-10 repetitions.)

Technique for Shacklock neural tissue mobilization

The straight leg raise (SLR) will be done for inducing longitudinal tension as the sciatic nerve.

The leg is lifted upward passively beyond 350, as a solid lever, while maintaining extension at the knee.

To introduce additional traction (i.e., sensitization) into the proximal aspect of the sciatic nerve, hip adduction, medial rotation or ankle dorsiflexion is added to the SLR.

Step 1: Sliders- using unaffected joints (remote sequence, remote sliders); affected area is places in the neutral or symptom free position.

Step 2: Sliders- using unaffected joints (remote sequence, remote sliders); affected area is placed in some range of motion, but without or with minimal symptoms.

Step 3: sliders- move affected area and any other area, but with or without minimal symptoms (remote sequence, local sliders).

DOSAGE: 30seconds-2minutes, 5 sets for 3 days a week, for two weeks.

Conventional therapy

Hot packs for 10 minutes.

Exercises:

Phase 1

Local Segmental Control. In patients with lower back pain, local core muscles undergo inhibition and are substituted by global muscle contraction. The aim of this phase is to reestablish local segmental control of multifidus and transverses abdominis. The therapist will palpate the local muscles to confirm their recruitment.

It includes

Transversus Abdominis contraction with pelvic floor muscle activation with lateral costal diaphragm breathing pattern in supine. Bilateral activation of multifidus with transverses abdominis activation, with controlled breathing.

Phase 2

Closed chain exercises with local segmental control with the patient in crook lying position.

Single leg slide with contra lateral limb supported:

Initially, ask the patient to perform the single leg slide with heel support, progress to single leg slide with the heel 5cms above the plinth.

Single leg slide with contra lateral leg unsupported:

Initially, ask the patient to perform the single leg slide with heel support, progress to single leg slide with the heel 5cms above the plinth.

The patient will be treated in the Out Patient Department for the first two weeks of intervention by superficial moist heat therapy and exercises for 5 sessions, along with SMWLM for group A and NTMs for group B, following the afore mentioned dosage.

Home exercise program for the next 2 weeks will be given to both groups, consisting of core strengthening exercises as per phase 2.

The outcome measures are as follows:

- Pain rating using Visual Analogue Scale [VAS].
- Hip range of movement (ROM) during SLR using goniometer.
- Lumbar spine mobility using inclinometer.
- Functional disability scores (Oswestry Disability Index).

Discussion

In SMWLMs group (A), the patients will report reduced pain, on Visual Analog Scale; and improved Lumbar range of motion (ROM), measured by dual inclinometer. In Shacklock Group B, patients will report reduced pain and improved Lumbar ROM. However, in group A, pain relief and improved mobility will be observed in the first follow up (at the end of one week), whereas Group B will obtain pain relief and improved Lumbar mobility by the second follow up (at the end of the second week). Both the findings will remain constant till the end of 4th week, at the third follow up.

The pain relief and improved Lumbar mobility obtained in group A can be explained by the following mechanism. Mulligan's technique corrects the positional fault [12] at the spinal level and relieves pain by the neurophysiologic mechanism. A minor positional fault may cause pressure on pain-sensitive structures and the nerve root traversing closely. Mobilization at the spinal level itself corrects this fault and relieves the impingement occurring thereby reducing pain in the low back as well as freeing the nerve so as to relieve the radiating symptoms in the lower limbs. Hence improved VAS may be attributed to this effect. Absence of pain will then lead to improved range of motion in the hypo-mobile segments.

Complete evaluation will reveal the following positive results: negative SLR at the end of first, second and third follow up in Group A; as compared to group B wherein SLR will be negative at second follow up (2 weeks). At the end of 4 weeks, SLR remains negative and ODI scores improve to the same extent in both groups.

In Group A, where Mulligan mobilization was done, negative SLR may be attributed to the effect of a rotational glide being applied to the spinous process of the affected vertebral segment, that increases the diameter of the canal at that level on the opposite side [13], thereby allowing the nerve to glide freely; due to absence of the mechanical compression that had caused paraesthesia.

Shacklock neural mobilization is thought to be effective due to its positive impact on restoring restricted mobility of the nerve, thereby

improving neural tissue glide with respect to its interface[14]. Compression, that may cause altered blood flow and axonal transport dynamics within the neural tissue, is relieved due to breaking of adhesions[14], thereby correcting the pathophysiology, hence relieving pain, radiating symptoms and Lumbar ROM in patients of group B.

Conclusion

In conclusion, SMWLM in conjunction with conventional therapy produces significant improvement in the low back pain radiating to the limb, range of motion and function of the patients. A four week follow up will reveal maintenance of the beneficial effects achieved during therapy.

Shacklock neural tissue mobilization in conjunction with conventional therapy also shows improvement in pain in the low back region and in the lower limb, Range of motion and ODI scores.

However Group A will show consistently quicker positive results in pain relief and lumbar mobility as compared to Group B.

Limitations

1. Unadvisable activities (gym, lifting heavy objects) carried out at home in spite of ergonomic advice will not be monitored.

Clinical Implications

The study will provide evidence for the beneficial effects of both Mulligan SMWLMs and Shacklock NTMs as an adjunct to Lumbar core strengthening and afore mentioned conventional therapy. Furthermore, it suggests that Mulligan spinal mobilization produces quicker relief of patient reported symptoms, as compared to neural mobilization. This may assist clinical physical therapists with a clearer approach while handling patients suffering from lumbar radiculopathy.

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