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IMMEDIATE EFFECT OF SUSTAINED NATURAL APOPHYSEAL GLIDES (SNAGS) ON PROLAPSED INTERVERTEBRAL DISC (PIVD) IN PATIENTS WITH LOW BACK PAIN: A PRE-POST EXPERIMENTAL STUDY

Original Research

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Acknowledgement: The authors sincerely thank all participants for their valuable time and cooperation.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Low back pain (LBP) is a leading musculoskeletal disorder globally, often resulting in functional disability and reduced quality of life. Among its etiologies, prolapsed intervertebral disc (PIVD) is a major contributor, frequently causing nerve compression and spinal mobility limitations. Manual therapy techniques such as Sustained Natural Apophyseal Glides (SNAGs), based on Mulligan's concept, have shown potential in alleviating symptoms by enhancing joint mechanics and reducing pain.

Objective: To evaluate the immediate effect of SNAGs on pain, spinal flexibility, and straight leg raise (SLR) range in patients with PIVD.

Methods: This pretest-posttest experimental study recruited 28 participants (19 males, 9 females; mean age = 32.32 ± 8.14 years) through non-probability convenience sampling. Inclusion criteria were age 20–60 years, clinical diagnosis of PIVD, and a finger-to-floor distance >20 cm. Exclusion criteria included spinal surgery, fractures, neurological disorders, psychosis, and pregnancy. All participants received a single session of standardized SNAGs applied to the affected lumbar segment. Outcome measures included the Visual Analog Scale (VAS) for pain, SLR for neural mobility, and Finger-to-Floor (FTF) test for spinal flexibility. Data were analyzed using SPSS v26.0, with Shapiro-Wilk test assessing normality and paired t-tests determining statistical significance.

Results: Pain levels significantly reduced post-intervention (VAS pre: 7.53 ± 1.23; post: 3.81 ± 0.25; $p = 0.002$). SLR improved markedly in both limbs (Right pre: 65.89° ± 15.15; post: 81.25° ± 9.09; $p = 0.000$ | Left pre: 68.60° ± 16.74; post: 77.32° ± 11.74; $p = 0.001$). Spinal flexibility improved as FTF distance decreased (pre: 23.91 ± 4.76 cm; post: 18.03 ± 5.12 cm; $p = 0.000$). Strong correlations were observed between pre- and post-values ($r = 0.630–0.897$).

Conclusion: SNAGs produced immediate and significant improvements in spinal flexibility, lower limb mobility, and pain levels among PIVD patients, supporting their clinical utility in conservative LBP management.

Keywords: Acute Low Back Pain, Manual Therapy, Prolapsed Intervertebral Disc, Range of Motion, SNAGs, Spinal Flexibility, Straight Leg Raise.

INTRODUCTION

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders globally, affecting individuals across all age groups and significantly contributing to disability and socioeconomic burden. It is generally categorized into non-specific LBP, LBP with nerve entrapment, and specific LBP with identifiable causes (1). Among these, intervertebral disc degeneration (IDD) stands out as a major contributor to discogenic LBP, often leading to persistent pain, functional limitation, and reduced quality of life (2). The intervertebral disc plays a critical role in maintaining spinal flexibility, load-bearing, and nutrient transport. Structurally, it comprises the nucleus pulposus, annulus fibrosus, and cartilaginous endplates, each serving a specialized function in spinal biomechanics (3,4). With advancing age and cumulative mechanical stress, these structures undergo degenerative changes, resulting in disc dehydration, altered disc height, and impaired function, often culminating in prolapsed intervertebral disc (PIVD) (5,6). PIVD is a condition in which the nucleus pulposus herniates through weakened annular fibers, commonly in a posterior or posterolateral direction, compressing adjacent nerve roots and causing pain, neurological symptoms, and restricted movement (7-9). This pathology frequently manifests as radiating pain, reduced lumbar flexibility, and impaired mobility, making it a central focus of conservative spinal care. While surgical options such as vertebroplasty and hydrogel injections have shown promise in severe cases by restoring disc height and stiffness (10,11), their long-term outcomes remain uncertain, thus placing greater emphasis on non-invasive management strategies.

Conservative treatments are widely endorsed as first-line therapy for PIVD and include modalities such as thermotherapy, electrotherapy, hydrotherapy, manual therapy, and targeted rehabilitation exercises (12-14). Manual therapy approaches, particularly the McKenzie method and Mulligan's mobilization techniques, have shown considerable efficacy in alleviating pain and restoring function in lumbar disc pathologies (15,16). Among these, Sustained Natural Apophyseal Glides (SNAGs), a manual therapy technique rooted in Mulligan's concept of mobilization with movement, has emerged as a promising intervention. SNAGs involve the application of passive gliding forces to spinal segments while the patient actively moves, aiming to correct biomechanical dysfunctions and relieve pain (17-19). This technique is postulated to facilitate neuromuscular re-education, optimize spinal mechanics, and restore functional capacity. Clinical evidence supports SNAGs in improving lumbar range of motion (ROM), reducing nerve root irritation, and enhancing daily functional activities in patients with PIVD (19,20). Despite the growing clinical use of SNAGs, there remains a paucity of data regarding their immediate effects on spinal flexibility and pain-related outcomes in acute disc prolapse scenarios. Given the disabling nature of discogenic LBP and the need for safe, effective, and accessible treatments, further research is imperative. This study, therefore, aims to evaluate the immediate effects of SNAGs on pain intensity, lumbar flexibility, and functional impairment in patients with PIVD, as assessed through the Visual Analogue Scale (VAS), Straight Leg Raise (SLR), and Finger-to-Floor (FTF) test. The findings are anticipated to contribute to evidence-based practice and guide clinical decision-making in the conservative management of discogenic low back pain.

METHODS

A pretest-posttest study design was conducted to assess the immediate effects of Sustained Natural Apophyseal Glides (SNAGs) on pain, spinal flexibility, and functional impairment in patients diagnosed with prolapsed intervertebral disc (PIVD). A total of 28 participants were recruited through non-probability, convenience sampling from a clinical population. Individuals aged between 20 and 60 years, presenting with acute low back pain (LBP) due to clinically confirmed PIVD and demonstrating a Finger-to-Floor (FTF) distance of more than 20 cm, were considered eligible for inclusion. Participants were excluded if they had a history of spinal surgery, spinal fractures, comorbid neurological or systemic conditions such as epilepsy or tumors, psychiatric disorders including psychosis, or if they were currently pregnant. These criteria were set to ensure homogeneity of the sample and to avoid potential confounding factors that could affect treatment outcomes. Prior to data collection, ethical approval was obtained from the institutional review board (IRB) and written informed consent was secured from all participants in accordance with the Declaration of Helsinki. Participants were evaluated at two time points: baseline (T0), prior to any intervention, and immediately after the application of the SNAG technique (T1). The intervention consisted of a standardized SNAG protocol administered by a licensed physiotherapist, targeting the specific lumbar vertebral segments identified as dysfunctional through clinical examination. Outcome measures included the Visual Analogue Scale (VAS) for pain intensity, the Straight Leg Raise (SLR) test for assessing nerve root mobility, and the Finger-to-Floor (FTF) test for spinal

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flexibility. All data were recorded in a controlled clinical setting. The statistical analysis was performed using SPSS version 26. The Shapiro-Wilk test was employed to evaluate the normality of data distribution, and paired sample t-tests were used to compare pre- and post-intervention scores, with a significance level set at $p < 0.05$.

RESULTS

A total of 28 participants were enrolled in the study, consisting of 19 males (67.9%) and 9 females (32.1%), with a mean age of 32.32 years (SD = 8.14), ranging from 21 to 60 years. The most common ages observed were 26 and 30 years. The demographic data reflected a relatively young adult population diagnosed with prolapsed intervertebral disc (PIVD) presenting with low back pain and reduced spinal flexibility. The Shapiro-Wilk test confirmed normal distribution of the data for the Straight Leg Raise (SLR) and Finger-to-Floor (FTF) tests ($p < 0.05$). Following the application of Sustained Natural Apophyseal Glides (SNAGs), there was a statistically significant reduction in pain scores measured by the Visual Analogue Scale (VAS). The mean VAS score decreased from 7.53 ± 1.23 at baseline to 3.81 ± 0.25 post-treatment, indicating a mean difference of 3.72 ± 0.98 ($p = 0.002$). This shift represented a change from the "very severe" to the "mildly moderate" pain category. In terms of lower limb nerve mobility, SLR outcomes demonstrated considerable improvement. For the right leg, the mean SLR increased from 65.89° ± 15.15° to 81.25° ± 9.09°, yielding a mean difference of 15.36° ± 6.06° ($t = -6.899$, $p = 0.000$). Similarly, the left leg showed an increase from 68.60° ± 16.74° to 77.32° ± 11.74°, with a mean difference of 8.72° ± 5.00° ($t = -4.096$, $p = 0.001$). Significant correlations were found between pre- and post-treatment SLR values on both the right ($r = 0.630$, $p = 0.000$) and left ($r = 0.741$, $p = 0.000$) sides. Spinal flexibility assessed through the FTF test also showed meaningful improvement. The mean pre-treatment FTF value was 23.91 cm ± 4.76 cm, which significantly reduced to 18.03 cm ± 5.12 cm post-intervention. The mean difference of 5.88 cm ± 0.36 cm ($t = 13.661$, $p = 0.000$) indicated enhanced lumbar mobility immediately after SNAGs application. The correlation between pre- and post-treatment FTF measures was strong ($r = 0.897$, $p = 0.000$), reinforcing the effectiveness of the intervention.

Table 1: Demographics Descriptive of the study population

Variable	Category	Value
Gender	Male	19 (67.9%)
	Female	9 (32.1%)
Total N		28 (100%)
Age	Mean:	32.32 years
	Standard Deviation:	8.14 Years
	Minimum - Maximum	21 – 60 Years
	Range:	39 Years
	Mode:	26, 30 Years

Table 2: VAS score (Paired t Test Results)

	Total N.	Mean + SD	Mean Difference	Sig. (p-Value)
VAS (Pain Scale)	28	Pre= M=7.53, SD= 1.23	3.72 ± 0.98	0.002
		Post= M= 3.81, SD= 0.25		

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Table 3: Paired T-Test and Desvriptive Analysis for Straight Leg Raise (SLR) Test

Variable (Test)	Mean ± SD	Mean Difference	t-value	p-Value
SLR Right Pre	65.89 ± 15.15	15.36 ± 6.06	-6.899	0.000
SLR Right Post	81.25 ± 9.09			
SLR Left Pre	68.60 ± 16.74	8.72 ± 5.00	-4.096	0.001
SLR Left Post	77.32 ± 11.74			

Table 4: Paired t Test Correlation Results for Pre-Post SLR Test

Test	Total N.		Correlation	Sig. Value
Straight Leg Raise (SLR)	28	Right Leg -Pre-Post	.630	0.000
	28	Left Leg -Pre-Post	.741	0.000

Table 5: Paired T-Test and Descriptive Analysis for Finger to Floor (FTF) Test for Spinal flexibility

Variable (Test)	Mean ± SD	Mean Difference	t-value	p-value
FTF Pre-treatment	23.91 ± 4.76	5.88 ± -0.36	13.661	0.000
FTF post-treatment	18.03 ± 5.12			

Table 6: Paired T Test for Correlation of Pre-Post (FTF) Test for Spinal Flexibility

	Total No. of Patients	Correlation	Sig. Value
Finger-to-floor pre- & post-treatment	28	.897	0.000

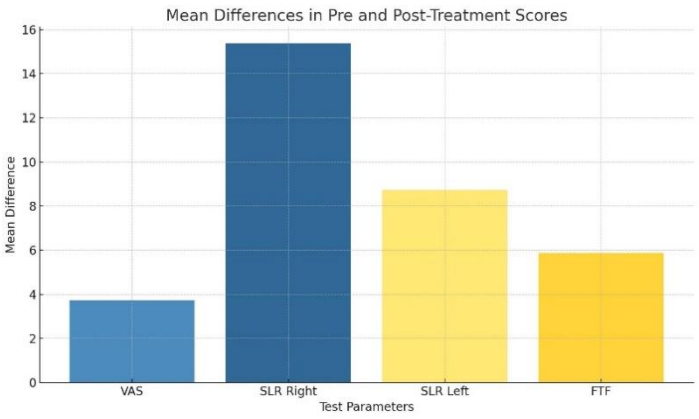

Figure 1 Mean Differences in Pre and Post-Treatment Scores

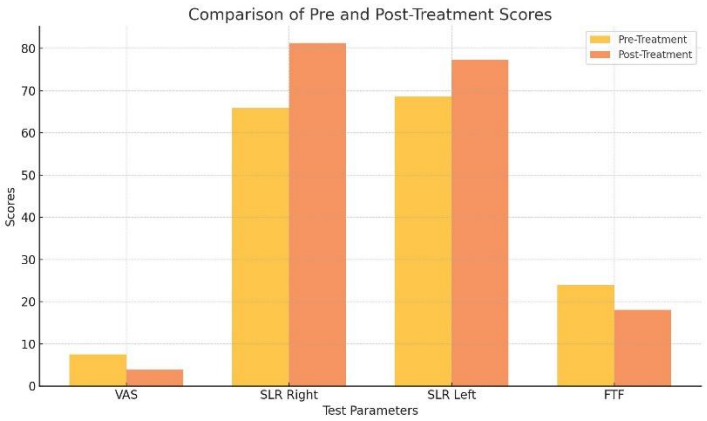

Figure 2 Comparison of Pre and Post-Treatments Scores

DISCUSSION

The present study investigated the immediate effects of Sustained Natural Apophyseal Glides (SNAGs) on patients with prolapsed intervertebral disc (PIVD), with particular focus on pain intensity, spinal flexibility, and straight leg raise (SLR) range of motion. The findings demonstrated significant improvements across all measured outcomes, suggesting the clinical relevance of SNAGs in the acute management of discogenic low back pain. These improvements are consistent with earlier studies, which reported enhanced functional capacity and pain reduction following the application of SNAGs without the need for adjunctive interventions such as traction, thoracic spine thrust manipulation, or neurodynamic sliders (15,16). The observed improvements in spinal mobility and pain attenuation further support the biomechanical rationale underlying SNAGs, which proposes that correcting minor positional faults at the zygapophyseal joints may alleviate neural tension and improve joint kinematics. The increase in SLR angles and reduction in Visual Analogue Scale (VAS) scores post-treatment reflects the positive influence of SNAGs on lumbar segmental motion and neural mobility (17). Biomechanical interpretations suggest that restoring normal gliding of the facet joints reduces mechanical irritation and improves neural

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excursion, thereby contributing to hypoalgesia and functional recovery. Some authors postulated that this may also reduce the production of inflammatory mediators and ischemic insult to nerve roots, further explaining the immediate pain relief observed (18-20). Enhanced outcomes in the Finger-to-Floor (FTF) test reinforce these interpretations, with changes in FTF flexibility correlating with early improvements in spinal function and possibly predicting long-term outcomes.

The role of sympatho-excitation and non-opioid centrally mediated pathways in SNAG-induced analgesia has also been suggested in literature, highlighting the neurophysiological mechanisms potentially involved in this manual therapy approach. Studies exploring mobilization with movement have shown hypoalgesic effects in peripheral regions without engaging the endogenous opioid system, suggesting SNAGs may act through similar central mechanisms. Evidence indicating sympatho-excitatory responses in asymptomatic individuals during cervical SNAGs further supports this perspective (21,22). These effects may contribute to the broader hypoalgesia and improved joint function observed in this study. Additionally, active participation by patients during mobilization—such as incorporating elbow movements in neural tension positions—could enhance neural sliding, further facilitating functional improvements and pain relief. The current findings are strengthened by the immediate assessment of outcomes using standardized clinical tools such as VAS, SLR, and FTF tests. These tools provided quantifiable and reliable measures of change, ensuring consistency in evaluating treatment response (23,24). The use of a focused and standardized SNAG protocol delivered by trained professionals also ensured procedural uniformity, which adds to the internal validity of the study.

However, despite the promising results, several limitations should be acknowledged. The sample size was relatively small, which restricts the generalizability of the findings. Moreover, the absence of a control or comparator group introduces the possibility of placebo effects or other non-specific therapeutic influences. The short-term nature of outcome assessment limits the understanding of sustained efficacy, making it difficult to draw conclusions about the long-term therapeutic potential of SNAGs. Although previous studies have shown benefits lasting up to three months, the current study did not include follow-up assessments to validate these findings over time. Future research should address these limitations by employing randomized controlled trials with larger sample sizes, extended follow-up periods, and comparison with other manual therapy techniques such as Maitland mobilization, McKenzie exercises, or neural mobilizations. Evaluating additional functional disability indices like the Oswestry Disability Index (ODI) and Roland-Morris Disability Questionnaire could further enhance the understanding of SNAGs' impact on daily life and occupational performance. Furthermore, exploring the neurophysiological and biomechanical mechanisms through imaging or electrophysiological assessments may elucidate the underlying processes more precisely (25). Overall, the study provides compelling evidence that SNAGs offer immediate benefits in reducing pain, enhancing range of motion, and improving spinal flexibility in patients with prolapsed intervertebral discs. The findings support the clinical utility of Mulligan's mobilization principles as a non-invasive, effective intervention in the conservative management of discogenic low back pain. However, further robust and longitudinal investigations are warranted to optimize treatment protocols and establish sustained clinical outcomes.

CONCLUSION

This study concludes that Sustained Natural Apophyseal Glides (SNAGs) are an effective manual therapy technique for improving lower limb range of motion and spinal flexibility in patients with prolapsed intervertebral disc. The intervention led to meaningful enhancements in straight leg raise mobility and reduced finger-to-floor distance, reflecting better lumbar function. These outcomes suggest that SNAGs not only alleviate pain but also support functional recovery and reduce disability, making them a valuable non-invasive option in the conservative management of discogenic low back pain. The findings reinforce the clinical relevance of SNAGs as a practical tool for enhancing patient outcomes in musculoskeletal rehabilitation.

Author Contribution

Authors	Contribution
Etisam Wahid	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Khubaib Ullah	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Soom Khalil	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Sanan Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ayesha Jamil Raja	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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