Effectiveness of Spinal Mobilization with Leg Movement along with Conventional Therapy Versus Thoracic Mobilization with Periscapular Stretching Along with Conventional Therapy on Pain, Range of Motion and Function in Participants with Lumbar Disc Herniation: A Quasi Experimental Study

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Abstract: ***Background**: Lumbar prolapsed intervertebral disc (PIVD), or herniation, among LBP participants is one of the most prevalent musculoskeletal disorders, affecting approximately 10% of the population. Mulligan mobilisation is used routinely in clinical practice for the management of LDH. The Mulligan concept is based on the theory that minor positional faults of articulating joints surfaces following injury or strain result in a painful and restricted, Range of motion (ROM). Thoracic mobilization and periscapular stretching aims to improve the mechanics of facet joints i. e., the mechanical interface which is primarily affected. **Design**: A Quasi Experimental study. **Methodology**: This study included 30 participants with Lumbar disc herniation. All participants were randomly divided into two groups group A(n-15) Spinal mobilization with leg movement along with conventional physical therapy and group B(n-15) Thoracic mobilization with periscapular stretching along with conventional physical therapy. Both groups were treated 5 sessions/week for 4 weeks Statistical analysis was done for scores of NPRS, all lumbar flexion range of motion and functional disability. **Result**: The result shows statistical significance ($p<0.05$) in both the groups but, group A findings were for pain ($p=0.00$) and ROM ($P = 0.000$) And for function ($P = 0.000$), in other side for group B results suggests that For Pain ($P = 0.00$), ROM ($P = 0.007$) and function ($P = 0.001$). **Conclusion**: This study concluded that Spinal mobilization with leg movement along with conventional physical therapy was superior than Thoracic Mobilization with periscapular stretching along with Conventional Physical Therapy on Pain, Range of Motion and functional disability in Participants with Lumbar disc herniation.***

Keywords: Thoracic mobilization, Periscapular stretching, Spinal mobilization with leg movement, Lumbar disc herniation, Low back pain

1. Introduction

Low back pain (LBP) is a broad group of musculoskeletal problems that affects 65–85% of people worldwide.[1,2] Among those with LBP, lumbar prolapsed intervertebral disc (PIVD), or disc herniation is one of the most common disorders, affecting roughly 10% of the population. [3-5] Based on existing studies, the **average prevalence** of lumbar PIVD is about **27.3%**. The **incidence** of a herniated disc is estimated at **5 to 20 cases per 1000 adults per year**, and it is most common in people aged **30 to 50 years**.Men are more frequently affected than women, with a **male-to-female ratio of 3:1**. [3] A **herniated disc** occurs when the soft inner part of the disc, called the **nucleus pulposus**, pushes out through a tear in the outer fibrous ring, called the **annulus fibrosus**. This happens through a series of changes:1. **Nucleus degeneration** – the inner disc material begins to break down 2. **Nucleus displacement** – the nucleus starts to shift from its normal position 3. **Fibrosis stages** – fibrous changes develop in the disc. **Disc herniation** can be classified into four types: **Bulging:** the disc extends beyond the edges of the vertebrae. **Protrusion:** the nucleus presses against the annulus, but the posterior longitudinal ligament remains intact. **Extrusion:** the nucleus escapes through the annulus fibers while the posterior ligament is still intact. **Sequestration:** the nucleus passes through the annular fibers and the posterior ligament is torn, sometimes entering the epidural space.[4,5] In most cases, the herniation occurs on the **postero-lateral side** of the disc. The **common levels** affected are **L4–L5** and **L5–S1**, as these vertebrae carry the majority of body weight. Herniated discs often cause **radiculopathy** due to mechanical compression of nerve roots. [6,7] Pain from a prolapsed disc is often described as **burning or stinging**, and it may radiate down the leg. It usually worsens with **standing, walking, or sitting and** can significantly **limit lumbar motion**, especially **flexion**, making daily activities difficult. The pain is typically **sharp or electric shock-like**.[8,9] The **Mulligan leg raise technique (SMWLM)** is a **painless intervention** that provides immediate relief for people with lumbar disc herniation.[10] When combined with **thoracic mobilisation and periscapular stretching**, which involves **postero-anterior pressure on the upper thoracic vertebrae and stretching of the upper back fascia**, pain may be further reduced, whether or not it radiates into the leg. [11,12] Strong evidence supports the effectiveness of **SMWLM** for reducing pain in lumbar disc herniation. Research also suggests that **upper back fascial stretching** can relieve secondary changes in the upper back, and **spinal mobilization** can improve spinal mobility. Considering the high incidence of **chronic low back pain due to disc herniation**, thoracic mobilization with periscapular stretching appears to be an effective approach.[12,13] However, there is **limited research** specifically comparing **SMWLM and thoracic mobilization with periscapular stretching** in patients with lumbar disc herniation. The **purpose of this study** is to evaluate the effects of both interventions, alongside conventional therapy, on participants with lumbar disc herniation in our local population. The goal is to determine which treatment is more effective and can be applied in clinical practice to **maximize patient benefits**.

Hypothesis:

Null Hyopthesis: H0
Ho1 = There is no statistically significant effect of Spinal mobilization with leg movement along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

Ho2 = There is no statistically significant effect of Thoracic mobilization with periscapular stretching along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

Ho3 = There is no statistically significant difference between Spinal mobilization with leg movement and thoracic mobilization with periscapular stretching along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

Experimental Hyopthesis:H1
H11 = There is statistically significant effect of Spinal mobilization with leg movement along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

H12 = There is statistically significant effect of thoracic mobilization with periscapular stretching along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

H13 = There is statistically significant difference between effect of spinal mobilization with leg movement and thoracic mobilization with periscapular stretching along with conventional therapy on pain, range of motion and functional disability in participants with lumbar disc herniation.

2. Review of Literature

1) **Suharto, Sudaryanto, Tiar Erawan, Muhammad Saleng (2023)** conducted a study "spinal mobilization with leg movement versus traction straight leg raise in low back pain patients due to hernia nucleus pulposus" concluded that "SMWLM and TSLR have a significant effect on improving the range of motion and lumbar function in patients with herniated nucleus pulposus, but SMWLM is more effective than TSLR in increasing range of motion and lumbar function in patients with herniated nucleus pulposus."
2) **Raj Kiran, Patitapaban Mohanty, and Monalisa Pattnaik (2017)** conducted a study "Thoracic mobilisation and periscapular soft tissue manipulations in the management of chronic Prolapsed Intervertebral Disc (PIVD) - An innovative manual therapy approach". Concluded "Stretching of periscapular muscles and fascia of the upper back and mobilization of upper thoracic spine is found to be effective for the management of chronic low back pain due to PIVD."

3. Materials & Methodology

The study employed a **quasi-experimental study design**. A **convenience sampling method** was used to select the **study population**, which consisted of participants diagnosed with lumbar disc herniation. The **sample size** included a total of 30 participants, with 15 in Group A and 15 in Group B. The study was conducted in the **Institutional Musculoskeletal Physiotherapy Outpatient Department (OPD)** over a **study duration of one year**. Each participant underwent a **treatment duration of four weeks**, with sessions scheduled **five days per week**.

The **inclusion criteria** consisted of individuals aged 20–55 years, of either gender, having an NPRS pain score between 3 and 8, with or without radiculopathy, and diagnosed with lumbar disc herniation confirmed by MRI. Participants were also required to have a **positive straight leg raise (SLR) test at less than 60 degrees**.[14.15.16]

The **exclusion criteria** included individuals who were unwilling to participate, those with osteoporosis, pregnancy, spinal tuberculosis, vertebral fractures, a history of previous spinal surgery, spondylolisthesis, lumbar spine tumors, spinal hypermobility, rheumatoid arthritis, mental illness, or those contraindicated for electrotherapeutic modalities such as TENS.[14,15]

The **outcome measures** included pain intensity assessed using the **Numerical Pain Rating Scale (NPRS)** [17], lumbar flexion range of motion (ROM) measured by the **Modified-Modified Schober's Test (MMST**)[18], and functional disability assessed using the **Modified Oswestry Disability Index (MODI)**[19].

4. Intervention

1) Transcutaneous Electrical Nerve Stimulation (TENS)[20]
Participants were positioned in prone lying with their feet placed outside the edge of the treatment table. TENS was applied to the lumbar spine in a resting position for **20 minutes** using a dual-channel portable electrical stimulation unit with two leads and four carbon-cloth electrodes (HMS – INDOTENS 4 channel, Class I). The units were factory-calibrated prior to use. A balanced asymmetrical waveform

was delivered at a frequency of **125 Hz**. The pulse duration varied according to the required intensity and ranged between **16- 360 microseconds**. The output intensity was set between **20- 40 mA**, depending on patient tolerance.

2) Core Stabilization Exercises [21]

Participants performed a series of core-stabilizing exercises as described below:

a) **Isometric Back Exercise (Supine Abdominal Draw-In):** Participants lay supine on a mat with knees flexed and feet flat. They were instructed to draw in their abdominal muscles and press the lower back into the mat. This exercise was repeated 10 times.
b) **Isometric Co-contraction of TrA and Multifidus with Alternate Arm and Leg Raise (Four-Point Kneeling):** In a hands-and-knees position, participants activated their core by gently drawing the navel toward the spine while stabilizing the lumbar region. They then alternately lifted the opposite arm and leg, held the position for 10 seconds, and returned slowly to the starting position. This was repeated 10 times.
c) **Supine Bridging:** Participants lay supine with hips and knees flexed to 90°, feet flat, and arms placed at their sides. After engaging the abdominal muscles, they elevated the pelvis until the trunk aligned with the thighs, held the position for 15 seconds, and slowly returned to the starting position. This was repeated 10 times.
d) **Supine Bridging on Swiss Ball:** Participants lay supine with legs extended and feet placed on a physioball. After activating core muscles, they raised the pelvis until the trunk aligned with the thighs, held for 15 seconds, and slowly lowered. This was repeated 10 times.
e) **Cat and Camel Exercise:** Participants alternated between flexion (Cat) and extension (Camel) of the spine in quadruped position with controlled breathing. This sequence was repeated **10 times.**
f) **Supine Twist:** In supine lying with hips and knees flexed to 90°, participants activated the abdomen and slowly rotated the knees to each side while keeping the pelvis stable. The oblique muscles were engaged to return to the center. This was repeated 10 times on each side.
g) **Isometric Co-contraction of TrA and Multifidus in Sitting on Swiss Ball:** Participants sat upright on a Swiss ball and engaged the TrA and multifidus by drawing the abdomen inward. They then lifted one leg while maintaining pelvic stability, held the position for 10 seconds, and repeated 10 times on each side.
h) **Wall Squat:** Participants stood with their back against the wall, feet shoulder-width apart, and heels approximately 18 inches forward. After tightening the core, they slowly slid into a squat with knees bent to 45-90°, held for a count of five, and rose back up. This was performed 10 times.

Protocol for Group A: Spinal Mobilization with Leg Movement [14,15]

Participants were positioned in side-lying near the edge of the treatment table. Two therapists worked together: **Therapist A** applied continuous transverse gliding over the lumbar spinous process, while **Therapist B** assisted the participant in performing pain-free active limb movements.

The affected leg was supported and slightly abducted (approximately 10°). Therapist A palpated the targeted spinous process using the thumbs and applied a sustained transverse glide toward the floor. Simultaneously, the participant actively performed the straight leg raise (SLR) with assistance from Therapist B to prevent symptom provocation.

For lesions at L4/L5, the L4 vertebra was selected as the point of mobilization. If pain occurred during movement, the participant paused, relaxed for three seconds, and returned to the starting position.

Dosage: Three sets of **7 repetitions**.

Protocol for Group B: Thoracic Mobilization with Periscapular Stretching [15]

Periscapular Stretching

Participants lay supine with the head flexed and supported against the therapist. The therapist stood behind the patient's head and induced rotation and lateral flexion at C1–C4 while applying downward pressure on the superior angle of the scapula using the thenar eminence. Each stretch was held for **30 seconds** and repeated **three times**.

Thoracic Maitland Mobilization

Participants lay prone with the thorax slightly flexed. The therapist applied posteroanterior central glides using the ulnar border of the hand positioned between the pisiform and hook of hamate over the facet joints from **T5–T12**. Grade II and Grade III oscillatory mobilizations were delivered for **30 seconds each**, with a 30-second rest between grades. The mobilization procedure lasted **60 seconds** and was repeated **twice**.

Outcome Measurement

Intensity of Pain (NPRS) [17]:

The intensity of pain was assessed using the numerical pain rating scale (NPRS) ranging from 0-10 points, with higher scores indicating greater pain intensity The 11- point numerical scale ranges from '0' representing "no pain" to 10 representing the "worst pain imaginable". The NPRS was administered graphically for self-completion. Each participant was asked to indicate the numeric value on the segmented scale that best describes their pain intensity Each participant was evaluated before the first session and after the last session NPRS has been validated and determined to be a reliable scale for pain assessment in LDH. The test-retest reliability ® of NPRS was high at 0.90

Lumbar Flexion Rom Modified-Modified Schobers Test [18]:

The examiner put his thumbs on the inferior margin of the participant's PSIS An ink mark was drawn along the midline of the lumbar spine horizontal to the PSIS (lower landmark). While the examiner held the tape firmly against the participant's skin. he marked a second line 15 cm above the original one (high landmark). Then the participant was asked to do an active anterior flexion of the trunk without increasing the pain. The new distance between the lower higher landmarks was then measured. The participant then returned to the neutral position. The difference in the initial distance between the skin markings in the neutral position and the new measurements made in the flexion position was used to indicate the amount of lumbar flexion therapist recorded measurements to the nearest mm. The test-retest reliability ® of MMST was high at 0.90

Functional Disability (MODI) [19]
This MODI is a self-report questionnaire of a participant's perceived disability associated with chronic low back pain. It consisted of a total of 10 items of pain and daily activities. Each section was scored on a 6-point scale (0-5), with 0 representing no limitation and 5 representing maximal limitation. The subscales combined to form a total maximal score of 50. The score was then doubled and interpreted as a percentage of the patient's perceived disability (the higher the score, the greater the disability). The MODI has been validated and determined to be a reliable scale. Interpretation of scale- 0% to 20% minimal disability, 21%-40% moderate disability, 41%-60% severe disability, 61%-80% crippled, 81%-100% patients are either bed-bound or exaggerating their symptoms. The test-retest reliability ® of MODI was high at 0.98

Data Analysis
All data were analyzed by using statistical software SPSS version 26. Before applying statistical tests, data were screened for normal distribution. All the outcome measures were analyzed at baseline and after 4 weeks of the treatment, by using appropriate statistical test. Level of significance was kept at 5%. Change in outcome measures were analyzed within group as well as between groups. Intra group comparison of pre and post treatment scores of Numerical pain rating scale (NPRS) was done by parametric paired T - test and non - parametric Wilcoxon sign rank test for ROM (MMST) and Modified Oswestry disability index (MODI) was done. Inter group comparison of pre and post difference of Numerical pain rating scale (NPRS) was done by Unpaired T- test, ROM and Modified Oswestry disability Index (MODI) was done by using Mann Whitney U test.

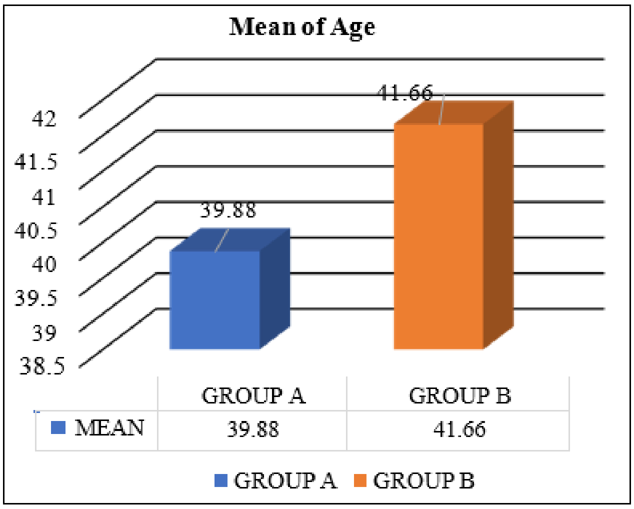
5. Results

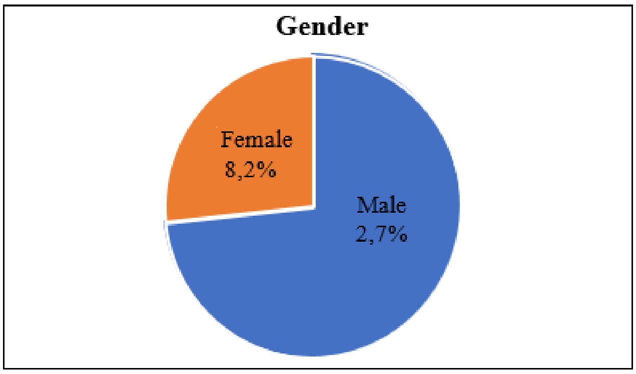
The general characteristics are shown in Table 1. In the preliminary examination among Group A and B , there is no significant differences were observed in the data among the groups, thus making the data homogenous. 3 participants were excluded because they did not meet the experimental standards, and 2 participants were declined to participate, finally statistical analysis was conducted on 30 particpants each in the Group A and Group B.

Table 1: The Baseline Characteristics of Participants

Characteristics	Group A	Group B	P value
Age	39.80 (6.10)	41.66(6.09)	0.409
Gender (male/female)	10/5	12/3	0.064

The values are presented mean (SD)





Graph 1 & 2: Gender and Age Distribution in Group A &B

The above table 1, Graph1& 2 shows the mean age and gender of both the groups. The age & gender of both the groups does not shows any statistical significance difference, providing that the groups are homogenous in terms of age.

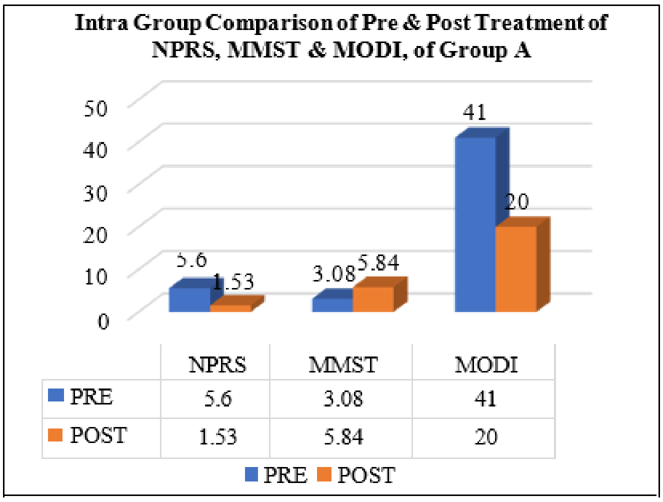
Table 2: Inter Group Comparison of Pre Value of Group A & B

Variables	Group A		Group B		T/Z Value	P Value
	Mean	SD	Mean	SD		
NPRS	5.6	1.63	5.61	1.6	0	1
MMST	3.08	0.73	2.88	0.68	-0.774	0.44
MODI	41	10.35	41.73	8	-0.217	0.83

Table 2 & Graph 3 shows the baseline characteristics of pre-treatment variables of group A & B. Differences in the pre-treatment mean values of both the groups were analysed using a parametric Unpaired T test for NPRS and Non - parametric Man Whitney u Test for Modified Oswestry disability Index (MODI) and Lumbar flexion range of motion (MMST), where the p value of all variable is > 0.05. It shows that there is no statistically significant difference between the pre- treatment score of NPRS, Lumbar flexion ROM (MMST) and MODI between group A & B. Hence, it proves that the pre outcome score of group A & B are homogenous.

Table 3: Mean and Standard Deviation of Values Obtained before and After Treatment for Group A And B with P Values

		Mean	SD	t/Z Value	P Value
NPRS G-A	PRE	5.60	1.63	11.80	0.000
	POST	1.53	0.74		
NPRS G-B	PRE	5.60	1.50	6.97	0.000
	POST	4.33	1.39		
MMST G-A	PRE	3.08	0.73	-3.410	0.000
	POST	5.84	0.32		
MMST G-B	PRE	2.88	0.68	-2.683	0.007
	POST	3.62	0.88		
MODI G-A	PRE	41.00	10.35	-3.440	0.001
	POST	20.00	9.44		
MODI G-B	PRE	41.73	8.00	-3.344	0.001
	POST	33.07	11.08		



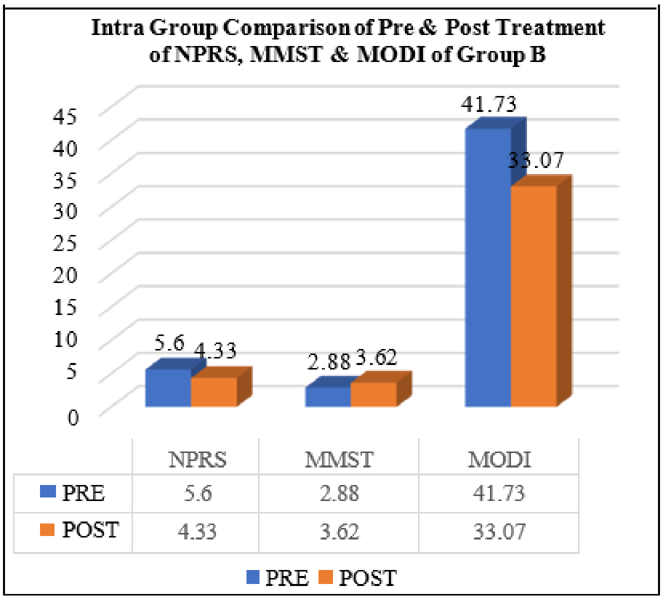
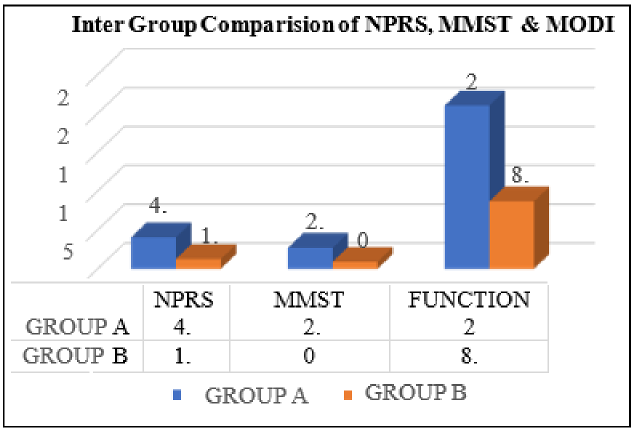


Table 3 & Graph 4 & 5 shows the comparison of pre & post treatment scores of NPRS, ROM and MODI of Group A & B. Differences in the pre and post treatment mean values of group A & B analysed using a parametric Paired T- test and Non - parametric Wilcoxon sign rank test for NPRS, lumbar flexion range of motion and MODI, Where the p value of all variable is <0.05. It shows that there is statistically significant difference between the pre and post treatment score of NPRS, MMST and MODI of group A & B. Hence, the null hypothesis (H_01) & (H_02) is rejected and experimental hypothesis (H_11) & (H_12) is accepted.

Table 4: Post Test Comparison of NPRS ROM and MODI between Group A & B

Variables	Group A		Group B		T/Z Value	P Value
	Mean	SD	Mean	SD		
NPRS	4.0667	1.33	1.2667	0.7	7.188	0
MMST	2.69	0.91	0.9	0.67	-3.41	0.006
MODI	21	6.6	8.66	6.04	-3.189	0



The above table 4 & Graph 6 shows the comparison of mean of difference of post intervention variables of group A & B. Differences in the mean of difference of post intervention values of both the groups were analyzed using a parametric Unpaired T test for NPRS, Lumbar flexion range of motion (MMST) and Modified Oswestry Disability Index (MODI) were analyzed by Non parametric Mann – Whitney U Test where the p value of all variable is < 0.05. It shows that there is statistically significant difference in the improvement between the groups. Hence, the null hypothesis (H_03) is rejected and experimental hypothesis (H_13) is accepted.

6. Discussion

Demographic details and detailed assessment of all participants were taken. Confidence interval was set at 95%. All data were analysed by using SPSS version 26. The result of pre- treatment score of both group at baseline shows p>0.05, which shows there is no statistically significant difference between the pre- treatment score of NPRS, MMST and MODI. Hence it proves that both groups were homogeneous at baseline. The data were taken at baseline and after 4 weeks of treatment. Group A, participants were given SMWLM along with conventional therapy for 4 weeks. After 4 weeks (5 days/week) of intervention, data were analysed by using Paired T- test and result showed statistically significant decrease in pain (p=0.00), a significant improvement in lumbar flexion range of motion using Wilcoxon Sign rank Test (p=0.000) and function (p =0.000) in the post treatment stage in comparison to the pre- treatment stage. Hence, null hypothesis is (Hol) is rejected and experimental hypothesis (H1l) is accepted on findings of current study. 56 Group B participants were given Thoracic mobilization with periscapular stretching along with conventional therapy for 4 weeks. After 4 weeks (5 days/week) of intervention, data were analysed by using Paired T – test and result showed statistically significant decrease in pain (p = 0.00)), a

Wilcoxon Sign rank test shows significant improvement in range of motion (p=0.00)), and function (p = 0.00) in the post treatment stage in comparison on to the pre- treatment stage. Hence null hypothesis (Ho2) is rejected and experimental hypothesis (H12) is accepted on findings of current study. By comparing the difference in outcome in both groups, the result revealed that there was significant difference between the group A and B. The data were analysed for Pain by Unpaired T test and Mann Whitney U test for Lumbar flexion Rom and function. The result showed that there was statistically significant difference in intensity of pain (p=0.000), range of motion (p=0.006) and function (p-0.000). Hence null hypothesis (Ho3) is rejected and experimental hypothesis (H13) is accepted. For pain, range motion and function between two groups. Results of present study showed positive findings with statistically significant ($p< 0.05$) decrease in pain intensity, a significant improvement in range of motion and functions after 4 weeks of intervention in both groups. Group A was more effective for reduced pain intensity, improve range of motion and function in participants with lumbar disc herniation. The findings of the present study indicate that core stabilization exercises combined with conventional physiotherapy are effective in reducing pain and improving functional outcomes in individuals with chronic low back pain associated with lumbar disc pathology. Pain reduction observed in the participants may be attributed to decreased mechanical compression on the nerve roots, which subsequently enabled patients to perform stabilization exercises with better control and tolerance. Core stability, in this context, refers to the ability to maintain control of trunk movements during dynamic functional activities involving the trunk and extremities. While the global muscle system contributes to overall spinal stability by generating compressive forces, its role in controlling segmental shear forces is limited, thereby highlighting the importance of targeted stabilization strategies.

TENS delivered at low frequency is proposed to elevate endogenous opioid levels in the CNS and modulate pain via spinal gating, leading to rapid analgesia by decreasing Aδ and C fiber conduction and producing a peripheral block to nociceptive transmission. The low-frequency pulsed current resembles endogenous bioelectric signals, allowing directional movement of charges that can alter the distribution of impulses and cellular function within the body. Through activation of large-diameter afferents, TENS is thought to close the spinal "gate" to pain, which explains the short onset of relief observed clinically.[21,22,23,24,25,26]

Core stabilization exercises such as supine bridging, cat–camel, wall squats, and TrAMF co contraction in various positions reduce pain partly by unloading the nerve roots and providing a more stable base for spinal motion. These exercises enhance control of trunk motion during dynamic tasks and improve segmental stability, thereby compensating for the limited ability of the global muscle system to control shear forces despite its contribution to compressive stability. Sitting and weight-bearing on specific devices during training may generate intermittent compressive forces that enhance disc nutrition through a pumping mechanism, while also addressing weakness and protective spasms of spinal musculature associated with disc degeneration and prolonged sitting. 27, 28

The SMWLM technique likely corrects small positional faults, reducing mechanical compression on neural structures and promoting centralization of radicular pain. Improvement in SLR and leg pain can be explained by decompression of the nerve root- especially at the dorsal root ganglion—through the rotational component of the mobilization. Biomechanical data suggest that axial rotation increases intervertebral foramen height and area on the side opposite rotation, supporting the rationale that rotational glides restore vertebral alignment, decompress the nerve root, and reduce disc bulging associated with facet hypomobility. [29 30 31] During lumbar rotation, facet joint gapping occurs opposite to the direction of rotation, so SMWLM may also address facet hypomobility and thereby further relieve pain. External forces applied to the motion segment deform the nucleus and annulus, creating alternating tension and approximation in different annular layers, which can reduce abnormal mechanical deformation in injured soft tissues. By modifying these mechanical stresses, rotational mobilizations may favorably influence disc mechanics and annular nociceptor activity, contributing to pain reduction and functional improvement. 10 9 Structurally, torque applied to a lumbar motion segment stretches collagenous structures such as the annular fibers, and reducing their mechanical deformation is expected to diminish nociceptive input. Neurophysiologically, Mulligan's MWM has been associated with immediate hypoalgesia and sympathoexcitation, suggesting activation of descending pain-inhibitory systems and non-opioid endogenous analgesic pathways. These changes resemble responses seen with other spinal manual therapies and support the view that both mechanical correction and central modulation contribute to the clinical effects of SMWLM. [32 33 29] The immediate pain relief observed with Mulligan techniques has been attributed to activation of non-opioid descending inhibitory pathways, likely via PAG-mediated mechanisms as indicated by changes in sympathetic activity. The present work therefore aims to evaluate the effects of sciatic nerve mobilization and SMWLM on chronic sciatica symptoms in chronic low back pain by synthesizing available evidence on these mechanical and neurophysiological mechanisms. Studies by Kiran Satpute and Anupama Thakur report that SMWLM applied over two weeks (six sessions) produces significant improvements in pain, ROM, and function, with benefits maintained on follow-up, suggesting durable effects of this technique. [29,30,31,32] A level 4 case report by **Danazumi and colleagues** showed that combining progressive inhibition of neuromuscular structures with SMWLM and conventional physiotherapy in lumbar disc herniation with radiculopathy led to marked short-term improvement that persisted for up to two years. This supports the use of SMWLM as an adjunct to conventional care for rapid and sustained symptom reduction in disc-related radiculopathy. [33]

In Group B, periscapular muscle stretching, upper back fascial stretching, and thoracic mobilization appear to provide additional pain reduction by influencing fascial nociceptors and autonomic responses. Chronic nociceptive input from sensitized fascial receptors increases sympathetic tone and lowers pain thresholds, whereas targeted stretching may inhibit this sympathetic facilitation and thereby decrease

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perceived pain. Manual therapy-induced mechanical stimuli trigger neurophysiological cascades that produce hypoalgesia in musculoskeletal pain, and patients with chronic pain often show enhanced temporal sensory summation (TSS), a short-lasting expression of central sensitization [34,35] Interventions such as upper thoracic spinal manipulation that reduce TSS may limit or reverse central sensitization and thus prevent progression to persistent pain states. **Bishop et al.** demonstrated that reductions in TSS can occur in both upper and lower limbs following thoracic SMT, possibly mediated by propriospinal neurons linking cervical–thoracic segments to lumbar dorsal horn circuitry. Experimental work by **Sandkühler** and others indicates that propriospinal pathways modulate noxious responses in lumbar dorsal horn neurons, while activation of vanilloid receptors in cervical muscles can increase activity in both cervical and lumbar dorsal horns, providing a plausible mechanism for cervicothoracic Spinal mobilization technique (SMT) -induced hypoalgesia in lumbar distributions. **Myers and Schwind** suggest that stretching can target "stuck layers" of fascia by fixing one layer and moving the adjacent one, generating shear that restores relative motion betw een fascial planes. [36]

In chronic low back pain related to disc pathology, thoracolumbar fascia dysfunction may involve fibrotic muscle changes and loss of elasticity, so improving muscle length and fascial gliding through stretching can help relieve pain and improve spinal flexibility. Stretching of levator scapulae and related structures attached to the thoracolumbar fascia may increase spinal flexibility by reducing stiffness transmitted through these fascial connections.[37,38] Fascial tissue demonstrates lengthening in response to sustained uniaxial stretch, and mechanical stress from stretching may induce a more gel-like, compliant state that increases soft-tissue mobility and lumbar ROM. Enhanced hydration and extensibility of the thoracolumbar fascia through upper back fascial stretching may further augment spinal motion range, while fascial continuity means that stretching periscapular muscles can transmit effects to adjacent fascial and skeletal structures. Increased mobility between thoracic motion segments due to mobilization, combined with stretching of tight tissues, likely explains the superior gains in spinal ROM in the experimental group, consistent with prior studies on spinal mobilization. Normal, pain-free ROM is essential for functional activities of any joint, including the lumbar spine, and disability indices such as MODI reflect the impact of pain and stiffness on daily tasks like lifting, walking, sitting, and working. The observed reduction in MODI scores in both groups can be attributed to decreased pain and improved spinal ROM, which collectively enhance personal care, sleep, social participation, and employment-related activities.[39,40,41]

7. Conclusion

This study concluded that Spinal mobilization with Leg movement along with conventional therapy was superior than Thoracic mobilization with periscapular stretching along with conventional therapy on Pain , Lumbar flexion Range of motion and function in participants with lumbar disc herniation.

Declaration by authors

Ethical Approval: Approved

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References

[1] Satpute K, Hall T, Bisen R, Lokhande P. The effect of spinal mobilization with leg movement in participants with lumbar radiculopathy: a double-blind randomized controlled trial. *Arch Phys Med Rehabil*. 2019;100(5):828–836. doi:10.1016/j.apmr.2018.11.004

[2] Ozturk B, Gunduz OH, Ozoran K, Bostanoglu S. Effect of continuous lumbar traction on the size of herniated disc material in lumbar disc herniation. *Rheumatol Int*. 2006;26(7):622–626. doi:10.1007/s00296-005-0035-x

[3] de Carvalho ME, de Carvalho RM Jr, Marques AP, de Carvalho Lucio LM, de Oliveira AC, Neto OP. Low intensity laser and LED therapies associated with lateral decubitus position and flexion exercises of the lower limbs in participants with lumbar disk herniation: a randomized clinical trial. *Lasers Med Sci*. 2016;31(7):1455–1463. doi:10.1007/s10103-016-2009-5

[4] Berg EJ, Ashurst JV. Anatomy, back, cauda equina. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2022.

[5] Huang YC, Hu Y, Li Z, Luk KDK. Biomaterials for intervertebral disc regeneration: current status and looming challenges. *J Tissue Eng Regen Med*. 2018;12(11):2188–2202. doi:10.1002/term.2750

[6] Phan K, Xu J, Schultz K, Zhang J, et al. Full-endoscopic versus microendoscopic and open discectomy: a systematic review and meta-analysis of outcomes and complications. *Clin Neurol Neurosurg*. 2017; 154: 1–12.

[7] Dutta A, Agarwala V, Daolagupu AK. Outcome of one level instrumented posterior lumbar interbody fusion in indicated cases of prolapsed intervertebral disc. *Int J Orthop Sci*. 2017;3(3):784–788.

[8] Capra F. Validity of the straight-leg raise test for patients with sciatic pain with or without lumbar pain using MRI results. 2011.

[9] Omar S. Accuracy of straight leg raise test in patients with lumbar disc herniation keeping MRI as a reference standard. *Med J*. 2016.

[10] Kuppuswamy S, George JC, Chemmanam M. Prevalence of lumbar disc herniation and disc degeneration in asymptomatic Indian subjects: an MRI-based study. *ISSN: 2395-1958*.

[11] Warude T, Shanmugam S. The effect of McKenzie approach and Mulligan's mobilisation (SNAGs) in lumbar disc prolapse with unilateral radiculopathy. *Int J Sci Res*. 2014; 3: 59–63.
[12] Jensen MP, Fayers P, Haugen D. Studies comparing numerical rating scales and visual analogue scales for assessment of pain intensity in adults: a systematic literature review. *J Pain Symptom Manage*. 2011.
[13] Kuppuswamy S, George JC, Chemmanam M. Prevalence of lumbar disc herniation and disc degeneration in asymptomatic Indian subjects: an MRI-based study. *ISSN: 2395-1958*.
[14] Kim SJ, Jang HY, Lee SM. Effects of spinal mobilization with leg movement and neural mobilization on pain, mobility, and psychosocial functioning of participants with lumbar disc herniation. *Phys Ther Rehabil Sci*. 2023;12(2):92–104.
[15] Raj Kiran, Mohanty P, Pattnaik M. Thoracic mobilisation and periscapular soft tissue manipulations in the management of chronic prolapsed intervertebral disc: an innovative manual therapy approach.
[16] Warude T, Shanmugam S. The effect of McKenzie approach and Mulligan's mobilisation (SNAGs) in lumbar disc prolapse with unilateral radiculopathy. *Int J Sci Res*. 2014; 3: 59–63.
[17] Hjermstad MJ, Fayers PM, Haugen DF. Studies comparing numerical rating scales and visual analogue scales for assessment of pain intensity in adults: a systematic review. *J Pain Symptom Manage*. 2011.
[18] Fritz JM, Cleland J, Childs JD. A comparison of a modified Oswestry Low Back Pain Disability Questionnaire and Quebec Back Pain Disability Scale. *Spine*. 2000;25(11):1343–1349.
[19] Tousignant M, Poulin L, Robert C. The modified-modified Schober test for range of motion: validity and reliability in low back pain. *J Orthop Sports Phys Ther*. 2005;35(6):375–380.
[20] Pop T, Pop V, Popescu R. Effect of TENS on pain relief in patients with degenerative disc disease in the lumbosacral spine. 2010.
[21] Kumar N, Singh R, Yadav A. Comparison of the effectiveness of core strengthening exercise and McKenzie extension exercise on pain and functional disability in lumbar PIVD. 2018.
[22] Melzack R, Wall PD. Pain mechanisms: a new theory. *Science*. 1965;150(3699):971–979.
[23] Sluka KA, Bjordal JM, Marchand S, Rakel BA. What makes transcutaneous electrical nerve stimulation work? *Phys Ther*. 2013;93(10):1397–1402.
[24] Johnson MI. Transcutaneous electrical nerve stimulation (TENS). *Pain Rev*. 1997;4(2):133–149.
[25] DeSantana JM, Walsh DM, Vance C, Rakel BA, Sluka KA. Effectiveness of TENS for pain control: a meta-analysis. *Pain*. 2008;138(3):507–517.
[26] Sjölund BH, Eriksson MBE. Endorphins and analgesia produced by peripheral conditioning stimulation. *Pain*. 1979;7(2):139–155.
[27] Walsh DM, Howe TE, Johnson MI, Sluka KA. Transcutaneous electrical nerve stimulation for acute pain. *Cochrane Database Syst Rev*. 2009;(2):CD006142.
[28] Richardson CA, Jull GA, Hodges PW, Hides JA. *Therapeutic Exercise for Spinal Segmental Stabilization in Low Back Pain*. 2nd ed. Edinburgh: Churchill Livingstone; 2004.
[29] Panjabi MM. The stabilizing system of the spine. Part II: Neutral zone and instability hypothesis. *J Spinal Disord*. 1992;5(4):390–397.
[30] Mulligan BR. *Manual Therapy: NAGS, SNAGS, MWMs etc.* 6th ed. Wellington: Plane View Services; 2010.
[31] Satpute K, Hall T, Bisen R, Lokhande P. The effect of spinal mobilization with leg movement in patients with lumbar radiculopathy. *J Man Manip Ther*. 2015;23(2):80–87.
[32] Thakur A, Kaur J, Singh P. Effectiveness of spinal mobilization with leg movement on pain and disability in lumbar disc herniation. *Int J Physiother Res*. 2016;4(2):1396–1402.
[33] Vicenzino B, Paungmali A, Teys P. Mulligan's mobilization-with-movement, positional faults, and pain relief. *Man Ther*. 2007;12(2):98–108.
[34] Sterling M, Jull G, Wright A. Cervical mobilisation: effects on pain and sympathetic nervous system activity. *Man Ther*. 2001;6(2):72–81.
[35] Danazumi A, Yakasai AM, Ibrahim S. Effects of spinal mobilization with leg movement combined with conventional physiotherapy in lumbar disc herniation with radiculopathy. *J Bodyw Mov Ther*. 2019;23(3):684–689.
[36] Bishop MD, George SZ, Robinson ME. Dynamic tactile acuity and temporal summation in chronic low back pain. *Pain*. 2011;152(1):82–89.
[37] Sandkühler J. Understanding LTP in pain pathways. *Mol Pain*. 2007; 3: 9.
[38] Myers TW, Schwind P. *Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists*. 3rd ed. Edinburgh: Elsevier; 2014.
[39] Schleip R, Klingler W, Lehmann-Horn F. Active fascial contractility. *Med Hypotheses*. 2005;65(2):273–277.
[40] Schleip R, Müller DG. Training principles for fascial connective tissues. *J Bodyw Mov Ther*. 2013;17(1):103–115.
[41] Fairbank JCT, Pynsent PB. The Oswestry Disability Index. *Spine*. 2000;25(22):2940–2952.

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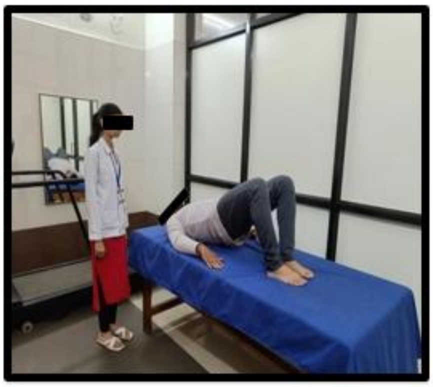
1.Application of Tens Over Lumbar Region

2.Isometric Back Exercise

3.Isometric co- contraction of TrA and MF with alternate arm and leg raise in 4 – point kneeling



4.Supine Bridging

5.Supine Bridging on Swissball

6. Cat and Camel Exercise

7. Isometric Co- Contraction of TRA and Multifidus in Sitting on Swiss Ball

8. Supine Twist

9. Wall Squats