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Comparison Between Immediate Effect Of Spinal Mobilization With Leg Movement And Lumbar Traction For Management Of Lumbar Radiculopathy: A Randomized Clinical Trial.

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ABSTRACT

Lumbar radiculopathy is a condition characterized by lower back and hip pain radiating down the back of the thigh into the leg, typically caused by compression of spinal nerve roots. This study compares the immediate effects of spinal mobilization with leg movement (SMWLM) and lumbar traction on pain intensity and Straight Leg Raise (SLR) range of motion in patients with lumbar radiculopathy. A randomized clinical trial was conducted with 30 subjects aged 20-50 years from IIMS&R and hospital in Lucknow. Subjects were divided into two groups: Group A (lumbar traction) and Group B (SMWLM). Baseline measurements for leg pain intensity using the Numeric Pain Rating Scale (NPRS) and SLR range of motion using a goniometer were recorded. Post-intervention measurements were taken immediately. Paired t-tests were used for within-group analysis, and independent t-tests for between-group comparisons, with statistical significance set at $p < 0.05$. Both groups showed significant improvements in NPRS scores and SLR range of motion post-intervention. Group A's NPRS decreased from 6 ± 0.845 to 4.6 ± 0.985, and SLR ROM increased from 49 ± 4.309 to 60 ± 4.629. Group B's NPRS decreased from 6.066 ± 0.883 to 4.6 ± 0.910, and SLR ROM increased from 48 ± 4.140 to 58.33 ± 5.232. No significant difference was found between the groups for NPRS ($p = 1$) and SLR ROM ($p = 0.363$).Both SMWLM and lumbar traction provide immediate relief in pain and improvement in SLR range of motion for lumbar radiculopathy, with no significant difference between the two methods.

Keywords: *Lumbar radiculopathy, spinal mobilization, lumbar traction, pain management, SLR range of motion*

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1. INTRODUCTION

Lumbar radiculopathy is a condition characterized by lower back and hip pain which radiates downward the back of the thigh into the leg [1]. It may be present in one or both lower extremities. This mainly occurs due to compression of spinal nerve roots at the level of L1- S4. The nerve root compression can cause weakness, tingling, radiating pain, numbness, occasional shooting pain and paresthesia. Radiculopathy can occur in any level of the spine but it is most commonly found in the neck (cervical radiculopathy) and the lower back (lumbosacral radiculopathy) and it is less common in the thoracic level of the spine (thoracic radiculopathy). The level of spinal nerve root involvement indicates specific dermatomes affected [1, 2].

Approximately 3% to 5% prevalence of lumbosacral radiculopathy, men and women both can be affected [3]. The incidence of Lumbar radiculopathy is 23.09% in India [4]. Low back pain (LBP) is most common problem affecting about 70-80% of general population [5]. The major contribution of Lumbar disc herniation (LDH) about 60-80% of lifetime incidence of low

back pain in general population [6]. Low back pain is more prevalent in female (76.2%) than in male (73.9%)[7]. Lumbar

disc herniation (LDH) commonly causes Impingement of neural structures and various spinal structures like the annulus fibrosus, paravertebral muscles, ligaments, facet joints, and spinal nerve roots [8]. some risk factors are responsible for the development of lumbar radiculopathy such as age, occupation, obesity and psychological factors [9,10].

The initial examination should be done through a complete history and physical examination including SLR test (Lasegue's sign), manual muscle testing, sensory testing, and deep tendon reflexes and some diagnostic modalities like magnetic resonance imaging (MRI), computerized tomography (CT), nerve conduction velocity (NCV) and electromyogram (EMG) can be used for further investigation for Lumbar radiculopathy [11].

Research is limited and controversial in the effect of manual therapy for intervention of lumbar radiculopathy in lumbar disc herniation. Mulligan's mobilization with movement (MWM) technique is commonly used as a treatment for low back disorders. Mulligan 's movement with mobilization (MWM) effectiveness is based on the theoretical concept related to "positional fault" which commonly occurs secondary to injury leading to the joint malt racking that causes symptoms like pain, stiffness, or weakness [12]. Mulligan's spinal mobilization with leg movement techniques (SMWLM) is the most common type of Mulligan's spinal mobilization techniques and is effective and also provides immediate response in spinal joint dysfunction and abnormal neural dynamics. According to mulligan in SMWLM technique therapist applied the transverse sustained glide on the spinous process of the affected vertebra with restricted lower limb movement is done simultaneously. [12, 13]

Lumbar traction is widely used as a part of physiotherapeutic modalities for the management of low back pain and discrelated symptoms. The mechanism of action of mechanical lumbar traction is defined not well, but it is suggested that traction separates the vertebral bodies, decreasing the compressive forces onherniated discs. The intervertebral foramen also enlarges by separation of the vertebral bodies, which decreases the nerve root compression due to more space is available for the disc and nerve roots. It also creates tension on the spinal ligaments, which helps to return the discs to their normal position [14, 15]. According to study [16] the results show that lumbar traction is able to reduce pain and improve functional status immediately in patients with chronic low back pain (CLBP) and 40% of the body weight was the optimum traction force for lumber traction.

Many Previous studies investigated the effectiveness of SMWLM and lumbar traction in management of lumbar radiculopathy but no any comparative study was performed between the immediate effect of SMWLM and lumbar traction for management of lumbar radiculopathy. So, this study was conducted to examine the Comparison between immediate effect of spinal mobilization with leg movement and lumbar traction to improve pain intensity and SLR ROM in patient with lumbar radiculopathy.

2. METHODOLOGY

This study is a Randomized Clinical Trial (RCT) designed to compare the effectiveness of traction therapy (Group A) and SMWLM technique (group b) in individuals diagnosed with unilateral radiculopathy. The study was conducted at the Physiotherapy Outpatient Department (OPD) of Integral Hospital & Research Centre, Integral Hospital, Lucknow.

Participants

A total of 30 participants (out of an initial 40 enrolled) were included in the study after fulfilling the inclusion and exclusion criteria. The sample comprised both male and female participants aged 20-50 years who were diagnosed with unilateral radiculopathy.

All participants were informed about the study objectives, procedures, potential risks, and benefits before they signed the informed consent form. The study adhered to ethical standards in accordance with the declaration of helsinki. Ethical approval was obtained from the Institutional Ethical Committee, Integral University before the initiation of the study. Participants were assured confidentiality and informed about their rights throughout the research process.

The inclusion criteria for this study were as follows: participants were required to have a diagnosis of unilateral radiculopathy, with a confirmed diagnosis of L4-L5 or L5-S1 nerve root compression, or involvement of both nerve roots. Additionally, participants needed to have a positive Straight Leg Raise (SLR) test, indicating nerve root tension and participants reporting mild to moderate pain, as assessed by the Numeric Pain Rating Scale (NPRS), with scores of NPRS < 7.

The exclusion criteria for this study were as follows: participants with underlying orthopedic conditions such as Rheumatoid arthritis, Ankylosing spondylitis, Paget's disease, vertebral collapse, spondylolisthesis, or osteoporosis, individuals with certain neurological conditions, including hemiparesis, hemiplegia, piriformis syndrome, or diabetic neuropathy, participants exhibiting constitutional symptoms, such as fever, weight loss, or malaise, any pathology of the hip, knee, or sacroiliac joint, history of lumbar spine fracture or surgery were excluded to prevent bias from prior interventions. Additionally, pregnant participants, participants experiencing severe pain (as indicated by an NPRS score > 7), who were unwilling to participate or showed a lack of interest were also excluded. Also, individuals with red flag symptoms, including a history of trauma, spinal cancer, or tuberculosis of the spine, were excluded.

After the enrolment, 40 participants, both male and female, aged 20-50 years, were equally divided into two groups: the Traction Therapy group (Group A) and the SMWLM Technique group (Group B). Odd-numbered participants were assigned to Group A, and even-numbered participants were assigned to Group B. Thirty participants signed the informed consent form before the study. The random selection and assignment were based on the inclusion and exclusion criteria. A CONSORT diagram with flow chartindicating each stage of this study is shown in Figure 1.

3. OUTCOME MEASURES:

SLR range of motion: It is the ranges of motion of the hip flexion during passively raise the leg in supine position until the patient complains of pain or tightness in back of the leg [18, 19]. Straight leg raise (SLR) test is a common neurodynamic examination to assess nerve root irritation in the lumbosacral area (L_4-S_2). It has also specific importance in identify disc herniation and neural compression. The straight leg raise test also known as the Lasegue's test [20- 22]. Some previous studies [22, 23] analyze the sensitivity and specificity of the straight leg raise test shows high sensitivity and low specificity of lumbar disc herniation with radiculopathy. SLR range of motion is the measurement of the hip flexion range of motion during SLR test.

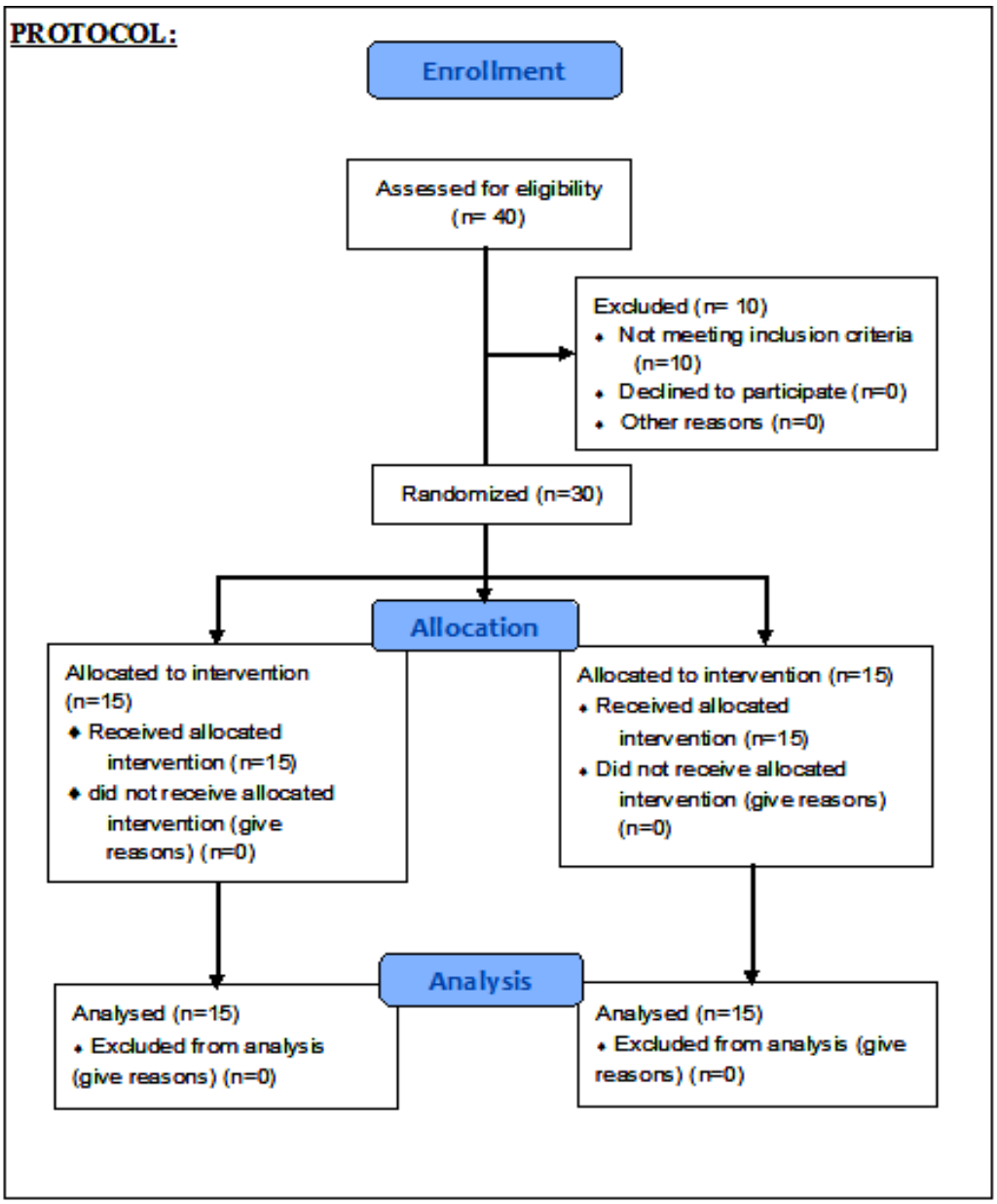


FIGURE1: CONSORT flow chart of the study.

NPRS (Numeric pain rating scale): It is a unidimensional measurement tool use for measure the pain intensity in adults. The NPRS is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0-10 integers) that best display the pain intensity of the patient. The common format is a horizontal line and 11- point numeric scale ranges from '0' (no pain) to '10' (Worst pain imaginable) [24-26]

4. PROCEDURE:

A total of 40 subjects were enrolled in this study. Both male and female were participated in this study having 20-50years. 30 subjects made to sign the inform consent form before the study. The subjects were randomly selected in the treatment group with every odd subject assigned to the Traction therapy group (group A) and every even subject selected to the SMWLM technique group (group B) on the basis of inclusion and exclusion criteria. Participant's demographic data was collected including their bodyweight in kg measured by using the weighing machine, Height in cm measured by using the stadiometer. Baseline measurements for leg pain intensity by NPRS and SLR ROM by goniometer were taken for every patient after that lumbar traction was applied for group A and SMWLM technique was applied for group B than SLR ROM and pain intensity on the NPRS were again noted immediately after intervention.

Baseline measurements procedure: Baseline measurements for leg pain intensity by NPRS in which asked the patients to select the numerical value of the scale i.e. range 0-10 and express verbally which indicates about his/her pain intensity and then baseline measurements for SLR range of motion in which asked the patients to lie supine on the couch without a pillow under patient head. Ipsilateral lower extremity was passively raised by an assistant therapist from the couch, the assistant therapist stands at the tested side with the distal hand around the patient's heel and proximal hand on patient's distal thigh (anterior) to maintain knee extension. The assistant therapist continues to raise the patient's lower extremity by hip flexion until the patient complains of pain or tightness in the back or back of the leg [20, 18], than therapist measure the degree of hip flexion by a universal full circle goniometer. The goniometer's fulcrum was placed over the greater trochanter, stationary arm parallel to the table and the moving arm along the midline of the thigh than degree of hip flexion was noted [19].

Intervention Procedure:

Group A – Lumbar traction:

Lumbar traction was performed in Fowler's position. Thoracic and pelvis harness used to fit the participants who were lying on the traction table. The participant's hips and knees were flexed at 90° and support the both legs by using the padded footstool beneath both leg and after that traction force was applied. [27]

Dosage: 10 min × repeated cycles of traction for 30 s and rest for 5 s. Load of traction: 40% of the body weight. [16]

FIGURE 2: Lumbar traction technique

Group B- spinal mobilization with leg movement (SMWLM) techniques:

SMWLM was performed according to Mulligan's concept [12]. SMWLM was performed in side lying position, facing towards the treating physiotherapist with affected lower limb uppermost. The affected leg supported by the assistant therapist. Treating physiotherapist bent over the patient and palpates the spinous process of the affected vertebrae as determined with reference to the posterior superior iliac crest, then put one thumb on the spinous process and supported by the other thumb, pressed down on the palpated spinous process by treating physiotherapist. This Pressure was continuing

and maintained while patient actively performed the SLR for the leg supported by the assistant therapist provided there is no pain.

Dosage: Three set × 7 repetitions[17].

FIGURE3: Spinal Mobilization with Leg Movement (SMWLM) Technique.

Post intervention measurements: Pain intensity on the NPRS and SLR range of motion were again noted same as the above immediately after intervention.

Statistical Analysis

Analysis was done for 30 subjects who completed the study. The outcome variables of the study included leg pain intensity on NPRS and SLR range of motion. Paired t-test was used for comparing the pretreatment and post-treatment scores of each variable for both the groups (within group analysis). Independent t-test was applied to compare the pain and SLR range of motion between the groups. The value of all two group i.e. Group A (Lumbar traction) and Group B (SMWLM), were compared at the pretest and immediately after single session of treatment. Statistical significance was set at $P < 0.05$. P value > 0.05 was considered as non-significant difference while P value < 0.05 was considered to have represented a significant difference. Value of confidence interval was set at 95%.

5. RESULT

The data in the study was normally distributed. Demographic characteristics showed that there was no significant difference in mean scores of age, weight, height and BMI between the groups. Baseline values (pretreatment) showed no significant difference in pain intensity (NPRS) and SLR range of motion between the two groups. The values of mean and standard deviation shown in the tables of demographic data of the participants (Table- 1). The mean age of group A was 36.73 ± 8.87years while mean age of group B 36.4 ± 9.23 was. The mean height of group A was 164.0 ± 10.06cm while mean height of group B was 164.4 ± 7.32 cm. The mean weight of group A was 73.6 ± 13.24 kg while mean weight of group B was 70.6 ± 14.55 kg. The mean BMI of group A was 27.20 ± 3.85 kg/m^2 while mean BMI of group B was 26.13 ± 5.19 kg/m^2.Paired t-test for the pre and post test comparisons revealed a significant improvement in NPRS - pain ($p = 0.000$) and SLR range of motion ($p = 0.000$). In Group A (Table- 2), (Graphs-1, 2). In group B there was significant improvement in NPRS- pain ($p = 0.000$) and SLR range of motion ($p = 0.000$) (Table- 3), (Graphs-1, 2).Independent t-test for between group comparisons was done for difference of pre-test and post-test reading between the two groups for each outcome measure. The results revealed no significant difference in the NPRS score ($p = 1$) and SLR range of motion ($p = 0.363$) between the groups (Table- 4), (Graph-3).

Table 4.1: Demographic data analysis of group A and group B

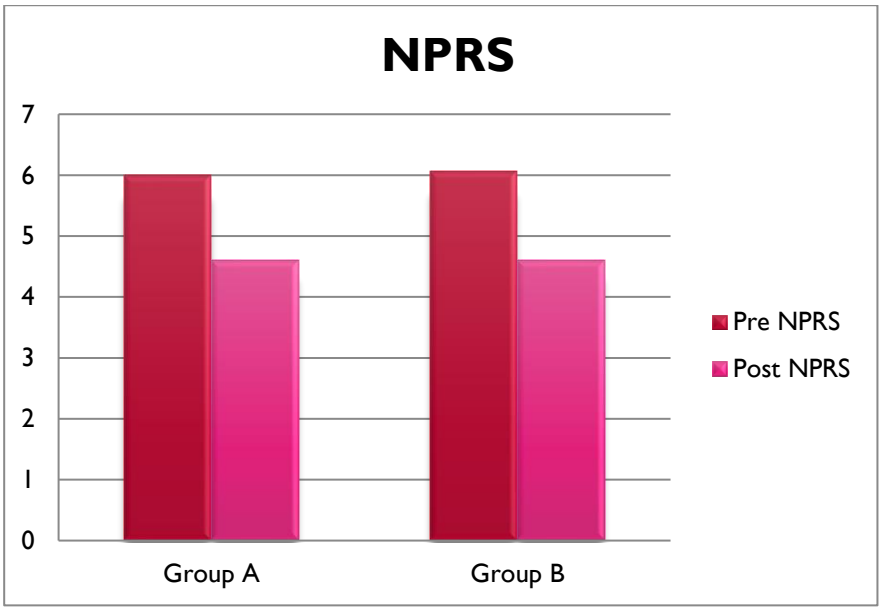
Variables	Group A (Mean ± SD)	Group B (Mean ± SD)
Age (year)	36.73 ±8.87	36.4 ±9.23
Weight(kg)	73.6 ±13.24	70.6 ±14.55
Height(cm)	164.0 ±10.06	164.4±7.32
BMI(kg/m2)	27.20 ±3.85	26.13 ±5.19

Table 4.2: Within group analysis of group A.

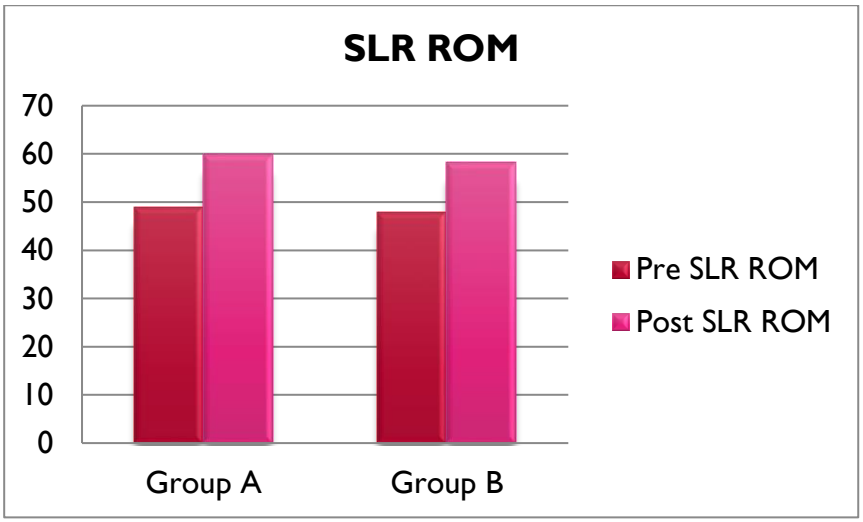
Variables	Pre test (Mean ± SD)	Post test (Mean ± SD)	t-value	p-value
NPRS	6 ± 0.845	4.6 ± 0.985		0.000*
SLRROM	49 ± 4.309	60 ± 4.629	2.144	0.000*

Table 4.3: Within group analysis of group B.

Variables	Pre test (Mean ± SD)	post test (Mean ± SD)	t-value	p-value
NPRS	6.066 ± 0.883	4.6 ± 0.910		0.000*
SLRROM	48 ± 4.140	58.33 ± 5.232	2.144	0.000*



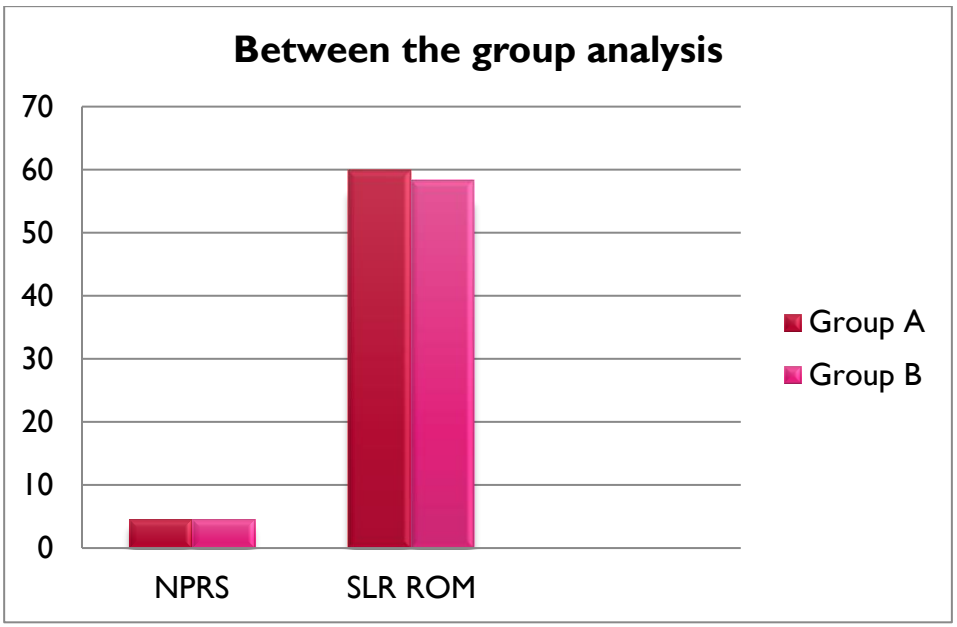
Graph 4.1 Within the group pre test and post test analysis of NPRS of group A and group B.



Graph 4.2: Within the group pre test and post test analysis of SLR ROM of group A and group B.

Table 4.4: Between the group analysis of group A and group B.

Outcome Measure	Group A (Mean ±SD)	Group B (Mean ± SD)	t-value	p-value
Pre NPRS	6 ± 0.845	6.066 ± 0.883		0.834
Post NPRS	4.6 ± 0.985	4.6 ± 0.910	2.048	1
Pre SLR ROM	49 ± 4.309	48 ± 4.140		0.522
Post SLR ROM	60 ± 4.629	58.33 ± 5.232	2.048	0.363



Graph 4.3: Between the group post test analysis of NPRS and SLR ROM

6. DISCUSSION

The findings of the study indicate that both techniques (SMWLM technique and lumbar traction) showed significant improvement in pain and SLR range of motion. The between group analyses was done using unpaired t-test and the result of the study confirmed the null hypothesis that there was no significant difference between the two groups. Spinal mobilization showed an immediate effect. This can be due to correction in positional fault done by Spinal Mobilization with Leg Movement at the spinal level [12].A study conducted by Das SMS et al has showed than Spinal mobilization and neural mobilization both were effective in improving the symptoms but spinal mobilization revealed an immediate effect. This might be due to correction of positional fault done by SMWLM at the spinal level [17].The Straight Leg Raise (SLR) test has a strong correlation with the intensity of leg pain, and notable improvement is often observed when mechanical compression of the nerve root, particularly at the dorsal root ganglion, is alleviated. This relief is facilitated by the manual rotation performed during the application of the Spinal Mobilization with Leg Movement (SMWLM) technique[28].A biomechanical study conducted by Fujiwara et al. demonstrated that axial rotation leads to an increase in the height and area of the intervertebral foramen on the side opposite to the direction of rotation [29]. This finding supports the concept that rotational gliding enhances the space within the intervertebral foramen. Consequently, pain relief can be attributed to the realignment of vertebral positioning and the decompression of the nerve root, achieved by expanding the intervertebral space [28].Lumbar traction has been shown to significantly reduce pain and increase the SLR range of motion, primarily because it facilitates the opening of the intervertebral foramen, thereby reducing pressure on compressed neural structures[27]. This decompression can lead to pain relief [30]. Additionally, traction stretches the paraspinal muscles, facet joints, ligaments, and discs [31], which may stimulate mechanoreceptors in these tissues, potentially inhibiting pain signals. Furthermore, it is suggested that the stretching of ligamentous and bony structures enhances nutrient flow to impinge neural and ligamentous areas, contributing to a decrease in pain transmission[32, 33].Fowler's position was selected for lumbar traction because, in the neutral position of the lumbar spine, the posterior collagenous tissues remain loose[34]. In a supine position, a significant amount of traction force would be used only to eliminate this soft tissue slack. However, when the patient is placed in Fowler's position, the lumbar spine flexes which stretches the posterior fibers and removes the slack. As a result, in Fowler's position, a lower traction force is needed to effectively stretch the posterior tissues [27].A study [16] indicates that lumbar traction effectively Reduces pain and enhances functional status in patients with chronic low back pain (CLBP) immediately after treatment. The optimal traction force for lumbar traction was determined to be 40% of the patient's body weight.

There are several limitations to this study. The sample size in study was small, to generalize the result, larger sample size is needed, no follow up was done, the present study examined the immediate effect only. Positional fault could not be measured objectively. A functional measurement of disability was not used because only immediate effects were measured. Radiographical findings were not measured in this study. Further studies may be done with larger sample size to generalize the results. Long term follows up of the patients is recommended in further studies to see the long-term effects. Radiographical findings are recommended in further studies to measure the effects.

7. CONCLUSION

In conclusion, this study demonstrates that both the SMWLM technique and lumbar traction are effective in providing immediate relief in terms of pain reduction and improvement in SLR range of motion in individuals with lumbar radiculopathy. However, no significant difference was found between the immediate effects of these two techniques, indicating that both treatment modalities offer comparable benefits for the management of lumbar radiculopathy. These findings suggest that either technique may be a viable option for clinicians to consider when addressing the symptoms associated with this condition

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