International Journal of Science and Healthcare Research
Vol. 8; Issue: 4; Oct.-Dec. 2023
Website: ijshr.com
ISSN: 2455-7587

Original Research Article

Effect of Self Neural Mobilization in Low Back Pain with Radiculopathy on Pain, ROM and Functional Disability - An Interventional Study

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DOI: https://doi.org/10.52403/ijshr.20230424

ABSTRACT

BACKGROUND: Leg pain extending below the knee into the foot and toes is lumbar radiculopathy, often accompanied by sensory, reflex or motor neurological problems along the lumbosacral nerves or nerve roots. Neural tissue mobilization techniques involve assessing and relieving neural tension through movements, restoring the nervous system's capacity to handle daily forces. These manual methods aid movement within neural structures and have been found, in research on both humans and animals, to reduce edema, enhance fluid dispersion, alleviate pain sensitivity, and reverse heightened immune responses resulting from nerve injuries. Nerve gliding exercises aim to improve nerve mobility and reduce irritation. They involve stretching and releasing a nerve in a controlled manner to potentially reduce swelling and alleviate symptoms. These exercises should be performed with caution and under the guidance of a healthcare professional.
OBJECTIVES: To study the effect of self-neural mobilization on pain by NPRS. To study the effect of self-neural mobilization in ROM by Goniometry. To study the effect of self-neural mobilization on functional disability by ODI.
METHODOLOGY: 36 patients were screened according to inclusion and exclusion criteria and divided into two groups; each consist of 18 patients. Group A received nerve mobilization and conventional treatment and Group B received conventional treatment.
Post outcome measures such as NPRS, ODI and SLR ROM were taken after 6 weeks of treatment.
RESULTS: After six-week data analysis was done suggest both group's p value is < 0.05 but interventional group has significant better improvement compared to control group.
CONCLUSION: From the current study it has been concluded that nerve mobilization technique is effective in reducing pain, reduce functional disability and improves SLR ROM.

Keywords: *Low back pain, Radiculopathy, Nerve mobilization*

INTRODUCTION

Leg pain that extends below the knee into the foot and toes is known as lumbar radiculopathy, which is also accompanied by sensory, reflexive, or motor neurological impairments along the distribution of the lumbosacral nerves or nerve roots.(1)
It typically occurs as a consequence of lumbar spine compression, which irritates the nerve roots. It is suspected that trauma, degeneration, or inflammation contribute to this compression.(2)
Lumbosacral radiculopathy can occur in anywhere between 1.2% and 43% of people. The incidence of low back pain in the Indian population has been estimated to be 23.09%, with a lifetime prevalence of 60-85%.(3)
Males are more likely than females to experience the symptoms first. Symptoms begin to appear in males at the age of 40, whereas they do so later in females—around the age of 50– 60.(4) 10–25% of individuals with lumbar radiculopathy experience

recurrent symptoms lasting longer than six weeks.

The constellation of symptoms that make up lumbosacral radiculopathy range in intensity from radiating pain, tingling, and numbness to muscle weakness, reflex alterations, and irregular gait.(5) There are two categories for the treatment of lumbosacral radiculopathy: conservative and surgical. Most frequently rest, medicine, and physical therapy make up the conservative first line of treatment in which Exercise therapy, heat therapy, decompression therapy, and electrotherapy are examples of physical therapy interventions.(5)

The International Classification of disease-10 (ICD-10) states that Lumbar Radiculopathy is: "A disorder characterized by inflammation involving a nerve root. Patients experience marked discomfort radiating along a nerve path because of spinal pressure on the connecting nerve root.(6)

Clinical manifestations include radicular pain, weakness, and sensory loss referable to structures innervated by the involved nerve root. One of the main characteristics of lumbar radiculopathy is pain in the affected dermatome. Edema results from an increase in the permeability of the blood vessels within the nerve root as a result of the compression of the nerve root. The nerve root's pain response threshold changes as a result of the persistent edema and fibrosis, making it more sensitive to pain. The release of inflammatory mediators such as prostaglandin E2, nitric oxide, leukotrienes, immunoglobulins, and pro-inflammatory cytokines (such as tumor necrosis factor alpha) has been theorized to trigger nociceptors' activation, increase their sensitivity to other pain inducing substances, or even directly cause injury.(5)

A decrease in the range of the straight leg raise (SLR) which is neural provocation testing is another characteristic of Lumbar Radiculopathy that is frequently observed by lengthening the nerves in the hip, knee, and ankle.(7)

The lumbosacral nerve is moved as a result of this elongation at the peripheral joints and distant roots in their foramen. The spinal cord (conus medullaris), which travels caudally in the spinal canal, receives this displacement thereafter. Hip flexion angle and conus displacement in SLR have a favorable association. Studies have demonstrated that there is reduced conus excursion during SLR in individuals with lumbar radiculopathy. As a result, the already-stretched nerves and nerve roots are subjected to further strain, intensifying the symptoms. Neural tissue mobilization techniques theorize to examine the neural tension in nerves and mobilize the nerves that exhibit neural tension by passive/active movements by using tensioning and gliding and focused on restoring the ability of the nervous system to tolerate the normal compressive, friction and tensile forces associated with daily activities.(8)

Neural mobilization facilitates movement between neural structures and their interface through manual techniques. Human and animal studies revealed that NM reduces intraneural edema, improves intraneural fluid dispersion, reduces thermal and mechanical hyperalgesia, and reverses the increased immune responses following a nerve injury.(2) Through such mobilization techniques, damages to the sciatic nerves may be removed, pain may be alleviated, and range of motion may be increased, and dynamic adaptability of the nervous system may be heightened, helping to patients to use their bodies without resistance.(2) When tension is applied to the nervous system during the mobilization techniques for the sciatic nerves, the cross section of the nerves decreases, and therefore small blood vessels that cross the epineurium are obstructed, thereby adjusting the amount of blood to the nerve fibres. This affects the axonal transport system, and increased flexibility of the shortened nerves and surrounding joint structures leads to increased muscle strength, as improved flexibility of the sciatic nerves decreases mechanosensitivity of the nervous system, which in turn heightens compliance of the nerve tissues.[8] Nerve gliding exercises for the sciatic nerve were designed to maximize nerve excursion while minimizing nerve strain. To achieve this, elongation of the nerve bed at one joint (loading) was counterbalanced by a simultaneous movement which reduces the length of the nerve bed in a neighbouring joint (unloading). some studies suggest that a reduction in intraneural edema is a therapeutic mechanism of reducing radiating symptoms and enhancing normal function.[10] In the contrary, the aim of a nerve tensioner intervention is to induce tension of a nerve trunk in relation to their adjacent tissues. The nerve tensioner technique applies joint movements to the targeted structure proximally and distally at the same time and in the same direction

MATERIALS & METHODS

➢ **INCLUSION CRITERIA:**

- Willingness to participate
- Pain radiating from lower lumbar area to one lower limb.
- Age group: 18 and above
- Both male and female included
- Patient with SLR1 positive [35º- 70º]

➢ **EXCLUSION CRITERIA:**

- Any red flag regarding neurodynamics was excluded.

➢ **WITHDRAWL CRITERIA:**

- If pain aggravates.
- Patient wishes to discontinue the treatment

➢ **MATERIALS:**

1. Consent form
2. Oswestry Back Disability Index Scale
3. Interferential Therapy Machine
4. Plinth
5. Stool
6. Paper, pencil, pen
7. Goniometer
8. Assessment form
9. Pressure biofeedback machine
10. Certificate of clinical neurodynamics

METHODOLOGY

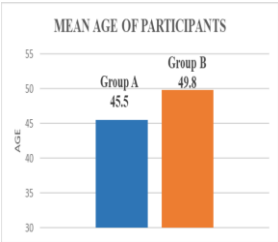
The research procedure involved 36 participants who met specific inclusion and exclusion criteria and provided informed consent to participate. These participants were randomly divided into two groups using the chit method: Group A, consisting of 18 individuals, was designated as the Experimental group, while Group B, also comprising 18 individuals, was designated as the Conventional group.

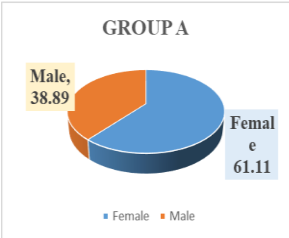
In the Experimental group (Group A), participants received a combined treatment approach, which included self-neural mobilization along with conventional therapies. In contrast, the Conventional group (Group B) received a standard treatment regimen consisting of Interferential Therapy (IFT), lumbar stabilization exercises, and ergonomic guidance.

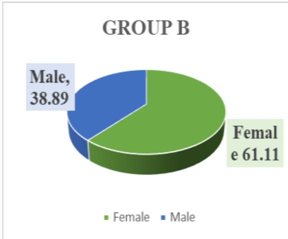
Before the intervention commenced, baseline data were collected for all participants. This included assessing their pain levels using the Numeric Pain Rating Scale (NPRS), measuring their range of motion with the Straight Leg Raise (SLR ROM) test, and evaluating their disability using the Oswestry Disability Index.

After a six-week period of receiving their respective treatments, post-intervention data were recorded for all participants. This data was then subjected to statistical analysis to determine the effectiveness of the treatment interventions on the measured outcomes.
Statistical Analysis:
Statistical analysis was done using SPSS version 16.
Prior to analysis, normal distribution and baseline differences were screened.
Within group analysis was done using baseline outcome measures taken before and after 6 weeks.
To check whether the data follows normal distribution or not, Shapiro-Wilk test was applied.

Level of significance was at 5% with confidence interval at 95%.







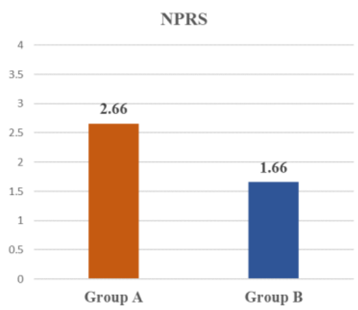
RESULT

WITHIN GROUP ANALYSIS:

Group A	Pre NPRS Means ± SD	Post NPRS Means ± SD	Z value	P value
Group A	6.83±0.95	4.16±1.30	-3.787	0.00001

Group B	Pre NPRS Means ± SD	Post NPRS Means ± SD	Z value	P value
Group B	6.33±1	4.66±0.81	-3.753	0.00001

BETWEEN GROUP ANALYSIS:



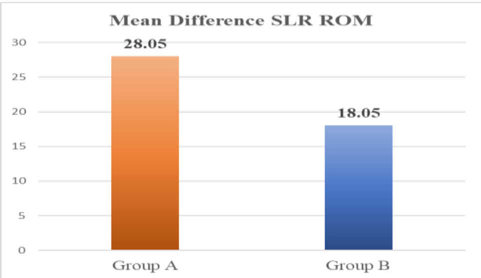
Variable	Group A Mean ± SD	Group B Mean ± SD	U Value	Z value	P value
NPRS	2.66±1.05	1.66±0.66	70	-3.18	0.003

As the p value is <0.05 for this outcome measure, null hypothesis can be rejected which states that there is significant difference in pain between experimental and conventional treatment group. So the effect in reducing pain is more among Experimental Group than Conventional Group.

WITHIN GROUP ANALYSIS FOR SLR ROM:

Group A	Pre SLR ROM Means ± SD	Post SLR ROM Means ± SD	Z value	P value
Group A	49±9.20	77.05±11.86	-3.729	0.000

Group B	Pre SLR ROM Means ± SD	Post SLR ROM Means ± SD	Z value	P value
Group B	48.33±4.71	66.38±7.99	-3.73	0.000



BETWEEN GROUP ANALYSIS:

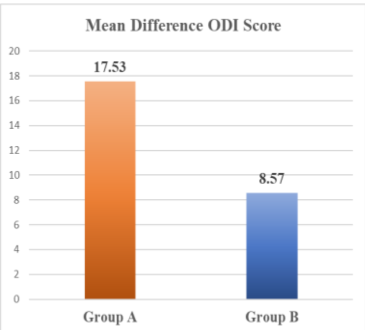
Variable	Group A Mean ± SD	Group B Mean ± SD	U Value	Z value	P value
SLR ROM	28.05±9.9	18.05±6.22	66.5	-3.03	0.002

As the p value is <0.05 for this outcome measure, Alternate hypothesis can be accepted which states that there is significant difference in SLR ROM between experimental and conventional treatment group.

WITHIN GROUP ANALYSIS:

Group A	Pre ODI Score Means ± SD	Post ODI Score Means ± SD	t value	P value
Group A	40.11±9.8	22.57±7.6	8.98	0.000

Group B	Pre ODI Score Means ± SD	Post ODI Score Means ± SD	t value	P value
Group B	40.59±7.6	32.01±6.85	8.47	0.000



BETWEEN GROUP ANALYSIS:

Variable	Group A Mean ± SD	Group B Mean ± SD	t value	P value
ODI Score	17.53±8.04	8.57±4.17	4.07	0.00013

As the p value is <0.05 for this outcome measure, Alternate hypothesis can be accepted which states that there is significant difference in ODI Score between experimental and conventional treatment group.

The statistical analysis was done using SPSS version 16, for those subjects who had taken all the six weeks of the protocol. The power of the study was kept 80% and the significance level was 5%. Shapiro–Wilk test was used to analyse the distribution of data. The data were not normally distributed. Hence, Mann– Whitney U-test was used for comparison of baseline data of age, which revealed that there was no statistically significant difference between the two groups. Wilcoxon test was used to compare the values of SLR ROM and NPRS before and after the intervention, which showed statistically significant difference in both outcome measures in both groups ($P < 0.05$). Mann–Whitney U-test was used to compare the differences in the outcome measure between the two groups which showed that the interventional group had better improvement in both outcome measures compared to the control group ($P < 0.05$). Unpaired t test was used to compare the values of ODI before and after the intervention, which showed statistically significant difference in both outcome measures in both groups ($P < 0.05$). Paired t test was used to compare the differences in the ODI between the two groups which showed that the interventional group had better improvement in ODI compared to the control group ($P < 0.05$).

DISCUSSION

The present study was designed to study effects of self-neural mobilization in low back pain with radiculopathy on pain, SLR ROM and Functional disability. Total 36 patients with lumbar radiculopathy were taken after screening according to inclusion and exclusion criteria and divided into two groups randomly by using chit method and given allocated interventions for 6 weeks; pre post outcome measures were taken and analysis was done using SPSS 16 Software. The results showed that there was statistically significant improvement in both – the experimental and control groups after the intervention for all the outcome measures within groups, in between group analysis results shows more improvement in all outcome measures in Experimental group compared to control group. Group A which received neural tissue mobilization in addition to conventional physical therapy performed significantly better compared to the control group. These effects could be attributed to gliding, sliding and elongation of the nerve roots due to neural tissue mobilization. However, the reduction of pain, increase in SLR ROM and functional status was also seen in the control group. These improvements could be due to the analgesic effects of IFT, the effects of Core stability exercises and ergonomics. The current study used conventional IFT which is 4000 Hz, base 80 sweep 120, duration 15 minute. Patient has given IFT in prone position The electrodes were placed in the lumbosacral region, equidistance from the most tender area and other two electrodes were placed as per the distribution of radiating symptoms of patient. IFT had a significant effect on pain intensity and distribution in the patient group Such improvement may be due to the effect of IFT on the pain gate.(9) A study conducted by Sami s. Al abdulwahab1 & Abulkhair m. Beatti concluded that the reduction in pain intensity and distribution with no change in H reflex during and after IFT application probably is a placebo improvement rather than physiological or anatomical changes however this modality has widespread usage and popularity among several countries.(10) Exercises that focus on core stability can also help people with low back pain feel less discomfort. According to research by Akhtar et al., core stability exercises are also more efficient than the conventional physical therapy approach at reducing pain in patients with nonspecific back pain. It has been proposed that core stabilisation workouts will enhance segmental muscles capacity to support the spine, enhance function, and lessen discomfort. Research by Paungmali A et al. evaluated the levels of beta-endorphin and cortisol in plasma after individuals with persistent nonspecific low back pain performed core-stabilization exercises. They discovered that the levels of Beta-endorphin were significantly different before and after applying core stability exercises, whereas the levels of plasma cortisol remained the same. This might explain that the beneficial effects of core stabilization exercises may be due to an endogenous opioid mechanism and not due to a stress related analgesia mechanism.(11) Similar results were obtained by Abdul Rehman1, Binash Afzal et al concluded that Active and passive neural mobilization are equally effective in improving disability, and reducing pain in patients with lumbar radiculopathy expect for straight leg raise which improved with passive neural mobilization only. One systematic review of forty chronic low back pain studies found that nerve mobilization improved the average Oswestry score by 9.3 points and the average VAS by 1.8 points.(1) It has been suggested that neural mobilization induces hypoalgesia by activation of the descending pain inhibitory system, reducing intraneural edema, and promoting nerve recovery which then help restore the neural tissues ability to tolerate stresses during activities of daily living.(12)

According to Cleland et al. and Gladson et al., neurodynamic techniques, which involve brief oscillatory movements, were sufficient to disperse the edema and relieve the hypoxia and its symptoms. This was because the nerve root was compressed and the microcirculation was compromised, which in turn affected the edema and demyelination.(13) It could possibly be directly related to the decrease in neurogenic inflammation brought on by immobility. The idea that nerve movement within pain-free variations might aid in reducing nerve compression, friction, and tension, hence lowering its mechanosensitivity, is another possibility. Therefore, compared to passive stretching alone, a neurodynamic method appears to be a more effective type of therapy. However, Kiran Satpute et al. has studied on ‘The Effect of Spinal Mobilization with Leg Movement in Patients with Lumbar Radiculopathy’ concluded better effect of spinal mobilization with movement on ODI, SLR ROM, global rating of change compared to nerve mobilization alone. This might be due to correction of positional fault done by SMWLM at the spinal level whereas neural mobilization worked on restoring the mobility of the nerve to its mechanical interface which was compressed due to herniated disc resulting in pain. It could be attributed to clear effect of SMWLM that produced greater hypoalgesia than other exercises. It was hypothesized that manipulation inhibits pain at dorsal horn of spinal cord by altering neuroplasticity of the nerve and central sensitization. Spinal mobilization may provide a stimulus that acts as counter-irritant to C fiber-mediated pain.(12)

CONCLUSION

The result of present study on 36 participants have accepted Alternate Hypothesis and Rejected Null Hypothesis of this study. Intervention group (Group A) receiving Conventional Physiotherapy and Self-neural mobilization improved better than control group (Group B) receiving conventional therapy alone. Thus it can be concluded that Self-neural mobilization along with conventional therapy is more effective in reducing pain, functional disability and improving SLR ROM in Unilateral lumbosacral radiculopathy.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Mahima Umeshbhai Joshi, Yagna Unmesh Shukla. Effect of self neural mobilization in low back pain with radiculopathy on pain, ROM and functional disability - an interventional study. *International Journal of Science & Healthcare Research.* 2023; 8(4): 170-177.
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