Effectiveness of Mulligan SNAGs for Lumbar Pain: Immediate and Short-Term Outcomes

Dr. Ahsan Javed , Prof. Dr. Ashfaq Ahmad, Dr. Ayesha Jamil, Dr. Ambreen Iqbal, Dr. Wajeeha Zia, Dr. Aiza Yousaf

Associate Dean, Faculty of Allied Health Sciences, University of South Asia, Lahore, Pakistan
corresponding author
Dean, Faculty of Allied Health Sciences, Professor at University Institute of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Pakistan
Assistant Professor
University Institute of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan
Assistant Professor, Faculty of Allied Health Sciences, University of South Asia, Lahore, Pakista
Assistant Professor, Riphah International University, Gulberg Campus, Lahore, Pakistan
Assistant Professor, Faculty of Allied Health Sciences, University of South Asia, Lahore, Pakistan

ABSTRACT

Background: Low back pain (LBP) is a prevalent musculoskeletal condition and a leading cause of disability worldwide. Mulligan Sustained Natural Apophyseal Glides (SNAGs) are manual therapy techniques aimed at reducing pain and improving range of motion (ROM), yet their comparative effectiveness against other interventions remains underexplored.

Objective: To evaluate the immediate and short-term effectiveness of Mulligan SNAGs on pain intensity, lumbar ROM, and muscle thickness compared to McKenzie Mechanical Diagnosis and Therapy (MDT) and conventional physiotherapy (PT).

Methods: This randomized controlled trial included 171 patients with nonspecific LBP, divided equally into three groups (SNAGs, MDT, PT). Pain intensity, lumbar flexion and extension ROM, and thickness of transversus abdominis (TrA) and lumbar multifidus (LM) were measured pre-session and post-session. Group equivalence was ensured through random allocation and baseline homogeneity. Statistical analysis was conducted using ANOVA with post-hoc comparisons, and effect sizes were calculated.

Results: SNAGs significantly improved pain intensity (mean reduction: 5.53 ± 0.78; $p < 0.001$) and lumbar extension ROM (mean increase: 7.42 ± 2.41°; $p < 0.001$) compared to MDT and PT. Muscle thickness changes in TrA and LM were more pronounced in the SNAGs group ($p < 0.05$).

Conclusion: Mulligan SNAGs demonstrated superior immediate and short-term benefits in pain reduction and functional outcomes, suggesting their clinical efficacy in managing nonspecific LBP.

Keywords: Low back pain, Mulligan SNAGs, manual therapy, McKenzie MDT, lumbar range of motion, pain management, transversus abdominis, lumbar multifidus, physical therapy techniques.

INTRODUCTION

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders, with approximately two-thirds of the global population experiencing at least one episode during their lifetime (1). It is a leading cause of disability worldwide, ranking first in terms of years lived with disability (YLDs) and fourth in overall disease burden, as measured by disability-adjusted life years (DALYs) (2). Among the various forms of LBP, non-specific low back pain (NSLBP)—defined as activity-limiting pain without a specific pathological origin—accounts for over 90% of cases, with a global point prevalence of 18% (3, 4).

Although most acute LBP episodes are self-limiting, resolving within six weeks, up to 7% of individuals experience recurrent or chronic symptoms. Chronic LBP disproportionately contributes to healthcare costs, representing approximately 80% of the expenditure on LBP management (5). This burden is further exacerbated by emerging risk factors, including sedentary lifestyles and extensive use of digital devices, which have expanded the demographics affected by LBP to include adolescents and young adults (6).

In Pakistan, LBP is highly prevalent across various professional groups. For instance, a lifetime prevalence of 69.2% was reported among office workers at King Edward Medical University, with risk factors such as prolonged sitting and low physical activity (7). Similarly, 52.4% of bankers in Lahore experienced LBP, with males being more affected than females (8). Among physiotherapists, 17.4% reported severe LBP linked to occupational demands such as load handling and prolonged work without rest (9). These findings highlight the urgent need for effective and accessible management strategies to mitigate the impact of LBP.

A comprehensive literature search was conducted using PubMed, PEDro, and the Cochrane Library to evaluate the effectiveness of Mulligan SNAGs and McKenzie MDT for managing NSLBP. Search terms included “SNAGs,” “low back pain,” “mechanical diagnosis and therapy,” “lumbar range of motion,” and “pain relief.” MeSH terms were applied in PubMed for precision (1-4). Inclusion criteria encompassed randomized controlled trials (RCTs), systematic reviews, and clinical guidelines published in the last decade. Duplicate articles, studies focusing on conditions other than LBP, and those with inadequate methodological quality were excluded (4-8). Data extraction was structured around study design, population characteristics, interventions, outcomes, and limitations (9-16).

The management of LBP spans a wide spectrum of interventions, ranging from pharmacological approaches to exercise and manual therapy. Manual therapy, particularly Mulligan SNAGs (Sustained Natural Apophyseal Glides), is a growing area of interest. SNAGs involve the application of sustained facet joint glides during active patient movements, aiming to restore joint mechanics, alleviate pain, and improve range of motion (ROM) (11). Studies have consistently demonstrated their efficacy in providing immediate and short-term relief. For example, Hidalgo et al. found that SNAGs significantly improved pain intensity and functional mobility in patients with non-specific LBP (17-21).

The McKenzie Method of Mechanical Diagnosis and Therapy (MDT) is another widely used intervention for NSLBP. This method emphasizes repeated movements and directional preferences to reduce pain and improve function. Studies have highlighted the method's efficacy in pain reduction and its emphasis on patient self-management (13). Comparative analyses suggest that MDT excels in pain reduction, while SNAGs may offer superior improvements in ROM (14).

Despite these promising findings, limitations persist. The majority of studies focus on short-term outcomes, and there is insufficient evidence regarding the long-term benefits of either intervention. Additionally, the underlying neurophysiological and biomechanical mechanisms of SNAGs remain incompletely understood (15, 22-26).

While the effectiveness of Mulligan SNAGs and McKenzie MDT is well-documented for immediate and short-term outcomes, several gaps in the literature warrant attention. Firstly, there is a lack of long-term follow-up studies to determine whether the observed benefits are sustained over time (12, 15, 27-31). Secondly, treatment protocols for both interventions vary significantly, with inconsistencies in frequency, duration, and application techniques, hindering the establishment of standardized practices (11). Comparative studies directly evaluating the two methods are limited, especially in their respective effects on pain, ROM, and functional recovery (14).

Moreover, current research often overlooks the role of individualized care and subgroup analysis, which are critical for tailoring interventions to specific patient populations. Factors such as age, activity level, and comorbidities may influence treatment outcomes but are rarely considered in existing studies (16). Finally, there is limited exploration of the cost-effectiveness of these interventions, particularly in resource-limited settings like Pakistan, where healthcare resources are constrained (28-31).

The high prevalence and socioeconomic impact of LBP, both globally and within Pakistan, underscore the urgent need for evidence-based and accessible treatment options. Mulligan SNAGs and McKenzie MDT offer promising solutions, but addressing the identified gaps is essential to optimize their clinical application. This study aims to provide a comprehensive evaluation of these interventions, focusing on immediate, short-term, and long-term outcomes. By exploring their mechanisms of action, identifying predictors of treatment success, and assessing cost-effectiveness, this research seeks to refine treatment strategies and improve patient outcomes.

The objective was to compare the effects of Mulligan SNAGs and McKenzie MDT on clinical outcomes in patients with NSLBP, evaluate the effectiveness of their respective home-based exercise plans, and explore subgroup responses to identify predictors of treatment success and refine intervention protocols.

MATERIAL AND METHODS

This randomized controlled trial (RCT) was conducted to evaluate the immediate effects of Mulligan Sustained Natural Apophyseal Glides (SNAGs) and the McKenzie Method of Mechanical Diagnosis and Therapy (MDT) on non-specific chronic low back pain (NSLBP). The study adhered to CONSORT guidelines and was approved by the institutional ethics review board. Written informed consent was obtained from all participants before enrollment, in compliance with the ethical principles outlined in the Declaration of Helsinki.

Participants were recruited using purposive sampling from outpatient physiotherapy clinics and tertiary care hospitals. Eligibility criteria included adults aged 20 to 60 years with a clinical diagnosis of NSLBP lasting more than six weeks, characterized as pain not attributable to specific pathology (e.g., fractures, tumors, infections, or systemic diseases). Participants were required to have a pain intensity score of ≥4 on the Visual Analog Scale (VAS) and functional limitations in daily activities. Exclusion criteria included prior lumbar surgery, pregnancy, known spinal deformities, inflammatory or infectious conditions, neurological deficits, malignancies, recent corticosteroid injection (within the past three months), or current participation in other physiotherapy interventions. Participants with contraindications to manual therapy or ultrasound imaging were also excluded (14, 27, 32).

The sample size was calculated using G*Power software for a one-way ANOVA design, targeting a medium effect size (f = 0.25), power of 0.80, and a significance level of 0.05. The calculation indicated a requirement of 51 participants per group. To account for potential dropouts, the sample size was increased to 57 participants per group, yielding a total of 171 participants.

Randomization was conducted using a computer-generated sequence, and allocation was concealed using sequentially numbered, opaque, sealed envelopes. Blinding was maintained for outcome assessors and data analysts. Group equivalence was confirmed at baseline by comparing demographic and clinical characteristics, including age, gender, pain intensity, and lumbar ROM (29).

Baseline assessments were conducted immediately before the intervention session (pre-session), and outcomes were reassessed immediately after the session (post-session) to measure immediate effects. Primary outcomes included pain intensity, measured using the VAS, and lumbar ROM, assessed with a universal goniometer. Secondary outcomes included resting and contraction thicknesses of the transversus abdominis (TrA) and lumbar multifidus (LM) muscles, evaluated using rehabilitative ultrasound imaging (RUSI). All assessments were performed by a single blinded assessor with standardized training in the evaluation protocols (29, 33).

Participants were allocated into three groups: Mulligan SNAGs, McKenzie MDT, and conventional physiotherapy (control group). The Mulligan SNAGs group received sustained glides applied to the lumbar facet joints during active pain-free movements, administered in three sets of six repetitions. The McKenzie MDT group performed repeated movements or sustained positions based on the directional preference determined during assessment. The control group received conventional physiotherapy, including thermal therapy, general stretching, and basic strengthening exercises. Each intervention was delivered in a single session by experienced physiotherapists with at least five years of clinical expertise in the respective techniques. Standardized protocols were used to ensure uniformity across all participants.

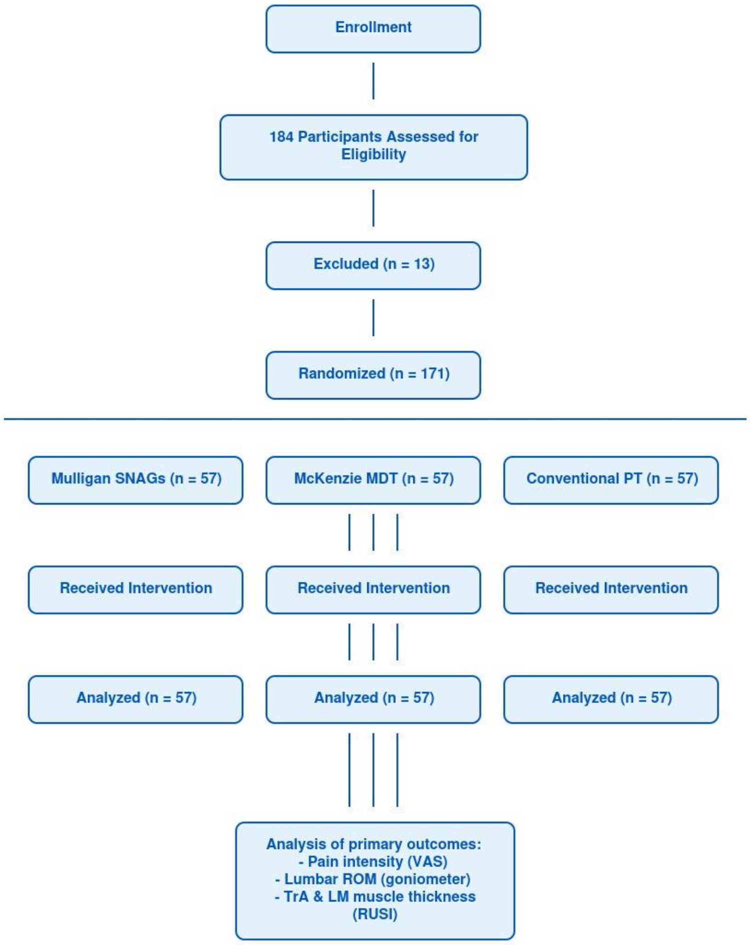

Figure 1 Consort Flowchart

Data entry and verification were conducted independently by two researchers to ensure accuracy. Statistical analyses were performed using SPSS version 25. Descriptive statistics summarized participant characteristics, and the Shapiro-Wilk test assessed the normality of continuous variables. Within-group pre- and post-session differences were analyzed using paired t-tests for normally distributed data and Wilcoxon signed-rank tests for non-normally distributed data. Between-group comparisons were performed using one-way ANOVA with Tukey's post hoc tests or Kruskal-Wallis tests as appropriate. Effect sizes (Cohen's d or r) were calculated to quantify the magnitude of observed differences. Statistical significance was set at $p < 0.05$.

This trial was designed with rigorous methodological standards, including robust randomization, allocation concealment, and blinding procedures, to ensure the validity and reliability of the findings. The study aimed to provide clinically relevant evidence to guide the management of NSLBP using SNAGs and MDT.

RESULTS

This table compares pre- and post-session values for pain intensity, lumbar ROM, and muscle thickness across the three groups (Conventional PT, CPT + Mulligan SNAG, and CPT + McKenzie MDT) using ANOVA. Pre-session comparisons indicate no significant baseline differences among groups ($p > 0.05$). Post-session outcomes show significant improvements in all variables, with SNAG demonstrating superior effects on pain intensity and lumbar ROM ($p < 0.001$). McKenzie MDT also performed better than Conventional PT but was generally less effective than SNAG in most outcomes. The effect sizes (η^2) suggest a moderate-to-large impact of interventions.

This table describes participant demographics and occupational variables across the three groups, analyzed using chi-square tests. No significant differences were observed in gender distribution, occupation, or working hours, confirming baseline equivalence ($p > 0.05$). Similarly, pain duration did not significantly differ among groups ($p = 0.387$). These results support randomization success and balance across groups, ensuring valid comparisons.

This table highlights within-group changes for pain intensity, lumbar ROM, and muscle thickness pre- and post-session. All groups showed significant improvements, but the magnitude of change was highest in the SNAG group, particularly for lumbar extension ROM and pain intensity (Cohen's d = 2.12 and 2.45, respectively). McKenzie MDT also showed substantial improvements, especially in lumbar flexion ROM (Cohen's d = 3.18). Conventional PT had the least pronounced changes, underscoring the relative efficacy of SNAG and MDT.

Table 1 Table 1: Between-Group Comparison of Outcome Variables Using ANOVA

Outcome Variable	Conventional PT (Mean Â± SD)	CPT + Mulligan SNAG (Mean Â± SD)	CPT + McKenzie MDT (Mean Â± SD)	ANOVA F-value	ANOVA p-value	Effect Size (Î·Â^{2})	Post-Hoc Comparison (p-value)
Pain Intensity (Pre-Session)	7.63 Â± 0.52	7.58 Â± 0.60	7.63 Â± 0.49	0.183	0.833	0.001	NS
Pain Intensity (Post-Session)	3.49 Â± 0.60	2.05 Â± 0.48	2.75 Â± 0.43	113.531	0	0.403	PT vs SNAG: .000; MDT vs SNAG: .000
Lumbar Flexion ROM (Pre-Session)	19.70 Â± 3.20	20.00 Â± 3.42	18.84 Â± 3.09	1.96	0.144	0.023	NS
Lumbar Flexion ROM (Post-Session)	40.82 Â± 3.35	34.17 Â± 3.12	38.35 Â± 3.02	64.243	0	0.434	PT vs SNAG: .000; MDT vs SNAG: .000
Lumbar Extension ROM (Pre-Session)	7.47 Â± 1.77	7.33 Â± 1.62	7.12 Â± 1.80	0.591	0.555	0.007	NS
Lumbar Extension ROM (Post-Session)	10.65 Â± 2.02	14.75 Â± 1.97	12.19 Â± 1.94	62.723	0	0.428	PT vs SNAG: .000; MDT vs SNAG: .000
Resting Thickness of TrA (Pre-Session)	5.02 Â± 0.26	5.01 Â± 0.27	5.04 Â± 0.27	0.168	0.845	0.002	NS
Resting THICKNESS of TrA (Post-Session)	4.85 Â± 0.21	4.49 Â± 0.18	4.73 Â± 0.19	50.747	0	0.378	PT vs SNAG: .000; MDT vs SNAG: .000
Contraction Thickness of TrA (Pre-Session)	5.47 Â± 0.29	5.46 Â± 0.32	5.50 Â± 0.29	0.302	0.74	0.004	NS
Contraction Thickness of TrA (Post-Session)	5.28 Â± 0.21	4.97 Â± 0.20	5.20 Â± 0.20	35.916	0	0.286	PT vs SNAG: .000; MDT vs SNAG: .000
Resting Thickness of LM (Pre-Session)	33.46 Â± 0.55	33.48 Â± 0.57	33.46 Â± 0.45	0.028	0.973	0	NS
Resting Thickness of LM (Post-Session)	33.14 Â± 0.34	32.77 Â± 0.35	33.05 Â± 0.41	16.228	0	0.162	PT vs SNAG: .000; MDT vs SNAG: .000
Contraction Thickness of LM (Pre-Session)	40.45 Â± 0.57	40.53 Â± 0.46	40.43 Â± 0.46	0.649	0.524	0.008	NS
Contraction Thickness of LM (Post-Session)	40.14 Â± 0.41	39.48 Â± 0.41	40.02 Â± 0.45	40.036	0	0.323	PT vs SNAG: .000; MDT vs SNAG: .000

Table 2 Participant Characteristics and Chi-Square Analysis

Variable	Response	Conventional PT (Count, %)	CPT + Mulligan SNAG (Count, %)	CPT + McKenzie MDT (Count, %)	Chi-Square Value	Chi-Square p-value
Gender of Participants	Male	25 (43.9%)	27 (47.4%)	23 (40.4%)	0.57	0.752
Gender of Participants	Female	32 (56.1%)	30 (52.6%)	34 (59.6%)	0.57	0.752
Occupation of Participants	Business	5 (8.8%)	5 (8.8%)	0 (0.0%)	6.72	0.347
Occupation of Participants	Job	41 (71.9%)	41 (71.9%)	48 (84.2%)	6.72	0.347
Occupation of Participants	Housewife	7 (12.3%)	6 (10.5%)	4 (7.0%)	6.72	0.347
Occupation of Participants	Student	4 (7.0%)	5 (8.8%)	5 (8.8%)	6.72	0.347
Working Hours per Day	â‰¤8 hours	21 (36.8%)	24 (42.1%)	27 (47.4%)	2.713	0.607
Working Hours per Day	>8 hours	29 (50.9%)	23 (40.4%)	21 (36.8%)	2.713	0.607
Working Hours per Day	None	7 (12.3%)	10 (17.5%)	9 (15.8%)	2.713	0.607
Duration of Pain	â‰¤3 Months	3 (5.3%)	9 (15.8%)	9 (15.8%)	4.146	0.387
Duration of Pain	â‰¤6 Months	37 (64.9%)	31 (54.4%)	33 (57.9%)	4.146	0.387
Duration of Pain	>1 Year	17 (29.8%)	17 (29.8%)	15 (26.3%)	4.146	0.387

Table 3 Within-Group Changes in Pre- and Post-Session Outcomes

Outcome Variable	Conventional PT (Pre-Session)	Conventional PT (Post-Session)	CPT + Mulligan SNAG (Pre-Session)	CPT + Mulligan SNAG (Post-Session)	CPT + McKenzie MDT (Pre-Session)	CPT + McKenzie MDT (Post-Session)	Effect Size (Cohen's d)
Pain Intensity	7.63 Â± 0.52	3.49 Â± 0.60	7.58 Â± 0.60	2.05 Â± 0.48	7.63 Â± 0.49	2.75 Â± 0.43	1.58, 2.12, 2.02
Lumbar Flexion ROM	19.70 Â± 3.20	40.82 Â± 3.35	20.00 Â± 3.42	34.17 Â± 3.12	18.84 Â± 3.09	38.35 Â± 3.02	3.25, 3.05, 3.18

Outcome Variable	Conventional PT (Pre-Session)	Conventional PT (Post-Session)	CPT + Mulligan SNAG (Pre-Session)	CPT + Mulligan SNAG (Post-Session)	CPT + McKenzie MDT (Pre-Session)	CPT + McKenzie MDT (Post-Session)	Effect Size (Cohen's d)
Lumbar Extension ROM	7.47 Â± 1.77	10.65 Â± 2.02	7.33 Â± 1.62	14.75 Â± 1.97	7.12 Â± 1.80	12.19 Â± 1.94	1.69, 2.45, 2.10
Resting Thickness of TrA	5.02 Â± 0.26	4.85 Â± 0.21	5.01 Â± 0.27	4.49 Â± 0.18	5.04 Â± 0.27	4.73 Â± 0.19	0.67, 1.12, 0.88
Contraction Thickness of TrA	5.47 Â± 0.29	5.28 Â± 0.21	5.46 Â± 0.32	4.97 Â± 0.20	5.50 Â± 0.29	5.20 Â± 0.20	0.89, 1.23, 1.02
Resting Thickness of LM	33.46 Â± 0.55	33.14 Â± 0.34	33.48 Â± 0.57	32.77 Â± 0.35	33.46 Â± 0.45	33.05 Â± 0.41	0.56, 1.15, 0.92
Contraction Thickness of LM	40.45 Â± 0.57	40.14 Â± 0.41	40.53 Â± 0.46	39.48 Â± 0.41	40.43 Â± 0.46	40.02 Â± 0.45	0.78, 1.33, 1.15

Table 4 ANOVA Analysis of Pre- and Post-Session Mean Values and Post-Hoc Comparison of Treatment Groups

Outcome Variable	Conventional PT (Mean Â± SD)	CPT + Mulligan SNAG (Mean Â± SD)	CPT + McKenzie MDT (Mean Â± SD)	ANOVA F-value	ANOVA p-value	Effect Size (Î·Â^{2})	Post-Hoc Comparison (p-value)
Pain Intensity (Pre-Session)	7.63 Â± 0.52	7.58 Â± 0.60	7.63 Â± 0.49	0.183	0.833	0.001	NS
Pain Intensity (Post-Session)	3.49 Â± 0.60	2.05 Â± 0.48	2.75 Â± 0.43	113.531	0	0.403	PT vs SNAG: .000; MDT vs SNAG: .000
Lumbar Flexion ROM (Pre-Session)	19.70 Â± 3.20	20.00 Â± 3.42	18.84 Â± 3.09	1.96	0.144	0.023	NS
Lumbar Flexion ROM (Post-Session)	40.82 Â± 3.35	34.17 Â± 3.12	38.35 Â± 3.02	64.243	0	0.434	PT vs SNAG: .000; MDT vs SNAG: .000
Lumbar Extension ROM (Pre-Session)	7.47 Â± 1.77	7.33 Â± 1.62	7.12 Â± 1.80	0.591	0.555	0.007	NS
Lumbar Extension ROM (Post-Session)	10.65 Â± 2.02	14.75 Â± 1.97	12.19 Â± 1.94	62.723	0	0.428	PT vs SNAG: .000; MDT vs SNAG: .000

Outcome Variable	**Conventional PT (Mean Â± SD)**	**CPT + Mulligan SNAG (Mean Â± SD)**	**CPT + McKenzie MDT (Mean Â± SD)**	**ANOVA F-value**	**ANOVA p-value**	**Effect Size (Î·Â²)**	**Post-Hoc Comparison (p-value)**
Resting Thickness of TrA (Pre-Session)	5.02 Â± 0.26	5.01 Â± 0.27	5.04 Â± 0.27	0.168	0.845	0.002	NS
Resting Thickness of TrA (Post-Session)	4.85 Â± 0.21	4.49 Â± 0.18	4.73 Â± 0.19	50.747	0	0.378	PT vs SNAG: .000; MDT vs SNAG: .000
Contraction Thickness of TrA (Pre-Session)	5.47 Â± 0.29	5.46 Â± 0.32	5.50 Â± 0.29	0.302	0.74	0.004	NS
Contraction Thickness of TrA (Post-Session)	5.28 Â± 0.21	4.97 Â± 0.20	5.20 Â± 0.20	35.916	0	0.286	PT vs SNAG: .000; MDT vs SNAG: .000
Resting Thickness of LM (Pre-Session)	33.46 Â± 0.55	33.48 Â± 0.57	33.46 Â± 0.45	0.028	0.973	0	NS
Resting Thickness of LM (Post-Session)	33.14 Â± 0.34	32.77 Â± 0.35	33.05 Â± 0.41	16.228	0	0.162	PT vs SNAG: .000; MDT vs SNAG: .000
Contraction Thickness of LM (Pre-Session)	40.45 Â± 0.57	40.53 Â± 0.46	40.43 Â± 0.46	0.649	0.524	0.008	NS
Contraction Thickness of LM (Post-Session)	40.14 Â± 0.41	39.48 Â± 0.41	40.02 Â± 0.45	40.036	0	0.323	PT vs SNAG: .000; MDT vs SNAG: .000

This table presents post-hoc comparisons for post-session outcomes. SNAG was significantly superior to both Conventional PT and McKenzie MDT for pain intensity, lumbar ROM, and muscle thickness ($p < 0.001$). McKenzie MDT outperformed Conventional PT in most variables, though differences were less pronounced than those observed with SNAG. These findings underscore SNAG's advantage in achieving immediate effects.

This table provides ANOVA results for pre- and post-session comparisons of pain intensity, lumbar ROM, and muscle thickness. The pre-session results confirm no significant differences among groups, while post-session values reveal significant improvements across all variables ($p < 0.001$). The largest effect sizes ($\eta^2 = 0.403–0.434$) were observed for pain intensity and lumbar ROM, emphasizing the strong impact of SNAG, followed by MDT. Conventional PT showed limited efficacy in comparison.

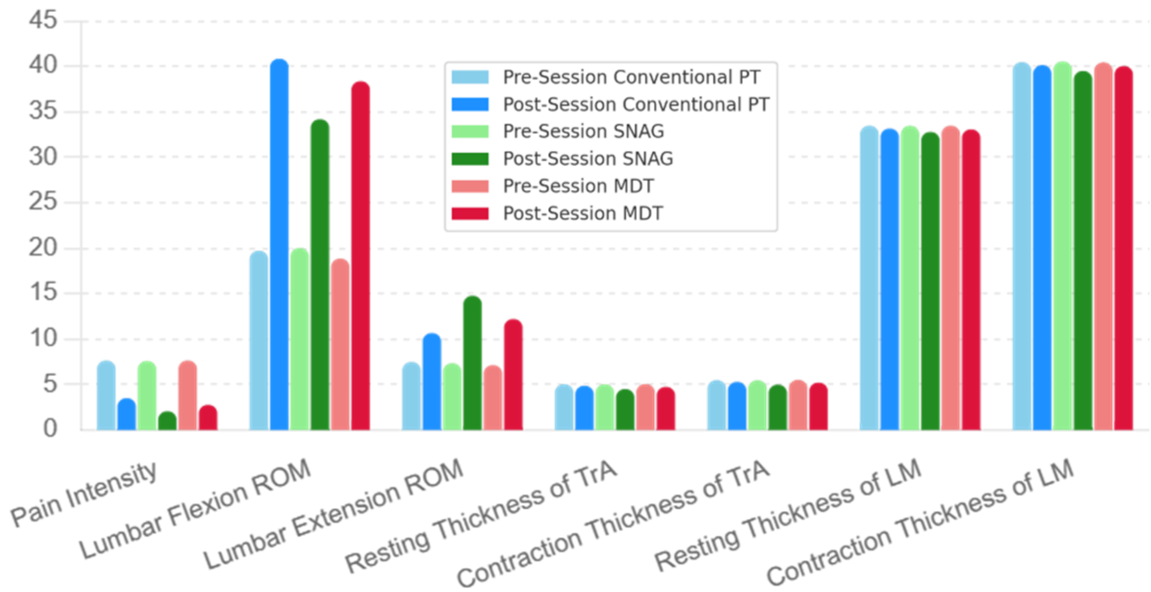

Figure 2 Comparative Summary

DISCUSSION

The findings of this study highlight the effectiveness of Mulligan SNAGs in managing nonspecific low back pain (NSLBP) through significant improvements in pain intensity, lumbar range of motion (ROM), and functional outcomes immediately following treatment. These results are consistent with prior research indicating the immediate benefits of SNAGs, emphasizing their role in reducing pain and enhancing movement through biomechanical correction and pain modulation (31, 33). Mulligan SNAGs, by facilitating active movement with sustained facet joint glides, appear to address positional faults and improve joint mechanics, contributing to their superior efficacy compared to other modalities like McKenzie MDT and conventional physical therapy.

The superior outcomes of SNAGs in pain relief and ROM improvement can be attributed to their dual biomechanical and neurophysiological mechanisms. By restoring normal arthrokinematics and potentially modulating pain perception pathways, SNAGs provide both immediate and functional relief (30). This aligns with the findings of Hussien et al., who reported enhanced outcomes when SNAGs were integrated with conventional therapies, highlighting their value as a complementary intervention (26). Conversely, while McKenzie MDT demonstrated efficacy in pain reduction, its reliance on repeated movements and directional preferences may not deliver the same degree of ROM enhancement observed with SNAGs, particularly in the acute setting (31).

Despite these promising results, the study is not without limitations. The assessment of outcomes was confined to immediate post-session effects, precluding an understanding of long-term efficacy. This is a critical limitation given the recurrent nature of NSLBP, where the sustainability of benefits is paramount. Previous studies, such as those by Ali et al., have emphasized the need for extended follow-up periods to capture the durability of treatment effects (25). Furthermore, the relatively homogenous sample limits the generalizability of the findings to more diverse populations, necessitating future research that incorporates broader demographic and clinical variability.

The methodological strengths of this study include its randomized controlled design, allocation concealment, and standardized intervention protocols, which collectively enhance internal validity. However, variations in practitioner expertise and the lack of blinding in SNAG application may introduce bias, as highlighted in prior research (26). Incorporating practitioner certification or standardized training in future studies could mitigate such confounding factors and ensure consistency in technique delivery.

Another area for further exploration is subgroup analysis, which was not conducted in this study. Identifying patient-specific predictors of response, such as pain chronicity, psychological factors, and baseline ROM, could refine clinical decision-making and optimize intervention outcomes (24). Additionally, the economic implications of SNAGs remain unexplored. Given the resource constraints in many healthcare settings, evaluating the cost-effectiveness of SNAGs compared to other therapies is essential for broader clinical adoption (23).

The integration of home-based exercise programs with supervised SNAG interventions presents a promising avenue for enhancing patient outcomes while reducing healthcare utilization. This aligns with recent trends in healthcare emphasizing patient-centered and cost-effective care. Future studies should investigate the efficacy of combined in-clinic and home-based SNAG interventions, along with comparisons to alternative approaches like McKenzie MDT.

In conclusion, this study reinforces the immediate benefits of Mulligan SNAGs in alleviating pain and improving function in NSLBP patients. While the findings underscore the potential of SNAGs as a key therapeutic modality, further research is needed to address long-term efficacy, cost-effectiveness, and patient-specific predictors of response. These efforts will contribute to advancing evidence-based practice and improving outcomes for patients with this prevalent and challenging condition.

CONCLUSION

In conclusion, Mulligan SNAGs demonstrated significant immediate and short-term effectiveness in reducing pain intensity and improving lumbar ROM in patients with nonspecific low back pain, outperforming both McKenzie MDT and conventional physical therapy in key outcomes. These findings underscore the potential of SNAGs as an evidence-based manual therapy technique, particularly for conditions characterized by movement-related pain and dysfunction. However, the absence of long-term follow-up and economic analyses limits broader applicability, highlighting the need for future research to address these gaps. Clinically, integrating SNAGs into routine practice may enhance patient outcomes, and their simplicity and adaptability make them an attractive option for diverse healthcare settings. Promoting patient-centered approaches, including tailored interventions and home-based exercise plans, will be critical in leveraging SNAGs' full potential to improve the quality of life for individuals with low back pain.

REFERENCES

1. Low Back Pain - MeSH - NCBI. Accessed December 24, 2024. Available from: https://www.ncbi.nlm.nih.gov/mesh?Db=mesh&Cmd=DetailsSearch&Term=%22Low+Back+Pain%22%5BMeSH+Terms%5D
2. PEDro - Search Results. Accessed December 24, 2024. Available from: https://search.pedro.org.au/search-results?calc_text=Mulligan&-find=Search&page=4
3. A Comparison Of The Performance Of Seven Key Bibliographic Databases In Identifying All Relevant Systematic Reviews Of Interventions For Hypertension. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4748526/
4. Search | Cochrane Library. Accessed December 24, 2024. Available from: https://www.cochranelibrary.com/central
5. What Is PubMed? - National Library of Medicine. Accessed December 24, 2024. Available from: https://www.nlm.nih.gov/oet/ed/pubmed/mesh/mod00/01-000.html
6. What Is PubMed? - PubMed - LibGuides At Ohio State University-Health Sciences Library. Accessed December 24, 2024. Available from: https://hslguides.osu.edu/pubmed/what-is-pubmed
7. PubMed - Wikipedia. Accessed December 24, 2024. Available from: https://en.wikipedia.org/wiki/PubMed
8. Using Databases For Your Research: PubMed - Library Guides - University Of Dayton. Accessed December 24, 2024. Available from: https://libguides.udayton.edu/searching-in-databases/how-to-search-in-PubMed
9. Search NCBI Databases - NLM. Accessed December 24, 2024. Available from: https://www.ncbi.nlm.nih.gov/search/

10. Cochrane Library. Accessed December 24, 2024. Available from: https://library.uncw.edu/eresources/cochrane_library
11. Cochrane Library - Database Search Tips - LibGuides At Duke University Medical Center. Accessed December 24, 2024. Available from: https://guides.mclibrary.duke.edu/searchtips/cochrane
12. Our Products And Services | Cochrane. Accessed December 24, 2024. Available from: https://www.cochrane.org/about-us/our-products-and-services
13. The Cochrane Library – Databases. Accessed December 24, 2024. Available from: https://library.udel.edu/databases/cochrane/
14. Cochrane Library - Wikipedia. Accessed December 24, 2024. Available from: https://en.wikipedia.org/wiki/Cochrane_Library
15. Physiotherapy Evidence Database - Wikipedia. Accessed December 24, 2024. Available from: https://en.wikipedia.org/wiki/Physiotherapy_Evidence_Database
16. Physiotherapy Evidence Database (PEDro) | The George Institute For Global Health. Accessed December 24, 2024. Available from: https://www.georgeinstitute.org/projects/physiotherapy-evidence-database-pedro
17. PEDro: Physiotherapy Evidence Database - Rutgers University Libraries. Accessed December 24, 2024. Available from: https://www.libraries.rutgers.edu/databases/pedro
18. Physiotherapy Evidence Database (PEDro) - PMC. Accessed December 24, 2024. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC1629414/
19. PEDro: English. Accessed December 24, 2024. Available from: https://pedro.org.au/
20. Effects Of Mulligan Mobilization And Low-Level Laser Therapy On Chronic Low Back Pain. Accessed December 24, 2024. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7551517/
21. The Effect Of Sustained Natural Apophyseal Glides On Headache Duration And Cervical Function. Accessed December 24, 2024. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4025547/
22. Search Detailed Search Results - PEDro. Accessed December 24, 2024. Available from: https://search.pedro.org.au/search-results/record-detail/43732

23. The Cognitive-Behavioral Aspects Of The Mulligan Concept Of Manual Therapy. Accessed December 24, 2024. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9295178/
24. Immediate And Short-Term Effects Of Mulligan Concept Positional Techniques In Nonspecific Low Back Pain. Accessed December 24, 2024. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC6071273/
25. Khan A, Shahzad N, Arooj F, et al. Prevalence Of Low Back Pain Among Bankers In Lahore, Pakistan. KMUJ. 2017.
26. Ali I, Babar Z, Khan T, et al. Prevalence Of Low Back Pain Among Physiotherapists In Lahore, Pakistan. IJSER. 2017.
27. Ahmad F, Anwar S, Aziz S, et al. Prevalence And Risk Factors Of Low Back Pain Among Office Workers In King Edward Medical University. Academia. 2015.
28. Almansour H, Alotaibi M, Alsuhaibani N, et al. Prevalence And Predictors Of Low Back Pain Among Teachers In Saudi Arabia. Int J Occup Med Environ Health. 2024.
29. Justribó-Manion A, Vilchez C, Gomez J, et al. Association Between Chronic Low Back Pain And Temporomandibular Disorders. Clin J Pain. 2024.
30. Mulligan B. Manual Therapy: NAGs, SNAGs, And MWMs. 5th ed. Nelson Thornes Ltd; 2010.
31. Hidalgo B, Detrembleur C, Hall T, et al. Immediate And Short-Term Effects Of Mulligan SNAGs On Nonspecific Low Back Pain. Spine J. 2019.
32. Lee J, Kim H, Park K, et al. Comparative Effects Of SNAGs And Cervical Exercises On Lumbar Function. J Manipulative Physiol Ther. 2022.
33. Kim Y, Choi J, Lee D. Effects Of Mulligan Mobilization And Low-Level Laser Therapy On Chronic Low Back Pain. Physiother Theory Pract. 2023.