

EFFECTIVENESS OF MULLIGAN SNAGS VS MAITLAND MOBILIZATION IN LUMBAR DISC BULGE: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background:

Lumbar disc bulge is one of the most common causes of low back pain and functional disability worldwide. Manual therapy techniques, particularly Mulligan Sustained Natural Apophyseal Glides (SNAGs) and Maitland mobilization, are frequently used in physiotherapy management. However, comparative evidence regarding their effectiveness in patients with lumbar disc bulge remains limited.

Objective:

To compare the effectiveness of Mulligan SNAGs and Maitland mobilization in reducing pain and disability among patients with lumbar disc bulge.

Methods:

A randomized controlled trial was conducted at the Department of Physical Therapy of a tertiary care hospital between January and June 2025. Sixty patients diagnosed with lumbar disc bulge confirmed by MRI were randomly allocated into two groups (n=30 each). Group A received Mulligan SNAGs along with conventional physiotherapy, while Group B received Maitland mobilization with the same conventional treatment. Interventions were administered three sessions per week for four weeks. Outcome measures included the Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI) for functional disability. Assessments were conducted at baseline and after four weeks of intervention. Data were analyzed using SPSS version 26. Independent and paired t-tests were applied, with significance set at $p < 0.05$.

Results:

Both groups demonstrated significant improvement in pain and disability following the intervention ($p < 0.001$). However, the Mulligan SNAGs group showed greater reduction in VAS scores (mean difference: 4.1 ± 1.2) compared with the Maitland mobilization group (3.2 ± 1.1) ($p = 0.02$). Similarly, ODI scores improved significantly in both groups, with a greater improvement observed in the Mulligan group ($p = 0.03$).

Conclusion:

Both Mulligan SNAGs and Maitland mobilization are effective in reducing pain and disability in patients with lumbar disc bulge. However, Mulligan SNAGs demonstrated superior clinical outcomes compared with Maitland mobilization over a four-week intervention period.

INTRODUCTION

Low back pain (LBP) is among the most common musculoskeletal conditions globally and the major cause of disability, functional impairment, and healthcare expenditure. Low back pain occurs in almost six through eighty percent of the population and is therefore a major issue with regard to the health of the people (1). LBP is one of the leading causes of years lived with disability globally and has a significant negative influence on socioeconomic burden in the form of healthcare expenditure, absenteeism, and work productivity. Epidemiological information suggests that the prevalence of LBP has risen over the last decades because of sedentary life, long sitting, bad ergonomic habits, and decreased levels of physical exercise in contemporary societies(2).

Lumbar intervertebral disc pathology is regarded as one of the most prevalent structural factors in the number of causes of low back pain. A lumbar disc bulge is described as

circumferential distension of the intervertebral disc to exceed the normal margins of the vertebral body with no interference with the annulus fibrosus (3). This condition is usually linked with degenerative changes in the disc, such as the nucleus pulposus becoming dehydrated and annular fibers becoming weaker. Mechanical loading, repetitive spinal movement, aging, and work aspects can increase the rate of degeneration of the disc and cause protrusion of the disc structure (4).

A lumbar disc bulge can cause the compression or irritation of the other neural structures, such as spinal nerve roots, and cause both local and radiating symptoms. The common manifestations seen with the patients include low back pain, radiating pain to the lower extremities, muscle rigidity, limited spinal movements, and functional capacities. Besides physical symptoms, chronic lumbar spine disorders can have an adverse impact on the psychological condition, which leads to the development of anxiety, depression, and diminished quality of life (5).

Radiological investigations have revealed that bulging of the disc is very common in people with chronic low back pain, but it may also occur in sick people who do not show the symptom. Magnetic resonance imaging (MRI) is a frequently applied technique to verify the pathology of the disc and determine the extent of degenerative alterations of the lumbar spine (6). Although there is an improvement in imaging modalities, clinical management of lumbar disc bulges has been mainly based on reduction of symptoms and recovery of functional mobility as opposed to structural correction only (7).

The treatment of patients with lumbar disc bulges with no severe neurological loss or surgical implication is usually the first-line practice of conservative management. Physiotherapy procedures are largely advised in clinical guidelines in the treatment of lumbar spine disorders (8). The objectives of these interventions are to decrease pain,

recover spinal movement, strengthen the muscles, and improve functional performance.

The frequent physiotherapy measures involve therapeutic exercise, stretching, electrotherapy modalities, patient education, and ergonomic and manual therapies (9).

Manual therapy is a treatment whose recognizability and applicability have been on the rise in the treatment of mechanical low back pain and spinal dysfunction. It is a set of expert practical skills used on joints and soft tissues in order to increase range of movement and decrease pain and to normalize neuromuscular activity (10). Manual therapy is thought to have therapeutic effects that are both mechanical and neurophysiological. In mechanical terms, to enhance joint motions and decrease stiffness, mechanisms such as nociceptive input modulation, activation of descending inhibitory pathways, and decrease of muscle guarding may be used to neurophysiologically improve the mechanics of mobilization (11).

The Maitland mobilization technique is one of the most commonly applied forms of manual therapy in the physiotherapy practice. The Maitland concept entails graded passive oscillatory movements of the spinal joints that are administered within a particular range of motion. These mobilizations are grouped into five grades with respect to the amplitude and location in joint range. Reducing pain and muscle spasm is normally done by using lower grades (I and II), but increasing joint mobility and returning to normal patterns of movement are done with higher grades (III and IV). Maitland mobilization is widely applied in the therapy of spinal pain disorders and proved to be effective in clinical results of decreasing pain and enhancing range of movement (12).

One more popular form of therapy in manual therapies is the Mulligan concept, which involves the use of mobilization methods alongside active movement of the patient. Sustained Natural Apophyseal Glide (SNAG) is one of the most important techniques of

this concept. In SNAGs, the therapist provides a continuous accessory spinal facet joint glide, and the patient actively moves his spine. The basic theory of this method is to correct minor positional errors in the joint, which could add to pain and restriction of movement. SNAGs will improve normal biomechanics and enable pain-free movement by employing passive joint sliding and active physiological movement (13).

Past clinical research has indicated that both Maitland mobilization and Mulligan SNAGs can be effectively used to reduce the level of pain and enhance the functional outcomes in patients with mechanical low back pain. Nevertheless, the mechanisms and clinical implications of these practices may vary because they have different treatment strategies. Mulligan SNAGs include the active involvement of the patients and movement correction, which can contribute to the improvement of neuromuscular control and functional transfer. Maitland mobilization, on the contrary, is based on passive oscillatory methods used by the therapist (14).

Although these manual therapy methods are very popular in the practice of physiotherapy, there is a general lack of high-quality evidence that directly contrasts the effectiveness of these techniques in patients with lumbar disc bulges. The majority of the past research addressed nonspecific mechanical low back pain and not disc-related pathology. Considering the mechanical and neurological factors that relate to lumbar disc bulges, it is necessary to determine the most effective manual therapy intervention that can streamline rehabilitation outcomes (15).

Thus, the current randomized controlled trial was done to compare the usefulness of Mulligan Sustained Natural Apophyseal Glides and Maitland mobilization in decreasing the pain and disability in patients diagnosed with lumbar disc bulges. By offering relative evidence as far as the two most frequently used manual therapy techniques are concerned,

the results of this study could help the clinician to choose the best method of intervention that will be effective in achieving better clinical results in patients with lumbar disc pathology.

Methodology

A parallel-group randomized controlled trial (RCT) was conducted to compare the effectiveness of Mulligan Sustained Natural Apophyseal Glides (SNAGs) and Maitland mobilization in patients with lumbar disc bulge. The study design followed the recommendations of the CONSORT (Consolidated Standards of Reporting Trials) guidelines to ensure methodological rigor and transparency.

The study was conducted at the in Yaseen Rehab clinic, Shifa rehabilitation center and Mensa Spine care, Pakistan, over a period of six months from January 2025 to June 2025. Participants were recruited from the outpatient physiotherapy and orthopedic clinics of the institution. Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the respective institution. All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior to participation, written informed consent was obtained from all participants after explaining the purpose, procedures, risks, and benefits of the study.

The sample size was calculated using G*Power software (version 3.1) based on an effect size reported in previous manual therapy studies investigating interventions for low back pain. Considering an effect size of **0.75**, a statistical power of 80%, and a significance level (α) of **0.05**, the minimum required sample size was calculated as **54** participants. To compensate for possible dropouts, the sample size was increased to 60 participants, with 30 participants in each group.

A non-probability purposive sampling technique was used to recruit eligible participants from patients presenting with lumbar disc bulge. After screening for eligibility criteria, participants were randomly allocated into two intervention groups.

Randomization and Allocation Concealment

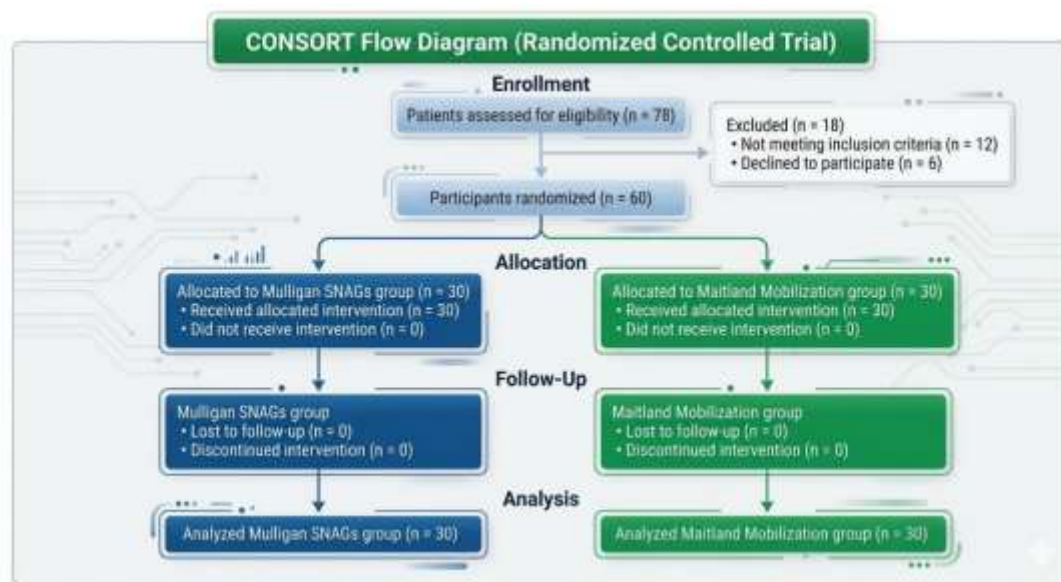
Participants were randomly assigned to either the Mulligan SNAGs group (Group A) or the Maitland mobilization group (Group B) using a computer-generated randomization sequence. Allocation concealment was ensured using sealed opaque envelopes prepared by an independent researcher who was not involved in participant recruitment or assessment.

Due to the nature of manual therapy interventions, blinding of the therapist was not feasible. However, the outcome assessor was blinded to group allocation to minimize assessment bias.

Participants

A total of 60 participants diagnosed with lumbar disc bulge were recruited for the study.

CONSORT FLOW DIAGRAM



Inclusion Criteria

Participants were included if they met the following criteria:

Age between 20 and 50 years

Diagnosed with lumbar disc bulge confirmed by MRI

Presence of chronic low back pain lasting more than 3 months

Pain intensity ≥ 4 on the Visual Analog Scale (VAS)

Ability to understand and follow instructions

Willingness to provide informed consent

Exclusion Criteria

Participants were excluded if they had:

- Previous lumbar spine surgery
- Spinal fractures, tumors, or infections

- Severe neurological deficits
- Spondylolisthesis or spinal instability
- Pregnancy
- Systemic inflammatory conditions such as rheumatoid arthritis
- Current participation in other physiotherapy or rehabilitation programs

Intervention Protocol

Participants were randomly divided into two groups, each receiving different manual therapy techniques along with conventional physiotherapy management.

Group A: Mulligan SNAGs

Participants in Group A received Mulligan Sustained Natural Apophyseal Glides (SNAGs) applied to the lumbar spine.

The intervention procedure included:

- The patient positioned in sitting.
- The therapist applied a sustained anterior-superior glide to the spinous process of the affected lumbar vertebra.
- The glide was maintained while the patient actively performed lumbar flexion or extension movements.
- Each session consisted of 3 sets of 10 repetitions.
- A short rest period of 30–60 seconds was provided between sets.

In addition to SNAGs, participants received conventional physiotherapy, including:

- Hot pack therapy for 15 minutes
- Core stabilization exercises
- Hamstring stretching exercises
- Postural education

Treatment sessions were conducted three times per week for four weeks.

Group B: Maitland Mobilization

Participants in Group B received Maitland posterior–anterior (PA) spinal mobilization applied to the symptomatic lumbar segments.

The intervention procedure included:

- The patient positioned in prone lying.
- The therapist applied central or unilateral posterior–anterior oscillatory mobilizations to the affected lumbar vertebrae.
- Grade III and Grade IV mobilizations were used to improve joint mobility and reduce pain.
- Each mobilization was performed for 60 seconds, with three repetitions per segment.

Participants in this group also received the same conventional physiotherapy program as Group A to ensure treatment consistency.

Treatment sessions were conducted three times per week for four weeks.

Outcome Measures

Outcome measures were assessed at **baseline (pre-treatment)** and after four weeks of intervention (post-treatment) by a blinded assessor.

Primary Outcome Measure

Pain Intensity

Pain intensity was assessed using the Visual Analog Scale (VAS). The VAS is a 10-cm horizontal line ranging from 0 (no pain) to 10 (worst imaginable pain). It is widely used in clinical research and has demonstrated high reliability and validity for measuring pain intensity.³

Secondary Outcome Measure

Functional Disability

Functional disability was measured using the Oswestry Disability Index (ODI), one of the most commonly used outcome measures for assessing disability related to low back pain. The ODI consists of 10 sections, each scored from 0 to 5, with higher scores indicating greater disability. The total score is converted into a percentage, with scores categorized as minimal, moderate, severe disability, or crippled.

Data Collection Procedure

Eligible participants were first screened according to the inclusion and exclusion criteria. Baseline demographic information, including age, gender, and duration of symptoms, was recorded. Participants then underwent baseline assessment using the VAS and ODI scales. After completion of the four-week intervention program, outcome measures were reassessed using the same instruments.

Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 26.

Descriptive statistics including mean, standard deviation, frequency, and percentages were calculated for demographic variables and outcome measures.

- Paired t-tests were used to evaluate within-group differences between pre-treatment and post-treatment scores.
- Independent t-tests were applied to compare the differences between the two groups.
- A p-value < 0.05 was considered statistically significant.

Results

Participant Flow and Retention

A total of 78 patients presenting with symptoms of low back pain were initially screened for eligibility. After applying the inclusion and exclusion criteria, 60 participants with MRI-confirmed lumbar disc bulge met the eligibility criteria and were enrolled in the study. Participants were randomly allocated into two equal groups: Group A (Mulligan SNAGs) and Group B (Maitland Mobilization), with 30 participants in each group. All participants completed the four-week intervention program and attended the scheduled treatment sessions. No dropouts or missing data were reported during the study period; therefore, all 60 participants were included in the final statistical analysis.

Baseline Characteristics

Baseline demographic and clinical characteristics of the participants are presented in Table 1. The mean age of participants in the Mulligan SNAGs group was 38.4 ± 7.2 years, while the Maitland mobilization group had a mean age of 39.1 ± 6.9 years. The distribution of male and female participants was comparable between the two groups. The average duration of symptoms was 7.5 ± 2.3 months in the Mulligan group and 7.8 ± 2.5 months in the Maitland group.

Baseline outcome measures were also similar between the groups. The mean baseline Visual Analog Scale (VAS) score was 7.2 ± 1.1 in the Mulligan SNAGs group and 7.0 ± 1.3 in the Maitland mobilization group. Likewise, the baseline Oswestry Disability Index (ODI) scores were $46.5 \pm 6.4\%$ and $45.8 \pm 5.9\%$, respectively. Statistical analysis indicated no significant differences between the groups at baseline ($p > 0.05$), confirming that the groups were comparable prior to the intervention.

Table 1: Baseline demographic and clinical characteristics of participants

Variable	Mulligan SNAGs (n=30)	Maitland Mobilization (n=30)	p- value
Age (years)	38.4 ± 7.2	39.1 ± 6.9	0.68
Male/Female	17 / 13	16 / 14	0.79
Duration of symptoms (months)	7.5 ± 2.3	7.8 ± 2.5	0.62
Baseline VAS	7.2 ± 1.1	7.0 ± 1.3	0.53
Baseline ODI (%)	46.5 ± 6.4	45.8 ± 5.9	0.67

Values are presented as Mean ± Standard Deviation.

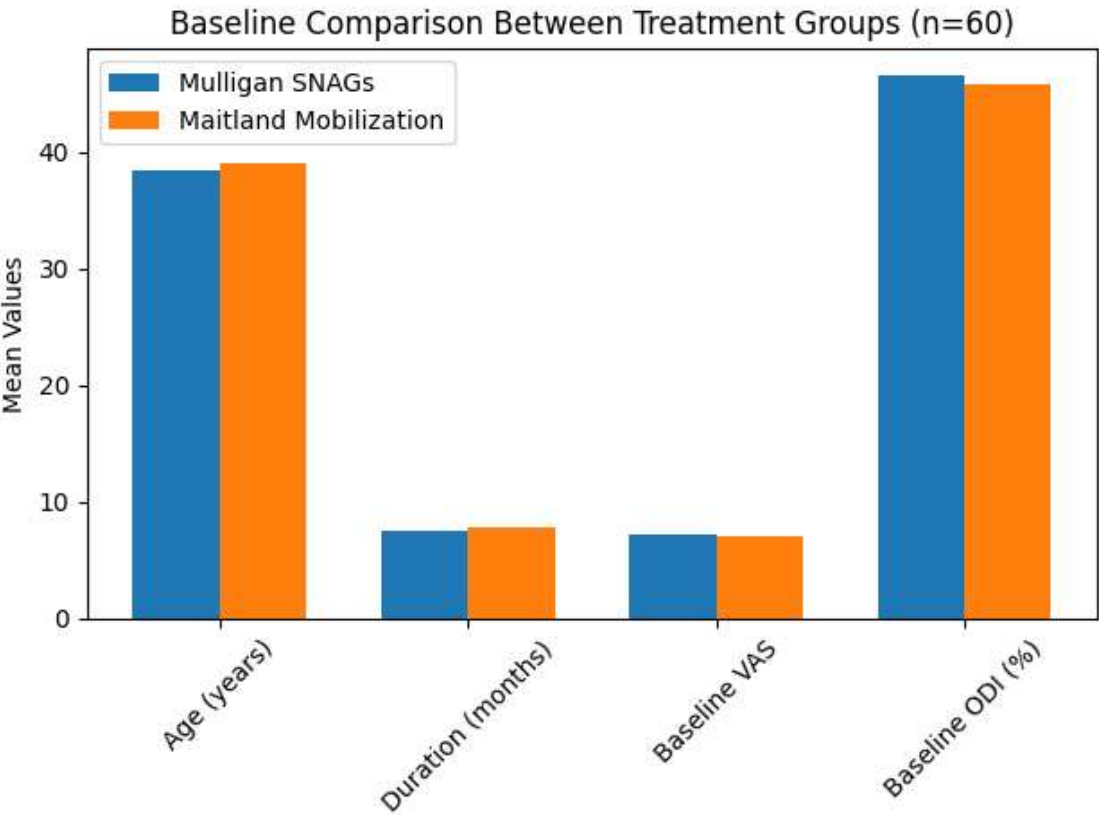


Figure 2: Shows baseline characteristics

Effect of Interventions on Pain Intensity (VAS)

Within-group analysis using paired t-tests demonstrated that both treatment groups experienced significant reductions in pain intensity after four weeks of intervention ($p < 0.001$).

In the Mulligan SNAGs group, the mean VAS score decreased from 7.2 ± 1.1 at baseline to 3.1 ± 0.9 after treatment, representing a mean reduction of 4.1 ± 1.2 points. In contrast, participants in the Maitland mobilization group showed a reduction in VAS scores from 7.0 ± 1.3 to 3.8 ± 1.0 , with a mean decrease of 3.2 ± 1.1 points.

Table 2: Within-group comparison of VAS scores

Group	Pre-treatment	Post-treatment	Mean Difference	p-value
Mulligan SNAGs	7.2 ± 1.1	3.1 ± 0.9	4.1 ± 1.2	<0.001
Maitland Mobilization	7.0 ± 1.3	3.8 ± 1.0	3.2 ± 1.1	<0.001

Between-Group Comparison of Pain Outcomes

Between-group comparison using independent t-tests revealed that the Mulligan SNAGs group achieved significantly greater pain reduction compared with the Maitland mobilization group. The mean post-treatment VAS score was 3.1 ± 0.9 in the Mulligan group compared to 3.8 ± 1.0 in the Maitland group. This difference was statistically significant ($p = 0.02$), indicating that Mulligan SNAGs were more effective in alleviating pain among patients with lumbar disc bulge.

Table 3: Between-group comparison of post-treatment VAS scores

Outcome	Mulligan SNAGs	Maitland Mobilization	p-value
Post-treatment VAS	3.1 ± 0.9	3.8 ± 1.0	0.02

Effect of Interventions on Functional Disability (ODI)

Functional disability assessed using the Oswestry Disability Index (ODI) also demonstrated significant improvement in both groups after the four-week treatment period.

Participants in the Mulligan SNAGs group showed a reduction in ODI scores from $46.5 \pm 6.4\%$ at baseline to $22.3 \pm 5.1\%$ post-treatment, reflecting a mean improvement of 24.2 ± 6.1 percentage points. Similarly, the Maitland mobilization group exhibited a reduction in ODI scores from $45.8 \pm 5.9\%$ to $26.8 \pm 6.2\%$, representing an average improvement of 19.0 ± 5.7 percentage points.

Table 4: Within-group comparison of ODI scores

Group	Pre-treatment (%)	Post-treatment (%)	Mean Difference	p-value
Mulligan SNAGs	46.5 ± 6.4	22.3 ± 5.1	24.2 ± 6.1	<0.001
Maitland Mobilization	45.8 ± 5.9	26.8 ± 6.2	19.0 ± 5.7	<0.001

Between-Group Comparison of Disability Outcomes

Independent t-test analysis comparing post-treatment ODI scores between the groups demonstrated a statistically significant difference favoring the Mulligan SNAGs group ($p = 0.03$). Participants treated with Mulligan SNAGs exhibited lower disability levels at the end of the intervention period compared with those receiving Maitland mobilization.

Table 5 Between-group comparison of post-treatment ODI scores

Outcome	Mulligan SNAGs	Maitland Mobilization	p-value
Post-treatment ODI (%)	22.3 ± 5.1	26.8 ± 6.2	0.03

The results of the present randomized controlled trial demonstrate that both Mulligan SNAGs and Maitland mobilization are effective manual therapy techniques for reducing pain and disability in patients with lumbar disc bulge. However, participants receiving Mulligan SNAGs showed greater improvements in both pain intensity and functional disability compared with those receiving Maitland mobilization. These findings suggest that the integration of Mulligan SNAGs with conventional physiotherapy interventions may provide superior short-term clinical outcomes in the conservative management of lumbar disc pathology.

Discussion

The current randomized controlled trial was planned to compare Mulligan Sustained Natural Apophyseal Glides (SNAGs) and Maitland mobilization as effective interventions to ease pain and level of functional disability in patients with lumbar disc bulges. The results of the present study have shown that both intervention methods resulted in a significant reduction in the pain levels and disability levels four weeks into the treatment. Nevertheless, the results of participants who underwent Mulligan SNAGs had a much higher improvement than those who were exposed to Maitland mobilization. The findings can indicate that although both manual treatment strategies are useful in the conservative treatment of lumbar disc pathology, Mulligan SNAGs might have better short-term clinical results.

Back pain from lumbar disc protrusion is frequently connected to mechanical malfunction of spinal areas, distortion of biomechanics, and neural tissue annoyance. Conservative physiotherapy measures are intended to normalize the joint mechanics, reduce pain, and increase functional mobility. Manual therapies such as spinal mobilization and spinal manipulation are very popular in achieving these therapeutic objectives. Past studies have

demonstrated that manual needle treatment has the potential of modulating pain in the mechanical, neurophysiological, and psychological ways (16, 17, and 18).

In the study under consideration, there was a significant decrease in the scores of the pain in both treatment groups, as assessed by the Visual Analog Scale (VAS). The results of the study are in line with previous studies showing that spinal mobilization methods can be utilized in the treatment of low back pain (19). Maher et al. cited that manual therapy interventions with exercise therapy have significant results on pain reduction and functional outcome in patients with chronic low back pain. 2 Coulter et al., in turn, discovered that mobilization and manipulation techniques have moderate evidence on pain reduction and disability in individuals with chronic spinal disorders (20).

The Mulligan SNAGs group in this case had shown more reduction in pain than the Maitland mobilization group. The possible reason for this observation is the effect of Mulligan techniques, which is not shared by other techniques. SNAGs are the use of a constant accessory movement to the spinal facet joints as the patient actively makes movements in medical practice (21). This kind of passive joint mobilization with active movement has the potential of correcting small positional errors of the joint and can restore normal arthrokinematics. The Mulligan concept suggests that positional errors can be a source of pain and limited movement; thus, the correction of these errors can lead to an immediate reduction in pain and an increase in joint functioning (22).

The other possible reason behind the high results that were achieved with SNAGs is the active patient participation in the treatment process. The active movements to be made when using SNAGs could be a stimulus to the proprioceptive feedback, neuromuscular coordination, and carryover effects of the therapeutic effects (23). Maitland mobilization, on the other hand, incorporates passive oscillatory movements mostly used by the

therapist and can lead to desirable outcomes in terms of the ability to modulate pain and enhance joint mobility but not necessarily the active movement patterns of the patient (24).

This study's findings are in line with other clinical studies that have been conducted on comparing Mulligan and Maitland methods. According to Hidalgo et al. and a study conducted by Satpute et al., Mulligan mobilization methods were found to be more effective than Maitland mobilization in the treatment of subjects with mechanical neck pain (⁶ and ⁷, respectively); this indicates that Mulligan SNAGs could have greater benefits since they are dynamic and involves movements (25).

Besides reduction in pain, the current study also showed notable changes of functional disability measurements of the Oswestry Disability Index (ODI) in both groups. The lumbar disc bulge is a major cause of functional disability, involve which is usually caused by pain and lack of spinal movement and muscle weakness (26). Pain-reduction and joint mobility recovery through physiotherapy intervention can consequently lead to better functional performance and active engagement in daily activities. The increased ODI scores that were found in the Mulligan SNAGs group could indicate that this technique is especially useful in the restoration of a functional pattern of movement and the minimization of activity problems (27).

These gains in both groups can also be credited partially to the traditional physiotherapy treatments given to all the parties, such as the hot pack therapy, stretching exercises, and core stabilization training. It has been well understood that exercise therapy is a fundamental part of any rehabilitation program in case of low back pain. The core stabilization exercises, especially, contribute to the increase of spinal stability, the

supporting muscle strengthening, and the decrease of mechanical load to the lumbar spine (28).

The neurophysiological response to the manual therapy is another potential explanation of the positive effect experienced in the two treatment groups. It has been demonstrated that manual therapy methods stimulate descending inhibitory mechanisms in the central nervous system and result in pain perception decrease. According to Bialosky et al., spinal mobilization has the potential to affect pain processing by various mechanisms, which could include, but are not limited to, dorsal horn modulation, mechanoreceptor stimulation, and the release of endogenous opioids (29).

Clinically, the results of this study underscore the need to use the right methods of manual therapy with patients having lumbar disc bulges. Although both Mulligan SNAGs and Maitland mobilization are well-known treatment methods, the more significant changes in SNAGs allow concluding that this method can be especially useful with regard to patients that have movement-related pain and functional debilitation. Active elements of SNAGs also can contribute to improved incorporation of the effects of the treatment in daily activity and functional tasks (30).

Along with those positive results, there are a number of limitations of the current study. To begin with, the methods used to carry out the study were limited; four weeks were considered as the maximum of the intervention, and no long-term follow-up was carried out. Thus, it is not clear whether the effects of the treatment are sustainable in the long run. Third, because of the specifics of the work of the therapists in the manual therapy used, the therapists could not be blinded, which could raise the possibility of performance bias. Further investigations on the comparative effectiveness of these techniques should

be conducted using bigger multicentric samples, longer follow-ups, and other outcome measures, including range of motion, muscle strength, and quality of life (23).

In general, the results of the current randomized controlled trial can be used to add to the increasing amount of evidence of the use of manual therapy in the treatment of lumbar spine disorders. Its findings show that Mulligan SNAGs and Maitland mobilization are successful when applied to reduce pain and disability in lumbar disc bulge patients, but the former seems to have more significant clinical outcomes. These results could help physiotherapists to choose evidence-based treatment interventions and maximize rehabilitation programs for people with lumbar disc pathology.

Conclusion

The current randomized control trial compared the effectiveness of Mulligan Sustained Natural Apophyseal Glides (SNAGs) and Maitland mobilization among patients with lumbar disc protrusion. The results of this study established that both interventions of manual therapy had a significant effect on the reduction of the frequency of pain and the enhancement of functional ability in four weeks of intervention. The findings are consistent with the potential of manual therapy as a valid conservative treatment modality in the management of lumbar disc pathology in patients.

Participants using Mulligan SNAGs, however, reported much bigger improvements in their pain reduction and functional outcome as compared to the participants who were subjected to Maitland mobilization. These better results could be due to the existence of sustained facet joint gliding along with active physiological movements that could increase the joint biomechanics, neuromuscular coordination, and pain-free movement.

On the whole, the results of this research indicate that both methods are clinically effective, but Mulligan SNAGs can have more therapeutic advantages in the short period of treating

lumbar disc bulges. The application of Mulligan mobilization techniques within the physiotherapy rehabilitation program could thus enhance the patient outcomes and speed up the recovery of the functions.

Clinical Implications

This research has a number of implications for physiotherapy practice and clinical rehabilitation.

To begin with, the results affirm that manual therapy is a viable non-surgical treatment method that can be used on patients with lumbar disc bulges. Manual therapy methods may be used to regain joint motion, decrease pain, and enhance functional performance. Second, the higher efficacy of Mulligan SNAGs identified during the current study implies that therapists can resort to the use of Mulligan methods as a priority in the treatment of the patients exhibiting lumbar disc-related pain, especially when these pain manifestations are related to the restricted movement.

Third, manual therapy in combination with therapeutic exercises, including core stabilization exercises and stretching exercises, seems to be synergistic. These are the reasons why a multimodal physiotherapy approach is important in managing lumbar spine disorders.

Lastly, the possibility of evidence-based manual therapy in reducing the number of invasive treatments and the overall quality of life of lumbar disc bulge patients can be achieved through early intervention in physiotherapy.

Study Limitations

Despite the fact that the results of this research are very useful in terms of identifying the comparative effectiveness between Mulligan SNAGs and Maitland mobilization, a number of limitations must be mentioned.

The sample size was also rather small, but it fit the necessary power calculation. The findings are suggestive that more extensive studies should be undertaken in the future in which more sample sizes can be employed to support the findings.

- Second, the intervention was carried out in four weeks, and no long-term follow-ups were done. Thus, it is not clear whether the effects of the treatment can be sustained in the long term.

Third, it was not possible to blind the therapist who administered the intervention because of the nature of manual therapy techniques, which could raise the possibility of performance bias.

Future studies need to take into consideration multicenter studies involving more participants and extending the follow-up time to explore the long-term effectiveness of these manual therapy procedures in patients with lumbar disc pathology.

Strengths of the Study

This study has a number of strengths despite all its limitations.

The research design was a randomized controlled trial study design, which is regarded as the standard of gold in determining the effectiveness of treatments.

The use of standardized outcome measures, such as the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI), ensured a credible evaluation of the pain and functional disability.

- The two intervention groups were exposed to a standardized treatment protocol, which minimized the differences in the way the treatment was given.
- The research adds to the sparse literature regarding the comparison of Mulligan SNAGs and Maitland mobilization in patients with lumbar disc bulges specifically.

Conflict of Interest

The authors declare no conflict of interest related to this study.

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Author Contributions

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Methodology: Author 1, Author 3

Data Collection: Author 2

Data Analysis: Author 1, Author 3

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Manuscript Review and Editing: All authors

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