Chapter-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 extremity. 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 paraesthesia. 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 use for further investigation for Lumbar radiculopathy[11].

Various surgical and non- surgical treatment strategies have been tried for lumbar radiculopathy in lumbar disc herniation but with varying degrees of success. If the conservative management fails to relieve symptom than surgical treatment is considered. The duration between surgery and when conservative management can be selected as failed treatment typically ranges between 4 and 8 weeks [12]. Conservative Treatment involves patient education, medication (non-steroidal anti-inflammatory drugs, Oral corticosteroids, epidural steroid injections, facet injection, or transforaminal injections, glucocorticoid, and a long-lasting anesthetic) [13, 14], Various physiotherapy interventions like strengthening and core stabilization exercises, manual therapy techniques involving the Mckenzie approach, Maitland mobilization, neural tissue mobilization, Mulligan's mobilization and physiotherapy modalities including Traction, TENS, Ultrasound, Hot pack these are commonly use for Lumbar radiculopathy[15,16]. Manual therapy techniques lead to greater improvements in pain and functional outcomes in the management of patients with both neural and non-neural back pain [17]. Manual therapy techniques are effective in the management of low back pain patient with long term or short term pain disability and back-related lower extremity symptoms. Despite this, there are no standard guidelines for low back pain that is treated with manual therapy techniques and it is suggested that as many treatment options as possible are needed [18-20].

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 maltracking that causes symptoms like pain, stiffness or weakness[21]. 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. [21, 22]

Lumbar traction is widely used as a part of physiotherapeutic modalities for the management of low back pain and disc related 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 on herniated 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 [23, 24]. According to study [25] 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.

Need of the study: Many Previous studies investigated the effectiveness of SMWLM and lumbar traction in management of lumbar radiculopathy but no any comparative study was perform 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.

AIM:

- To compare immediate effect between spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.

OBJECTIVE:

- To evaluate the immediate effect of spinal mobilization with leg movement for management of lumber radiculopathy.
- To evaluate the immediate effect of lumbar traction for management of lumber radiculopathy.
- To compare the immediate effect between spinal mobilization with leg movement and lumbar traction for management of lumber radiculopathy.

HYPOTHESIS

- **Experimental hypothesis:** There will be significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.
- **Null hypothesis:** There will be no significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.

OPERATIONAL DEFINITION

Lumbar traction:

Lumbar traction is the process of applying a stretching force to the lumbar vertebrae through body weight, weights, and/or pulleys to distract individual joints of the lumbar spine. The word traction is a derivative of the Latin word "tractico", which means" a process of drawing or pulling [23].

Lumbar radiculopathy:

Lumbar radiculopathy is a disorder that causes pain in the lower back and hip which radiates down the back of the thigh into the leg. This damage is caused by compression of the nerve roots which exit the spine, levels L1- S4. The compression can result in tingling, radiating pain, numbness, paraesthesia, and occasional shooting pain [1].

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). [33, 34]

Mobilization with movement:

Mobilization with movement (MWM) is the concurrent application of sustained accessory mobilization applied by a therapist and an active physiological movement to end range applied by the patient. Passive end-of-range overpressure, or stretching, is then delivered without pain as a barrier [2].

Pain:

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated` with, actual or potential tissue damage."[26]

CHAPTER - 2

REVIEW OF LITERATURE

Das SMS, Iyengar R et al, 2018, conducted the study to find out the effect of spinal mobilization with leg movement as an adjunct to neural mobilization and conventional therapy could bring better outcome in patients when compared to conventional therapy or neural mobilization and conventional therapy. 90 patients were selected randomly with lumbar radiculopathy.This study concludes that all the three groups showed improvement in pain, functional disability and straight leg raise (SLR). SMWLM as an adjunct to neural mobilization and conventional therapy showed significantly better outcomes in pain, functional disability and SLR when compared to conventional therapy or neural mobilization and conventional therapy [37].

Bello B, Danazumi MS, et al, 2019, conducted the study to compare the effectiveness of Dowling's and Mulligan's manual therapy techniques on pain and disability in the management of lumbar disc herniation with radiculopathy (LDHR). A total of 40 individuals with LDHR were randomly allocated into 2 groups, 20 participants each in PINS and SMWLM groups. Each participant was assessed at baseline, 4 and 8 weeks post intervention. This study concludes that no significant differences were observed in the baseline characteristics of participants in both groups. This study concludes that there was no difference in pain or disability between the 2 manual therapy techniques in the management of LDHR [38].

N. Ahmed, Z. Khan et al, 2016, conducted the study to compare the effects of two dissimilar manual therapy techniques namely neural tissue mobilization and Mulligan's spinal mobilization with limb movement (SMWLM) in patients with L4/L5-L5/S1 lumbar

disc herniation associated with radiculopathy. A pre-test post-test experimental design using random sampling was used on 24 patients between 25-60 years of age. Group A patients received neural mobilization with conventional physiotherapy and group B patients received mulligan's SMWLM in addition to conventional physiotherapy. This study concludes that the neural Tissue mobilization group was statistically better than the spinal mobilization with limb movement (SMWLM) group and hence the magnitude of response in relieving pain, improving functional disability and promoting centralization was better in patients who received neural tissue mobilization. [39]

Sahiba Y, Paresh P et al, 2014, Conducted the study to find out if Mulligan's Spinal Mobilization with Leg Movement technique (SMWLM) in conjunction with conventional treatment is better than conventional treatment alone in improving leg pain intensity (VAS), localization of leg pain (body diagram by Donelson), back specific disability (RMQ) in patients with lumbar radiculopathy (L5/ S1 nerve root) in lumbar disc herniation. The study is a randomized controlled trial performed on 30 patients with lumbar radiculopathy. This study concludes that SMWLM technique in addition to conventional physical therapy produced significant improvement in leg pain intensity, location of pain and back specific disability in patients with lumbar radiculopathy in lumbar disc herniation. [30]

T. Iversen, TK Solberg et al, 2013, conducted the study to investigate the association between findings at clinical examination and nerve root impingement, to evaluate the accuracy of clinical index tests in a specialised care setting, and to see whether imaging clarifies the cause of chronic radicular pain. A total of 116 patients referred with symptoms of lumbar radiculopathy. This study concludes that the tests are not very helpful

in clarifying the cause of radicular pain, and are therefore inaccurate for guidance in the diagnostic workup of the patients. The study population was highly selected and therefore the results from this study should not be generalized to unselected patient populations in primary care nor to even more selected surgical populations. [1]

MS. Danazumi, Bashir B et al, 2021, conducted the study to compare the combined effects of two manual therapy techniques (SMWLM and PINS) with the individual techniques alone (SMWLM or PINS) in the management of individuals with lumbar radiculopathy. A total of 60 patients diagnosed with unilateral lumbar radiculopathy secondary to disc herniation. This study concludes that a combined SMWLM with PINS treatment protocol showed greater improvement than the individual techniques alone in the management of individuals with lumbar radiculopathy in this study. [41]

Thomas FM, Ronald O et al, 2000, conducted the study to determine the effects of lumbar traction with 3 different amounts of force (1 0%, 30% and 60% body weight) on pain-free mobility of the lower extremity as measured by the straight leg raise (SLR) test. 10 subjects with subjective complaints of low back pain or radicular symptoms with a positive unilateral SLR test below 45' participated in this study. This study concludes that traction in this group of patients improved the mobility of the lower extremity during the SLR test. Both 30% and 60% of body weight tractions were shown to be effective for increasing motion beyond pretraction levels. [32]

L. Cavagnaro, M. Basso et al, 2014, conducted the study to summarize and analyze the latest result reporting the use of lumbar traction in LBP treatment in order to evaluate the real effectiveness and indications of this specific physical therapy. 14 studies were

included in the review. This study concludes that the Lumbar traction seems to produce positive results in nerve root compression symptoms. Data in degenerative and discogenic pain are debatable. To date, the use of lumbar traction therapy alone in LBP management is not recommended by the best available evidence. [42]

AA. Harte, GD. Baxter et al, 2003, Conducted the study to assess the efficacy of traction for patients with low back pain (LBP) with or without radiating pain, taking into account the clinical technique or parameters used. RCTs were included if: participants were over the age of 18 years, with LBP with or without radiating pain. The study was conducted in 2 strands. Strand 1 assessed methodological quality using a specific criteria list recommended by the Cochrane Back Review Group. The evidence for the use of traction in LBP remains inconclusive because of the continued lack of methodological rigor and the limited application of clinical parameters as used in clinical practice. Further trials, which give attention to these areas, are needed before any firm conclusions and recommendations may be made. [43]

H. Tanabe, M. Akai, T. Doi et al, 2020, conducted the study to prove the efficacy and safety of traction on CLBP patients, using equipment capable of precise traction force control and of reproducibility of the condition based on the previous biomechanical and pre-clinical studies. 95 patients with non-specific CLBP. This study concludes that lumbar traction was able to improve the pain and functional status immediately in patients with CLBP. This study contributes to add some evidence of the efficacy of lumbar traction. [25]

Anupama T., Ravinder k.m. 2015 conducted the study To assess which of the two methods of manual therapy- Mulligan's Spinal Mobilization With Leg Movements and

Shack lock Neural Tissue Mobilization is more effective in improving low back pain (VAS), radiating limb pain (SLR), lumbar spine stiffness and disability (ODI) in patients with Lumbar Radiculopathy. A Randomized Controlled Trial will be performed on 102 patients with lumbar radiculopathy. This study concludes that Patients treated with Spinal Mobilization with Leg Movement technique produce more significant improvement than those treated with Shack lock Neural Tissue Mobilization in leg pain intensity, lumbar range of motion and back specific disability. [44]

Lee, Raymond YW; Evans, John H 2001 conducted the study to determine the loads acting on the lumbar spine when traction therapy was given in the Fowler's position. The study had two parts: a theoretical analysis which showed that traction produced a flexion moment on the spine as well as axial distraction; and an experimental study which measured the flexion moment induced by the adoption of the Fowler's position. The angle of pull on the traction harness influences the friction between the body and the couch. The relative magnitude and direction of loads produced, and their variation with segmental level should be considered by therapists when choosing a technique for treating low back pain. This study concludes that traction produced flexion of the lumbar spine as well as axial distraction. Adoption of the Fowler's position was found to impose significant flexion moment on the spine. [36]

Tomic S, Butkovic S, Kovac B, Faj D et al, 2009, conducted the study to demonstrate factors which effect appearance and severity of lumbosacral radiculopathy. We analyzed 100 electromyoneurographically examined patients. Patients were categorized on bases of their BMI, sex, age, job type, and chronic diseases. This study concludes that no statistic significance was found in relationship between patients suffering from diabetes mellitus,

arterial hypertension, and hyperlipidemia, and the severity of lumbosacral radiculopathy. Obese patients, males, elderly patients, and patients doing physically intensive jobs are at abigger risk of suffering from severe radiculopathy. Diabetes mellitus, arterial hypertension, and hyperlipidemia do not influence the severity of lumbosacral radiculopathy. [9]

Jensen O, Nielsen C, Stengaard-Pedersen K, 2010, conducted the study to identify clinical and psychosocial risk factors at baseline influencing disability and pain at 1 year in LBP patients sick-listed 3 to 16 weeks, and to look for differences between nonspecific LBP and radiculopathy. 325 patients were followed for 1 year. This study concludes that only in patients with verified nerve root affection, older age, and restrained alcohol seemed to play a role. The multivariate models were insufficient in predicting disability and pain, partly because disability and pain were also strongly associated with return to work. [10]

John T. Farrar, Andrea B. Troxel et al, 2008, conducted a study to assess the validity and reliability and determine clinical importance, of change in a 0-10 NPRS measure of spasticity, a post hoc analysis of a randomized, a double blind, and pacebo-controlled trial. In this study 189 patients were included [114 women, 75 men]. Mean age was 49 years. This study concludes that the measurement of the symptoms of spasticity using a patient rated 0-1O NPRS was found to be both reliable and valid. [45]

Schoenfeld, Andrew J.; Laughlin, Matthew et al, 2012, conducted a study to evaluate the incidence of symptomatic lumbar radiculopathy, and identify risk factors for its

development, among individuals serving in the United States military over a 10-year period. This study concludes that the incidence of lumbar radiculopathy in this young, racially diverse, and physically active population is higher than many other degenerative conditions. In this study female sex and white race increased the risk of developing lumbar radiculopathy. However, increasing age seems to be one of the most significant independent factors for developing this disorder.[46]

Carla V, Alice P. at el, 2020, conducted a study to evaluate the effects of different types of traction added to or compared with conservative treatments on pain and disability. Data were obtained from CENTRAL, PUBMED, CINAHL, Scopus, ISI Web of Science, and PEDro from their inception to April 2020. All randomized controlled trials on adults with LR, using mechanical traction, and without any restriction regarding publication time or language were considered. 8 studies met the inclusion criteria, and 5 were meta-analyzed. . This study concludes that the literature suggests that, for pain and disability in LR, there is short-term effectiveness of supine mechanical traction when added to physical therapist intervention. [47]

Ahmed, M., Anwar, N. at el, 2021, conducted a study to compare the effects of lumbar sustained natural apophyseal glide and Mechanical Traction in patients with discogenic lumbosacral radiculopathy. A total of 44 patients were included in this study in 2 groups of 22 each. This study concludes that Sustained natural apophyseal glide are more effective in the treatment of lumber radiculopathy patients as compared to mechanical traction. Further studies can be carried out to see the combination of these techniques to have better effects. [48]

Ferraz MB, Quaresma MR et al, 1990, conducted a study on reliability of pain 9 scales in the assessment of literate and illiterate patients with rheumatoid arthritis. They evaluated the reliability of 3 pain scales VAS, NPRS and Verbal Rating Scale. Patient with rheumatoid arthritis attended an outpatient rheumatology clinic were interviewed and asked to score their pain levels. Number of patients were 91 (25 illiterate and 66 literate) and study concluded that NPRS has the higher reliability in both groups. [49]

Donald R Murphy; Eric L Hurwitz et al, 2009, conducted a study to describe and discuss the diagnostic utility of the distribution of pain in patients with cervical and lumbar radicular pain. Two hundred twenty-six nerve roots in 169 patients were assessed. This study concludes that in most cases nerve root pain should not be expected to follow along a specific dermatome, and a dermatomal distribution of pain is not a useful historical factor in the diagnosis of radicular pain. The possible exception to this is the S1 nerve root, in which the pain does commonly follow the S_1 dermatome. [2]

Kumari, A., Quddus, N. at el, 2021, conducted a study to compare the effects of three traction forces on the straight leg raise (SLR) test and LBP intensity. A total of 45 participants were recruited for the study. Participants were divided into groups A, B, and C wherein traction forces equal to one-fifth, one-third, and one-half of their bodyweight were applied, respectively. SLR ROM and pain were examined before and immediately after the application of traction. This study concludes that all three forces were equally effective in immediately improving SLR ROM in patients suffering from lumbar PIVD; however, pain improvement was observed with one-half of bodyweight only. [24]

Johannsen F et al, 1995, conducted a study on effectiveness of coordination training and endurance training in 40 patients with chronic low back pain. This study concluded that coordination training for patients with chronic low back pain is equally as endurance training in relieving pain, disability and spinal mobility.[50]

Chapter-3
METHODOLOGY

Sample size:

A sample of 30 subjects was selected to take part in the study based on the fulfillment of inclusion and exclusion criteria. The subjects were selected from IIMS&R and hospital in Lucknow.

Inclusion criteria:

- Age-20-50 years of both male and female
- Unilateral radiculopathy
- SLR test – positive
- Mild – Moderate pain scale (NPRS<7)[37]
- Confirmed diagnosis of L4-L5 or L5-S1 and both nerve roots compression

Exclusion criteria-

- Some orthopedic conditions like Rheumatoid arthritis, Ankylosing spondylitis, Paget's disease, Vertebral collapse, Spondylolisthesis, osteoporosis
- Some neurological problems like Hemiparesis / Hemiplesia, Piriformis syndrome, Diabetic neuropathy
- Constitutional symptoms (fever, weight loss, malaise)
- Pathology of hip, knee and Sacroiliac joint
- History of fracture and surgery in the lumbarspine
- Pregnancy
- severe pain (NPRS > 7)[37]
- Red flag such as trauma, cancer, TB spine

Study Design: A Randomized Clinical Trial

VARIABLES:

1. **Dependent:** NPRS (Numeric pain rating scale),

   SLR ROM (Straight leg raise range of motion)

2. **Independent:** Lumbar traction,

   Spinal mobilization with leg movement

TOOLS-

- Traction unit
- Foot stool
- Goniometer- universal full circle
- Weighing machine

OUTCOME MEASURES:

1. **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 [31, 32]. 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 [27- 29]. Some previous studies [29, 30] 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.

2. **<u>NPRS (Numeric pain rating scale):</u>** 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)[33-35]

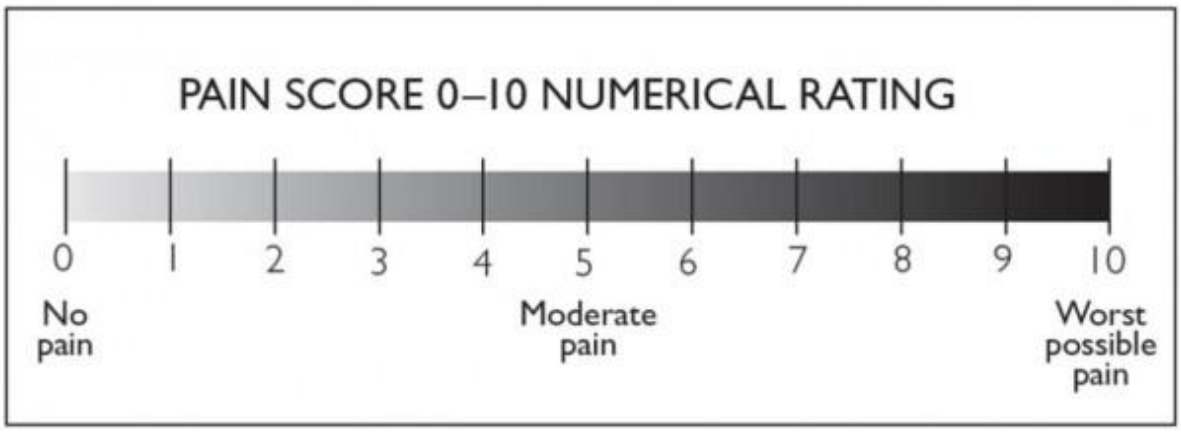


Figure 3.1: Numeric pain rating scale (NPRS)

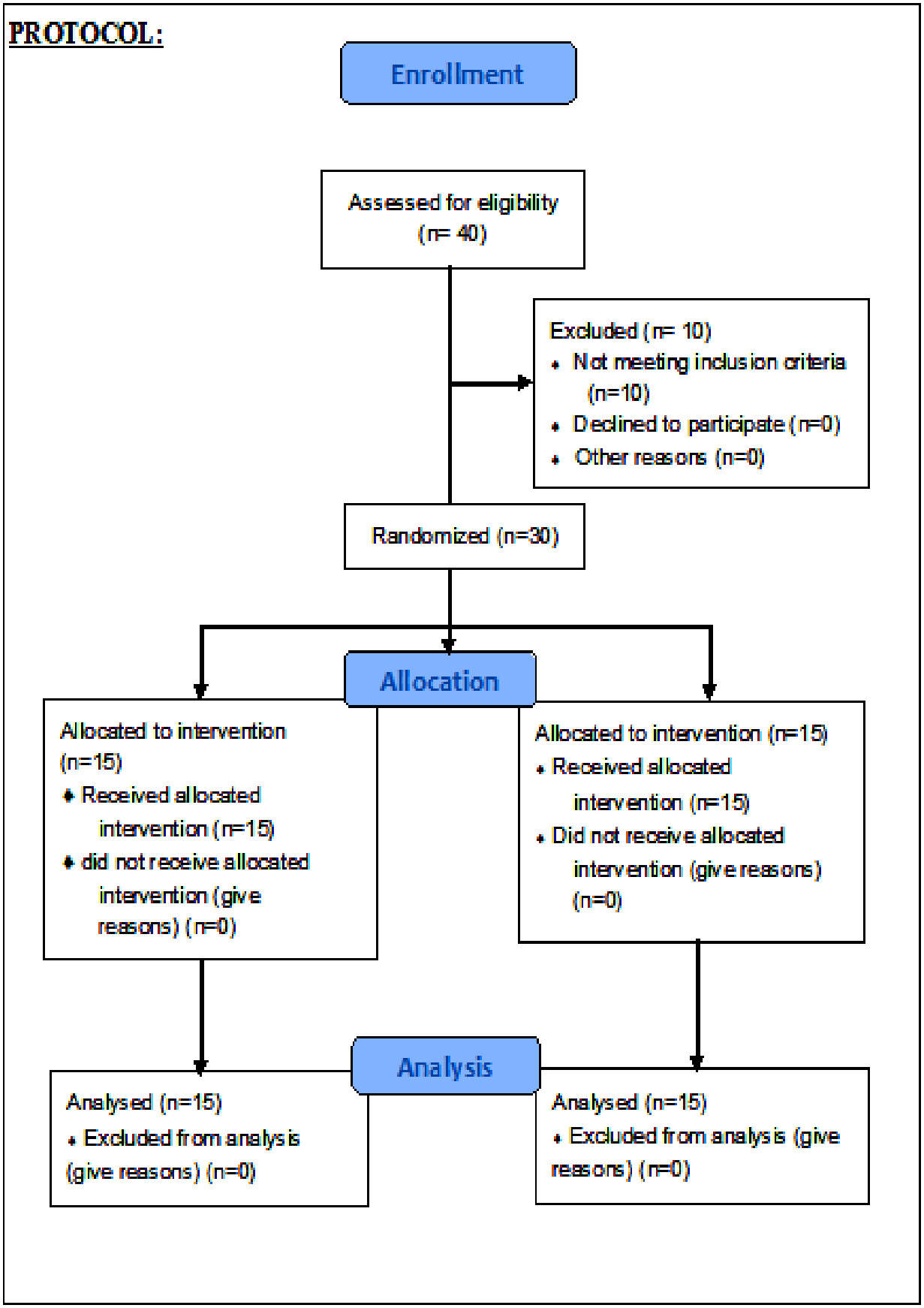


Figure 3.2: Consort flow chart of study

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 [27, 31], 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 [32].

INTERVENTIONS:

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. [36]

Dosage: 10 min × repeated cycles of traction for 30 s and rest for 5 s. Load of traction: 40% of the body weight. [25]

Figure 3.3: Lumbar traction technique.

<u>Group B- spinal mobilization with leg movement (SMWLM) techniques:</u>

SMWLM was performed according to Mulligan's concept [21]. 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, than 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 continues 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 repetition [37]

Figure 3.4: Spinal Mobilization with Leg Movement Techniques.

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 pre test 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%.

Chapter-4

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 ± 8.87 years while mean age of group B 36.4 ± 9.23 was. The mean height of group A was 164.0 ± 10.06 cm 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

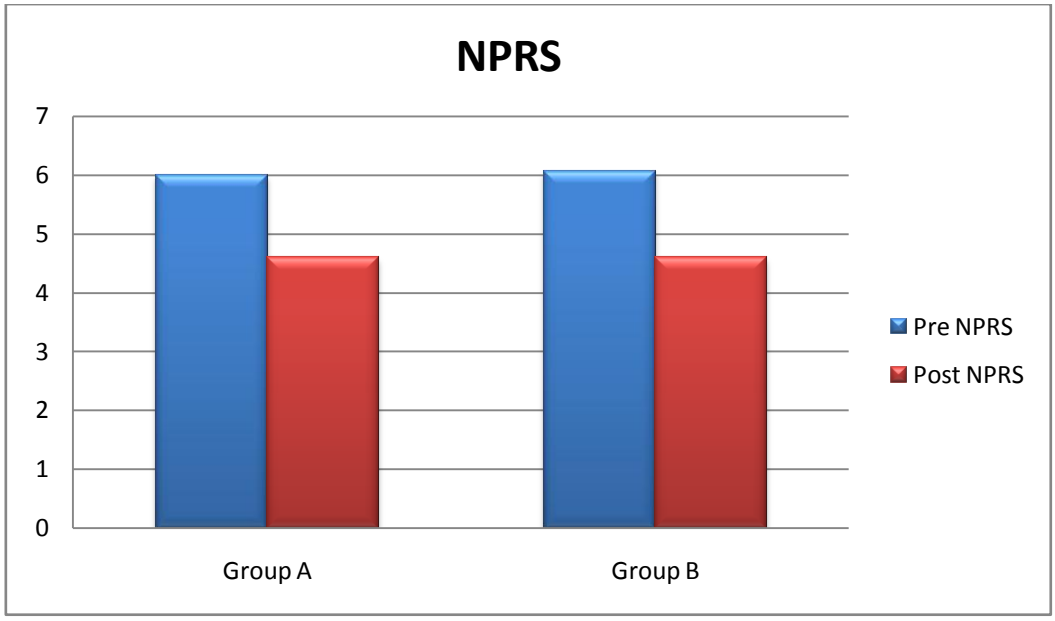
Variables	Group A (Mean ± SD)	Group B (Mean ± SD)
Age (year)	36.73 ± 8.87	36.4 ± 9.23
Weight(kg)	73.6 ± 13.24	70.6 ± 14.55
Height(cm)	164.0 ± 10.06	164.4 ± 7.32
BMI(kg/m2)	27.20 ± 3.85	26.13 ± 5.19

Table 4.2: Within group analysis of group A.

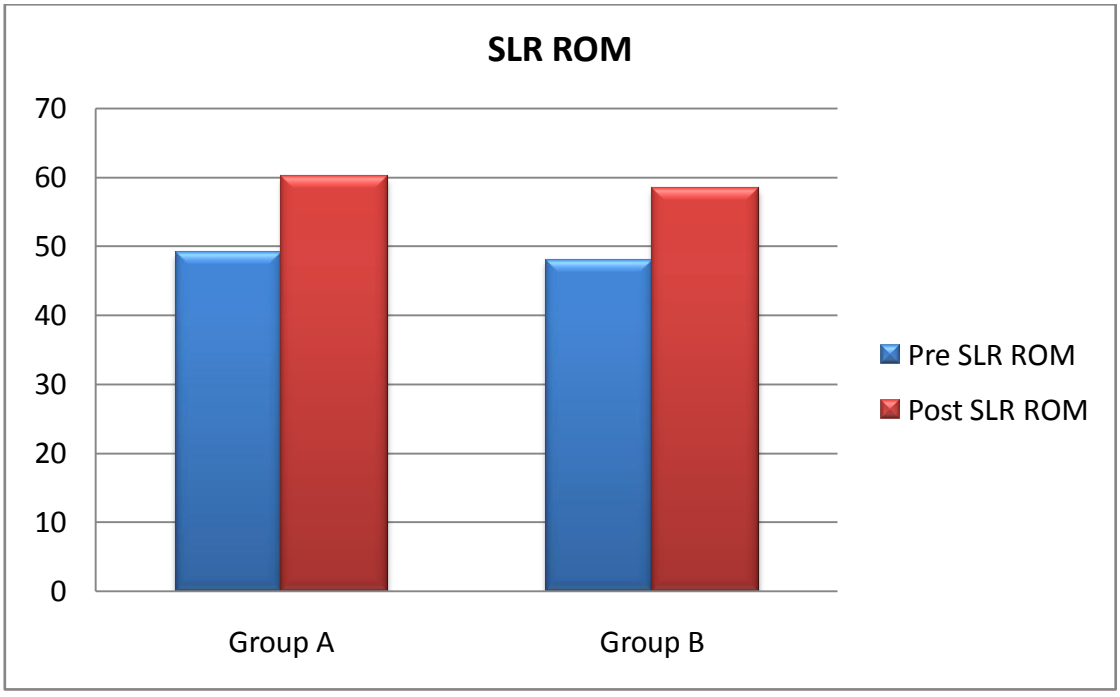
Variables	Pre test (Mean ± SD)	Post test (Mean ± SD)	t-value	p-value
NPRS	6 ± 0.845	4.6 ± 0.985		0.000*
SLRROM	49 ± 4.309	60 ± 4.629	2.144	0.000*

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*



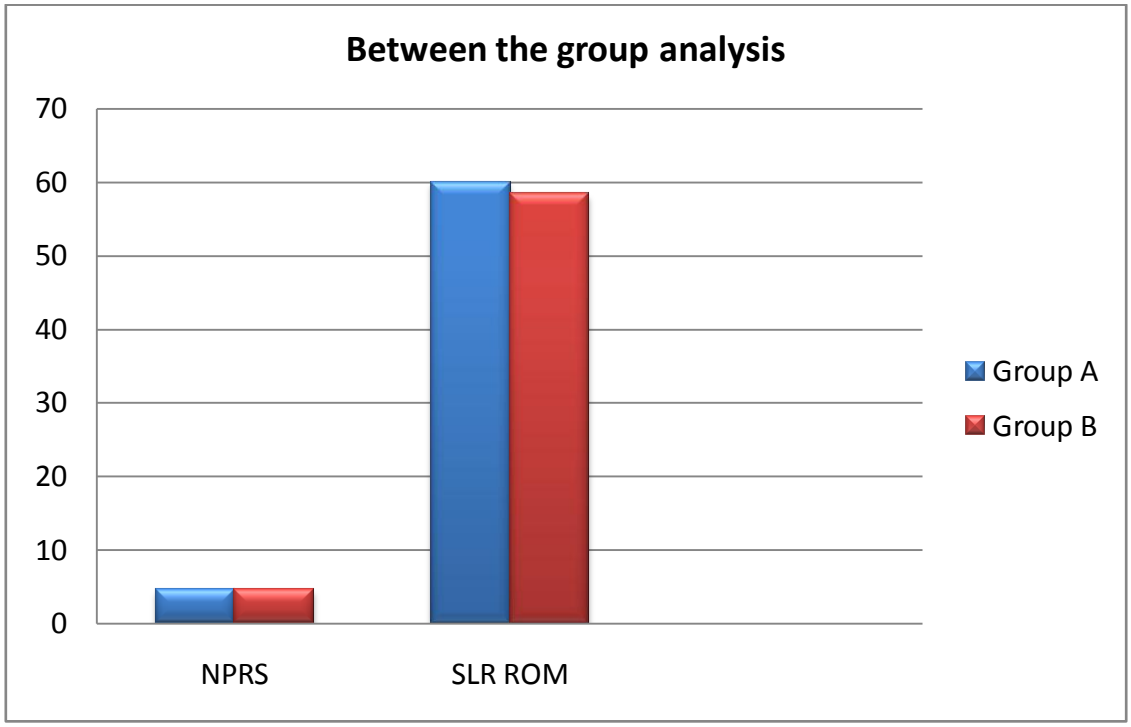
Graph 4.1 Within the group pre test and post test analysis of NPRS of group A and group B.



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

Chapter-5

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[21]. 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. [37]

The SLR is strongly correlated with the severity of leg pain and thus it also showed improvement, because of mechanical compression of nerve root, especially at dorsal root ganglion that was relieved by the rotation produced manually during application of SMWLM technique. [51]

A biomechanical study by Fujiwara et al has showed that axial rotation increases the intervertebral foramen height and area at the side opposite to the rotation[52]. Thus, reinforcing the fact that the space of intervertebral foramen increased by the rotational glide. Hence, pain relief could be explained by restoration of vertebral position and decompression of nerve root by opening the intervertebral position. [51]

Lumbar traction showed significant improvement in pain and SLR range of motion because traction causes the opening of the intervertebral foramen[36] and thus, the pressure on the impinged neural structures is lessened[53]. This may reduce pain. Moreover, traction causes stretching of paraspinal muscles, facet joints, ligaments, and discs[54]. It is hypothesized that mechanoreceptors present in these structures are stimulated because of stretching, which may cause inhibition of pain impulses. It is also proposed that stretching of ligamentous and osseous structures may improve nutrition to local impinged neural and ligamentous structures, thus causing reduced pain transmission. [55, 56]

Fowler's position was chosen for the lumbar traction because the posterior soft collagenous tissues are slack in the neutral position of the lumbar spine[57]. Therefore, if a traction force is applied in a supine lying position (neutral lumbar spine), a considerable force will be spent just to take up that soft tissue slack. However, if Fowler's position is held by the patient, then the lumbar spine will go into flexion, the posterior fibers will be stretched, and thus, the slack will be taken up. Therefore, in Fowler's position, less traction force is required to stretch the posterior tissues. [36]

According to study [25] 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.

LIMITATIONS

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.

RECOMMENDATIONS FOR FUTURE STUDY

Further studies may be done with larger sample size to generalize the results. Long term follow 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.

Chapter-6

Conclusion

This study concludes that both techniques (SMWLM technique and lumbar traction) are able to provide immediate effect in pain and SLR range of motion in lumbar radiculopathy but there is no significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy

Chapter-7

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APPENDICES

Appendix-A

CONSENT FORM

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH
DEPARTMENT OF PHYSIOTHERAPY

CONSENT FORM

S.NO.	Date: -
Name: -	Age/ Gender: -
Fathers/Husbands Name: -	

The details of the study entitled **"Comparison between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumber radiculopathy: A Randomized Clinical Trial"** have been explained to me in my language and

1. I understand the purpose of the study and I have right to withdraw from the study at any point in time during the investigation. I can decline to answer to any particular question if it offends my privacy in any form without losing the right to be treated.
2. I understand that my participation in this study will be kept confidential and is primarily meant for research and for the benefits for the society.
3. I give for consent for my details to be used in this study. I understand that on completion of the study, if I withdraw from the study, my personal report form will be destroyed. I also understand that if there is any problem with any of the examination test or measurement taken, I will be informed and the report will be kept confidential.
4. The risk factors like increase in pain, chance of swelling and redness have been explained to me.
5. I do hereby give my consent voluntarily without any inducement, to take part in this study and I have no objection to the use of data in my publication.

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Signature of Patient Signature of Investigator/Practitioner

For further information, please contact

…….

Department of Physiotherapy

Integral University, Lucknow

Contact no: ……

इंटीग्रल इंस्टिट्यूट ऑफ़ अलाइड हेल्थ साइंसेज एंड रिसर्च

फिजियोथेरेपी का विभाग

इंटीग्रल विश्वविद्यालय

<u>सहमति पत्र</u>

क्र.सं. तारीख : मरीज का नाम: आयु / सेक्स: पिता / पति का नाम:

- **अध्ययन के विवरण "Comparison between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumber radiculopathy: A Randomized Clinical Trial" मेरी भाषा में मुझे समझाया गया है और मैं अध्ययन के उद्देश्य को समझता हूं और जांच के दौरान किसी भी समय अध्ययन से मुझे वापस लेने का अधिकार है।**
- **यदि किसी भी रूप में इलाज के अधिकार को खोए बिना किसी भी रूप में मेरी गोपनीयता को अपमानित करता है तो मैं किसी विशेष प्रश्न का उत्तर देने में अस्वीकार कर सकता हूं।**
- **मैं समझता हूं कि इस अध्ययन में मेरी भागीदारी को गोपनीय रखा जाएगा और मुख्य रूप से अनुसंधान और समाज के लाभों के लिए इस का मतलब है।**
- **मैं इस अध्ययन में अपने विवरणों का उपयोग करने के लिए सहमति देता हूं। मैं समझता हूं कि अध्ययन पूरा होने पर, यदि मैं अध्ययन सेवा पस लेता हूं, तो मेरा व्यक्तिगत रिपोर्ट फॉर्म नष्ट हो जाएगा।**
- **मैं यह भी समझता हूं कि यदि परीक्षा या माप के साथ कोई समस्या है , तो मुझे सूचित किया जाएगा और रिपोर्ट गोपनीय रखी जाएगी।**
- **दर्द में वृद्धि जैसे जोखिम कारक , सूजन और लाली का मौका मुझे समझाया गया है। मैं इस अध्ययन में भाग लेने के लिए , बिना किसी प्रलोभन के स्वेच्छा से अपनी सहमति देता हूं और मुझे अपने प्रकाशन में डेटा के उपयोग पर कोई आपत्ति नहीं है।**

…….. ……

रोगी के हस्ताक्षर जांच कर्ता के हस्ताक्षर

आगे की जानकारी के लिए कृपया संपर्क करें

……

फिजियोथेरेपी विभाग

इंटीग्रल विश्वविद्यालय, लखनऊ

संपर्क संख्या: ……

Appendix-B

DATA COLLECTION PROFORMA

DATA COLLECTION PROFORMA

GROUP A (LUMBAR TRACTION)

Name-

Age-

Sex-

Weight-

Height-

BMI-

Diagnosis-

Duration-

s.no.	Group A	Pre Treatment	Post Treatment
1.	NPRS		
2.	SLR ROM		

DATA COLLECTION PROFORMA

GROUP B (SMWLM)

Name-

Age-

Sex-

Weight-

Height-

BMI-

Diagnosis-

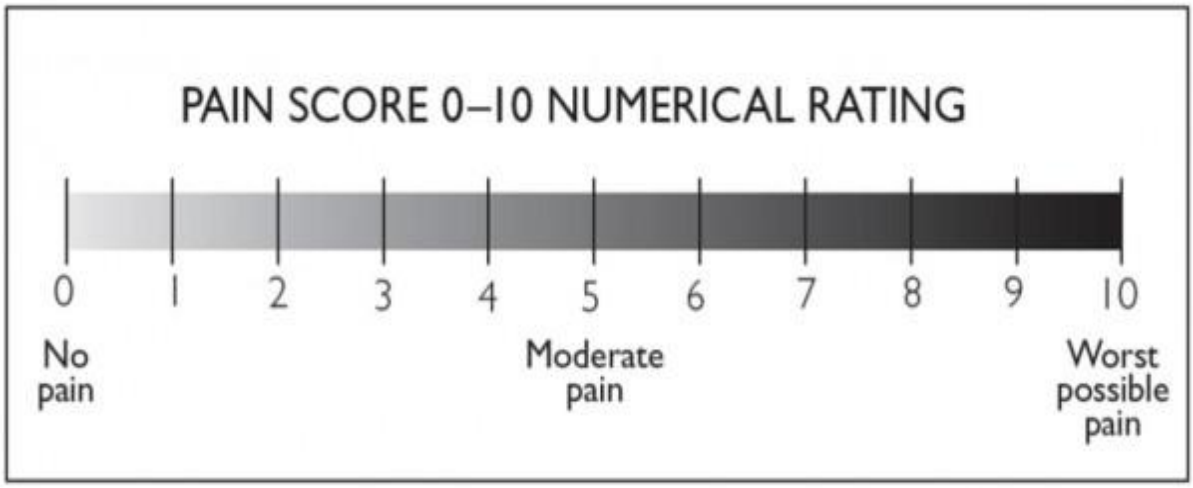
Duration-

s.no.	Group B	Pre Treatment	Post Treatment
1.	NPRS		
2.	SLR ROM		

Appendix-C

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)[33-35]



Appendix-D

MASTER CHART

MASTER CHART

S.NO.	Group	SEX	Age	Weight (kg)	Height (cm)	BMI (kg/m^2)	NPRS 0	NPRS 1	SLR ROM 0	SLR ROM 1
1	A	M	30	80	170	27.7	6	5	50	55
2	A	F	33	75	157	30.4	6	4	50	65
3	A	M	37	77	170	26.6	6	5	50	55
4	A	M	28	74	160	28.9	7	5	55	60
5	A	M	49	90	170	31.1	5	3	50	60
6	A	M	50	78	167	28	7	5	45	55
7	A	F	45	58	157	23.5	6	5	45	60
8	A	M	32	84	185	24.5	6	4	45	65
9	A	M	25	70	160	27.3	7	6	55	70
10	A	F	46	90	160	35.2	6	6	45	55
11	A	F	32	71	154	29.9	4	3	55	65
12	A	M	30	86	182	26	5	3	45	60
13	A	M	44	50	152	21.6	6	5	45	55
14	A	M	45	75	165	27.5	7	5	45	60
15	A	F	25	46	152	19.9	6	5	55	60
16	B	F	35	52	172	17.6	5	5	45	50
17	B	M	50	72	167	25.8	6	5	45	60
18	B	M	38	84	172	28.4	7	6	45	50
19	B	F	48	68	157	27.6	7	5	55	60
20	B	M	29	87	167	31.2	5	4	45	60
21	B	M	29	70	162	26.7	5	4	50	60
22	B	F	25	45	167	16.1	6	3	55	70
23	B	M	27	84	182	25.4	5	3	55	60
24	B	M	41	83	157	33.7	6	5	45	60
25	B	F	26	45	152	19.5	7	5	45	60
26	B	M	27	69	162	26.3	5	4	50	60
27	B	M	38	85	165	31.2	7	6	50	60
28	B	M	50	58	160	22.7	7	5	45	55
29	B	M	35	75	162	28.6	6	4	45	60
30	B	M	48	82	162	31.2	7	5	45	50

Appendix-D

Publishable format

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

Background/Aims: Lumbar radiculopathy is a condition characterized by lower back and hip pain which radiates downward the back of the thigh into the leg. It may be present in one or both lower extremity. This mainly occurs due to compression of spinal nerve roots at the level of L1-S4. The nerve root compression can cause tingling, radiating pain, numbness, occasional shooting pain and paraesthesia. The purpose of this study was to compare immediate effect between spinal mobilization with leg movement (SMWLM) and lumbar traction for management of lumbar radiculopathy.

Methods: 30 patients with lumbar radiculopathy were selected randomly allocated in to two groups, 15 subjects each in group A (Lumbar traction) and group B (SMWLM). The outcomes measures included SLR range of motion using goniometry and pain intensity on NPRS which were assessed at baseline and immediate after single session of lumbar traction and SMWLM.

Results: Paired t-test was done 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 and in group B there was significant improvement in NPRS- pain ($p = 0.000$) and SLR range of motion ($p = 0.000$). 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.

Conclusion: This study concludes that both techniques (SMWLM and Lumbar Traction) are able to provide immediate effect in pain and SLR range of motion in lumbar radiculopathy but there is no statistical significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.

Key Words: Lumbar radiculopathy, spinal mobilization with leg movement, lumbar traction, immediate effect, physical therapy.

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 extremity. 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 paraesthesia.

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 use 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 maltracking 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 disc related 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 on herniated 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 perform 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.

AIM: To compare immediate effect between spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.

OBJECTIVE

- To evaluate the immediate effect of spinal mobilization with leg movement for management of lumber radiculopathy.

- To evaluate the immediate effect of lumbar traction for management of lumber radiculopathy.
- To compare the immediate effect between spinal mobilization with leg movement and lumbar traction for management of lumber radiculopathy.

HYPOTHESIS

- **Experimental hypothesis:** There will be significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.
- **Null hypothesis:** There will be no significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy.

METHODOLOGY

Sample size:

A sample of 30 subjects was selected to take part in the study based on the fulfillment of inclusion and exclusion criteria. The subjects were selected from IIMS&R and hospital in Lucknow.

Inclusion criteria: Age-20-50 years of both male and female, Unilateral radiculopathy, SLR test – positive, Mild – Moderate pain scale (NPRS<7) [17], Confirmed diagnosis of L4-L5 or L5-S1 and both nerve roots compression.

Exclusion criteria: Some orthopedic conditions like Rheumatoid arthritis, Ankylosing spondylitis, Paget's disease, Vertebral collapse, Spondylolisthesis, osteoporosis, Some neurological problems like Hemiparesis / Hemiplesia, Piriformis syndrome, Diabetic neuropathy, Constitutional symptoms (fever, weight loss, malaise), Pathology of hip, knee and Sacroiliac joint, History of fracture and surgery in the lumbarspine, Pregnancy**,** severe pain (NPRS > 7)[17], Red flag such as trauma, cancer, TB spine

Study Design: A Randomized Clinical Trial

VARIABLES: There are two dependent variables i.e. NPRS (Numeric pain rating scale), SLR ROM (Straight leg raise range of motion) and two independent variables i.e. Lumbar traction, Spinal mobilization with leg movement

TOOLS-

- Traction unit
- Foot stool
- Goniometer- universal full circle
- Weighing machine

OUTCOME MEASURES:

3. **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.

4. **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]

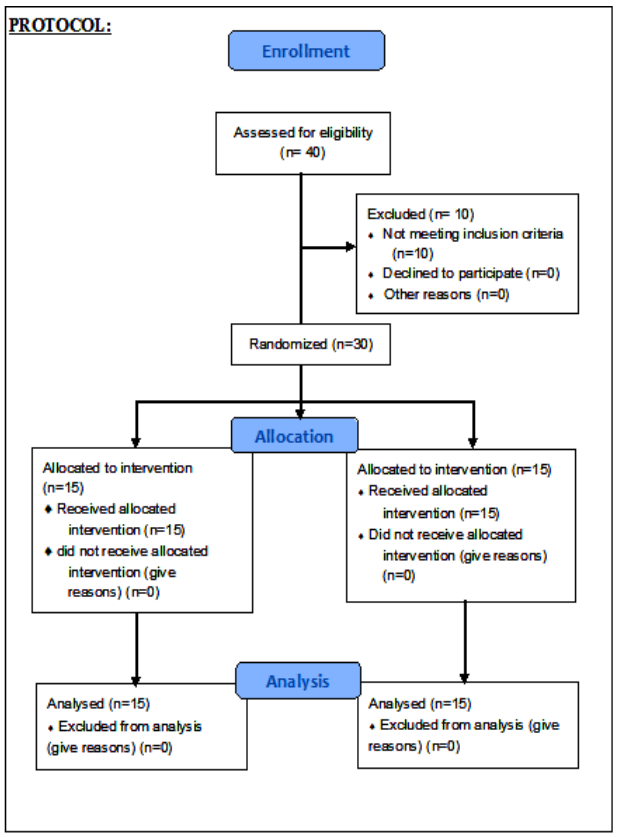


Figure 3.2: Consort flow chart of study

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].

INTERVENTIONS:

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]

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, than 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 continues 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 repetition [17].

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 pre test 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%.

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 ± 8.87 years while mean age of group B 36.4 ± 9.23 was. The mean height of group A was 164.0 ± 10.06 cm 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

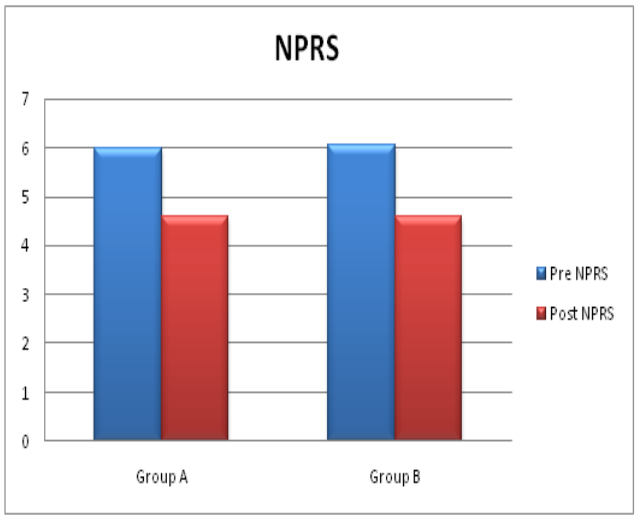
Variables	Group A (Mean ± SD)	Group B (Mean ± SD)
Age (year)	36.73 ± 8.87	36.4 ± 9.23
Weight(kg)	73.6 ± 13.24	70.6 ± 14.55
Height(cm)	164.0 ± 10.06	164.4 ± 7.32
BMI(kg/m2)	27.20 ± 3.85	26.13 ± 5.19

Table 4.2: Within group analysis of group A

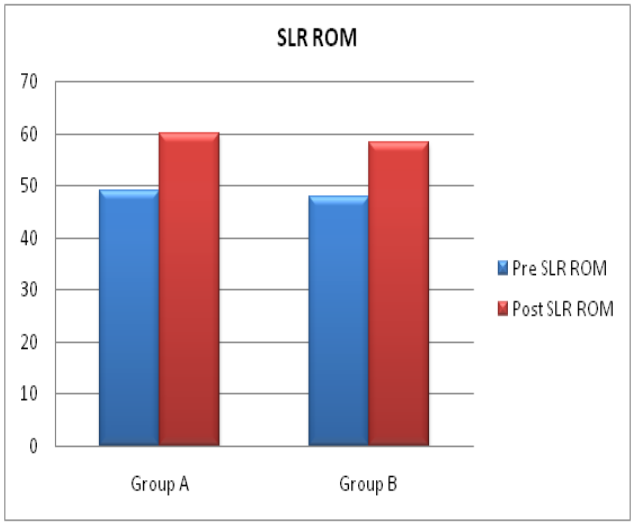
Variables	Pre test (Mean ± SD)	Post test (Mean ± SD)	t-value	p-value
NPRS	6 ± 0.845	4.6 ± 0.985		0.000*
SLRROM	49 ± 4.309	60 ± 4.629	2.144	0.000*

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*



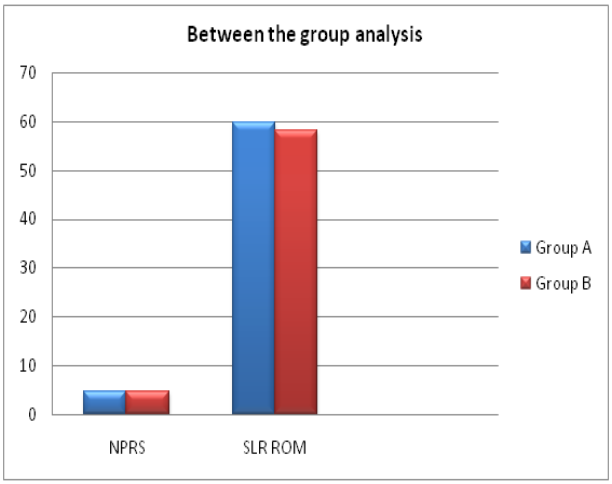
Graph 4.1 Within the group pre test and post test analysis of NPRS of group A and group B.



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

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 SLR is strongly correlated with the severity of leg pain and thus it also showed improvement, because of mechanical compression of nerve root, especially at dorsal root ganglion that was relieved by the rotation produced manually during application of SMWLM technique. [28]

A biomechanical study by Fujiwara et al has showed that axial rotation increases the intervertebral foramen height and area at the side opposite to the rotation [29]. Thus, reinforcing the fact that the space of intervertebral foramen

increased by the rotational glide. Hence, pain relief could be explained by restoration of vertebral position and decompression of nerve root by opening the intervertebral position. [28]

Lumbar traction showed significant improvement in pain and SLR range of motion because traction causes the opening of the intervertebral foramen [27] and thus, the pressure on the impinged neural structures is lessened [30]. This may reduce pain. Moreover, traction causes stretching of paraspinal muscles, facet joints, ligaments, and discs [31]. It is hypothesized that mechanoreceptors present in these structures are stimulated because of stretching, which may cause inhibition of pain impulses. It is also proposed that stretching of ligamentous and osseous structures may improve nutrition to local impinged neural and ligamentous structures, thus causing reduced pain transmission. [32, 33]

Fowler's position was chosen for the lumbar traction because the posterior soft collagenous tissues are slack in the neutral position of the lumbar spine [34]. Therefore, if a traction force is applied in a supine lying position (neutral lumbar spine), a considerable force will be spent just to take up that soft tissue slack. However, if Fowler's position is held by the patient, then the lumbar spine will go into flexion, the posterior fibers will be stretched, and thus, the slack will be taken up. Therefore, in Fowler's position, less traction force is required to stretch the posterior tissues. [27]

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.

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 follow 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.

Conclusion

This study concludes that both techniques (SMWLM technique and lumbar traction) are able to provide immediate effect in pain and SLR range of motion in lumbar radiculopathy but there is no significant difference between immediate effect of spinal mobilization with leg movement and lumbar traction for management of lumbar radiculopathy

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