

EFFECTS OF SUSTAINED NATURAL APOPHYSEAL GLIDES WITH AND WITHOUT PILATES ON PAIN AND RANGE OF MOTION IN PATIENTS WITH LUMBAR DISC BULGE

Original Research

Ammar Javeid¹, Faiza Ashraf², Anum Fatima³, Maryam Nasim⁴, Muhammad Sarfraz⁵, Samia Khaliq⁶, Amna Masood⁷, Rafia Imtiaz^{8*}

¹Senior Lecturer at Bakhtawar Amin medical and dental college Multan, Pakistan.

²Senior Lecturer at Riphah International University Pakistan.

³Lecturer at Multan Medical & Dental College, Multan Pakistan.

⁴University of South Asia Raiwind Road Lahore. Pakistan.

⁵Assistant Professor, DIPMR, Physiotherapy Department, Dow University of Health Sciences, Pakistan.

⁶Alshifa Institute of Health Sciences Narowal, Pakistan.

⁷Lecturer at Bakhtawar Amin College of Rehabilitation Sciences, Multan, Pakistan.

⁸Government College University Faisalabad, Pakistan.

Corresponding Author: Rafia Imtiaz, Government College University Faisalabad, Pakistan. rafia_imtiaz@yahoo.com

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ABSTRACT

Background: Lumbar disc bulge is a common musculoskeletal condition that leads to pain, restricted movement, and functional limitations, impacting activities such as bending, lifting, and prolonged sitting. This condition can contribute to immobility and disability, significantly affecting the quality of life. Effective rehabilitation strategies are crucial to restoring spinal function, improving range of motion (ROM), and reducing pain. Manual therapy techniques such as Sustained Natural Apophyseal Glides (SNAGS) and movement-based exercises like Pilates have been explored as treatment options to enhance spinal mobility and relieve symptoms.

Objective: To compare the effects of Sustained Natural Apophyseal Glides (SNAGS) with and without Pilates on pain and lumbar range of motion in patients with lumbar disc bulge.

Methods: A randomized clinical trial was conducted at Bakhtawar Amin Hospital, Multan, over eight months following approval from the ethical council of Riphah College of Rehabilitation & Allied Health Sciences. A total of 44 participants were randomly assigned to Group A (SNAGS with Pilates) or Group B (SNAGS alone) using a lottery method. Group A received SNAGS, Pilates, transcutaneous electrical nerve stimulation (TENS), and therapeutic ultrasound, while Group B received SNAGS, TENS, and therapeutic ultrasound. Pain was assessed using the Numeric Pain Rating Scale (NPRS), and lumbar ROM was measured using an inclinometer. Data were analyzed using SPSS version 26.

Results: Statistically significant improvements were observed in both groups for pain and ROM ($p = 0.000$). In Group A, NPRS scores reduced from 7.95 ± 1.32 to 3.86 ± 1.20 , while in Group B, they decreased from 7.54 ± 1.10 to 4.54 ± 1.33 . Spinal flexion improved from $40.90 \pm 4.93^\circ$ to $51.68 \pm 3.74^\circ$ in Group A and from $38.31 \pm 5.80^\circ$ to $46.95 \pm 4.67^\circ$ in Group B. Spinal extension increased from $8.50 \pm 1.71^\circ$ to $13.77 \pm 2.15^\circ$ in Group A and from $8.50 \pm 1.71^\circ$ to $13.59 \pm 2.08^\circ$ in Group B. Pain relief was comparable in both groups, but Group A demonstrated superior improvements in spinal flexion.

Conclusion: Both SNAGS and Pilates effectively reduced pain and improved ROM in patients with lumbar disc bulge. However, the addition of Pilates resulted in greater improvements in spinal mobility, suggesting that it is a beneficial adjunct to manual therapy for managing lumbar disc pathology.

Keywords: Exercise, Flexibility, Lumbar Disc Bulge, Manual Therapy, Pain, Pilates, Range of Motion.

INTRODUCTION

Lumbar disc degeneration is a leading cause of low back pain (LBP), a prevalent musculoskeletal condition that imposes a significant financial burden on healthcare systems, particularly in developed nations (1). Among the various disc-related abnormalities, herniated nucleus pulposus is one of the most frequently diagnosed conditions associated with sciatica and LBP (1,2). Two of the most common intervertebral disc injuries contributing to lower back pain, along with numbness and tingling in the lower limbs, are disc herniation and disc bulge. These conditions can significantly impact daily activities and quality of life. The use of magnetic resonance imaging (MRI) and other radiological techniques plays a crucial role in diagnosing disc pathologies and guiding treatment strategies (3). Lower back pain affects individuals across various age groups, often linked to degenerative disc disease, spinal canal stenosis, facet joint arthropathy, and intervertebral disc herniation. The prevalence of nerve root compression is evident in both males and females, with disc herniation occurring more frequently in individuals aged 19 to 21 years, while nerve root compression is more common among those aged 22 to 24 years (4). Among the lumbar segments, L1/L2 demonstrates the highest susceptibility to disc degeneration, whereas nerve root compression predominantly affects L2/L3, L3/L4, L4/L5, and L5/S1 levels (3,4).

Exercise-based rehabilitation is a cornerstone in managing lumbar disc-related conditions, with various therapeutic approaches aiming to alleviate pain and enhance functional capacity. The Pilates method, developed in the early 20th century, incorporates principles from ballet, yoga, martial arts, and ancient Greek and Roman exercises to create a comprehensive movement-based rehabilitation system (5). Rooted in Contrology, Pilates focuses on six fundamental principles: breathing, control, precision, concentration, centering (core activation), and fluid movement. This method has gained widespread recognition as an effective intervention for improving spinal stability and muscular strength while minimizing excessive mechanical stress on the spine (5,6). The potential benefits of Pilates for individuals with lumbar disc bulges stem from its emphasis on core strengthening, postural alignment, and controlled movement patterns. By avoiding high-impact forces on spinal structures, Pilates may alleviate symptoms associated with lumbar disc pathologies. However, despite its increasing popularity, there remains a paucity of research exploring its specific efficacy in managing lumbar disc bulges, particularly when combined with other therapeutic modalities such as manual therapy techniques (7).

Sustained Natural Apophyseal Glides (SNAGs) represent a widely utilized manual therapy approach for addressing spinal dysfunctions and mitigating pain. This technique, commonly applied to the cervical and thoracic spine, has demonstrated promising results in reducing pain and enhancing joint mobility (8). Given its efficacy in managing other spinal conditions, SNAGs may offer a beneficial therapeutic option for individuals with lumbar disc bulges. However, the extent to which SNAGs can contribute to symptom relief and functional improvement in this population remains insufficiently explored (9). The integration of SNAGs and Pilates presents a novel multimodal approach that may enhance treatment outcomes for individuals with lumbar disc bulges. By combining the benefits of manual therapy with structured movement-based rehabilitation, this approach may offer a comprehensive strategy for pain relief, mobility enhancement, and functional recovery (10). Despite the theoretical advantages, limited research has examined the synergistic effects of these interventions, leaving a critical gap in the evidence base. Investigating the combined impact of SNAGs and Pilates on lumbar disc bulge management is essential to inform clinical practice and refine rehabilitation protocols (11). This study aims to evaluate the efficacy of SNAGs and Pilates, both individually and in combination, in individuals diagnosed with lumbar disc bulges. By systematically assessing their impact on pain reduction, range of motion, and functional improvement, this research seeks to provide evidence-based recommendations for optimizing rehabilitation strategies. The findings will contribute to the growing body of literature on multimodal treatment approaches, offering valuable insights for healthcare professionals involved in the management of lumbar disc pathologies.

METHODS

The study was a randomized clinical trial conducted at Bakhtawar Amin Hospital, Multan, over a nine-month period from July 2023 to January 2024, following approval from the Research Ethics Council at Riphah International University, Lahore. The study adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines to ensure methodological transparency and rigor. Participants were recruited using a convenient sampling method and were then randomly allocated to one of two groups through a lottery-based randomization process. The sample size of 44 participants, with 22 assigned to each group, was determined using G*Power software

based on the effect size derived from post-treatment pain assessment using a pain rating scale (9). Participants were included if they were between 40 and 60 years of age, regardless of gender, and experienced unilateral radiating pain along the sciatic nerve for a minimum duration of three months, accompanied by restricted lumbar mobility. Eligibility was confirmed through specific clinical assessments, including a positive slump test correlating with the pain site (12), a positive passive lumbar extension test characterized by severe low back pain and a sensation of heaviness or instability in the lower back, and a positive Straight Leg Raise (SLR) test, defined as radiating discomfort along the sciatic nerve below the knee occurring between 30 and 70 degrees of hip flexion (13). Participants had to be capable of comprehending study instructions and voluntarily consenting to participation.

Exclusion criteria included a history of lower extremity injuries, dislocations, or subluxations, as well as the presence of systemic diseases such as rheumatoid arthritis, psoriatic arthritis, fibromyalgia, chronic pain syndrome, systemic lupus erythematosus, or malignancies. Individuals with prior lumbar spine surgery, clinically verified lumbar radiculopathy or myelopathy, or diagnosed neurological conditions such as occipital or trigeminal neuralgia were excluded. Participants with a history of primary headaches (migraine or tension-type headaches) or those who had received lumbar physical therapy within the last six months were also excluded (14). Upon enrollment, participants underwent a thorough physical examination and provided detailed medical histories. Written informed consent was obtained following an explanation of the study's objectives and methodology, and all personal data were kept confidential. Participants retained the right to withdraw at any stage. The Institutional Review Board (IRB) approved the data collection process. The intervention spanned three weeks, with participants attending three sessions per week. Data collection occurred at baseline and after the completion of all sessions.

The experimental group (Group A) received an integrated intervention consisting of 8 minutes of therapeutic ultrasound, 10 minutes of transcutaneous electrical nerve stimulation (TENS) (16), Sustained Natural Apophyseal Glides (SNAGs), and Pilates-based exercises (15). Individual sessions were designed with a specific emphasis on breath control, pelvic-lumbar stabilization, chest and shoulder alignment, and head and neck positioning. A structured exercise regimen was implemented, including movements such as Hundreds, Hundred 1-2, Shears, One-Leg Stance, Bilateral Leg Stretching, Hip Twist, Shoulder Bridge, Arm Gaps, Side Kick, Clam, Swan Diving, and One-Leg Kick. Each session lasted between 45 and 60 minutes and included a warm-up, main exercises, and a cool-down. Participants who successfully completed an individual session were considered eligible for group-based training; however, it remained unclear whether those who struggled with individual sessions continued in the study or were reassigned. The transition from individual to group training was not explicitly standardized, raising a potential methodological inconsistency regarding participant retention and progression criteria. The control group (Group B) received 8 minutes of therapeutic ultrasound, 10 minutes of TENS (16), and SNAGs without the inclusion of Pilates exercises. The rationale behind the selection of a three-week intervention period was not elaborated, posing a limitation regarding its adequacy in assessing long-term therapeutic benefits. Future studies should explore longer treatment durations to enhance the generalizability and clinical applicability of the findings. Addressing these methodological concerns, particularly in defining progression criteria for Pilates-based exercises, standardizing the transition to group training, and ensuring sufficient intervention duration, would improve the reliability and applicability of the study's outcomes.

RESULTS

The study included 44 participants, evenly divided into two groups: SNAGS with Pilates (Group A) and SNAGS alone (Group B). Group A consisted of 10 males (45.5%) and 12 females (54.5%), with a mean age of 49.22 ± 6.15 years. Group B had 13 males (59.1%) and 9 females (40.9%), with a mean age of 48.22 ± 6.19 years. The normality of the data was verified using the Shapiro-Wilk test, which indicated that all variables were normally distributed ($p > 0.05$). Statistical analysis was conducted using SPSS, with the paired t-test employed for within-group comparisons of pre- and post-treatment values, and the independent t-test used to assess differences between groups. Within-group analysis demonstrated significant improvements in all outcome measures in both groups. In Group A, the Numeric Pain Rating Scale (NPRS) score significantly decreased from 7.95 ± 1.32 pre-treatment to 3.86 ± 1.20 post-treatment ($p = 0.000$). Similarly, Group B showed a reduction from 7.54 ± 1.10 pre-treatment to 4.54 ± 1.33 post-treatment ($p = 0.000$). Flexion of the spine improved from $40.90 \pm 4.93^\circ$ to $51.68 \pm 3.74^\circ$ in Group A ($p = 0.000$) and from $38.31 \pm 5.80^\circ$ to $46.95 \pm 4.67^\circ$ in Group B ($p = 0.000$). Extension of the spine increased from $8.50 \pm 1.71^\circ$ to $13.77 \pm 2.15^\circ$ in Group A ($p = 0.000$) and from $8.50 \pm 1.71^\circ$ to $13.59 \pm 2.08^\circ$ in Group B ($p = 0.000$). Between-group comparisons revealed no significant differences in NPRS scores pre-treatment ($p = 0.272$) or post-treatment ($p = 0.083$), suggesting that both interventions provided pain relief. However, significant differences were observed in spinal flexion post-treatment, with Group A achieving greater improvement ($p = 0.001$). No significant difference was found in spinal extension between the two groups pre-treatment ($p = 1.000$) or post-treatment ($p = 0.778$).

Table 1 Baseline Demographics of Both Groups

Baseline characters	SNAGS with Pilates (A)	SNAGS (B)
No. of participants	22	22
Gender	Male = 10 (45.5%) Female = 12 (54.5%)	Male = 13 (59.1%) Female = 9(40.9%)
Mean Age	49.22 ± 6.15	48.22 ± 6.19

Table 2 Within-group interpretation of Group A (SNAGS with Pilates) and Group B (SNAGS)

Variables	Groups	Treatment values	Mean ± S. D	p-value
NPRS	Group A	Pre-Treatment	7.95 ± 1.32	0.000
		Post Treatment	3.86 ± 1.20	
	Group B	Pre-Treatment	7.54 ± 1.10	0.000
		Post Treatment	4.54 ± 1.33	
Flexion of Spine	Group A	Pre-Treatment	40.90 ± 4.93	0.000
		Post Treatment	51.68 ± 3.74	
	Group B	Pre-Treatment	38.31 ± 5.80	0.000
		Post Treatment	46.95 ± 4.67	
Extension of Spine	Group A	Pre-Treatment	8.50 ± 1.71	0.000
		Post Treatment	13.77 ± 2.15	
	Group B	Pre-Treatment	8.50 ± 1.71	0.000
		Post Treatment	13.59 ± 2.08	

Table 3 Across the Group Comparison Group A (SNAGS with Pilates) and Group B (SNAGS)

Outcome measures	Time Points	SNAGS with Pilates (Group A)	SNAGS (Group B)	p-value
NPRS	Pre-Treatment	7.95 ± 1.32	7.54 ± 1.10	0.272
	Post Treatment	3.86 ± 1.20	4.54 ± 1.33	0.083
Flexion of Spine	Pre-Treatment	40.90 ± 4.93	38.31 ± 5.80	0.118
	Post Treatment	51.68 ± 3.74	46.95 ± 4.67	0.001
Extension of Spine	Pre-Treatment	8.50 ± 1.71	8.50 ± 1.71	1.000
	Post Treatment	13.77 ± 2.15	13.59 ± 2.08	0.778

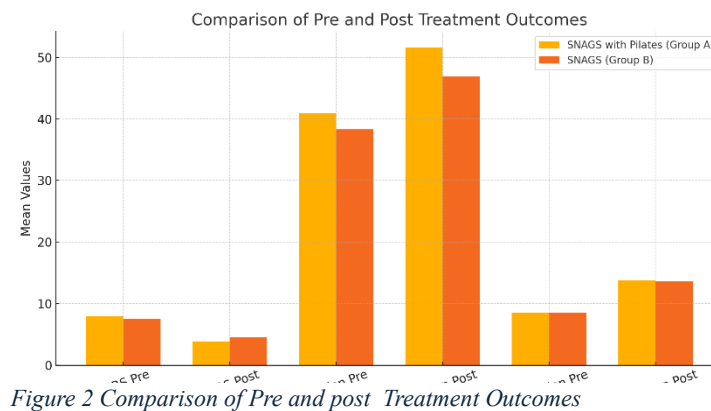


Figure 2 Comparison of Pre and post Treatment Outcomes

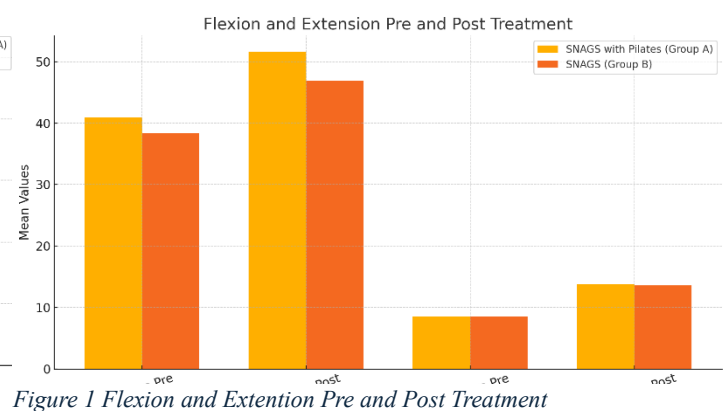


Figure 1 Flexion and Extension Pre and Post Treatment

DISCUSSION

The study aimed to assess the effects of Sustained Natural Apophyseal Glides (SNAGS) and Pilates on pain and range of motion (ROM) in patients with lumbar disc bulge. Findings demonstrated significant improvements in both groups, with pain levels decreasing and ROM increasing following three weeks of intervention. Notably, while both groups exhibited similar pain reduction, Group A, which received SNAGS combined with Pilates, showed superior improvements in spinal flexion and extension compared to Group B, which received SNAGS alone. These findings suggest that incorporating Pilates into rehabilitation protocols may enhance spinal mobility in lumbar disc bulge patients. Pain relief observed in both groups aligns with previous research indicating that SNAGS effectively reduce pain by applying sustained pressure to targeted spinal segments, restoring normal joint mechanics, and alleviating nerve compression. Pilates, on the other hand, has been widely recognized for its role in improving posture, core strength, and neuromuscular control, which may contribute to decreased stress on the lumbar spine and enhanced pain modulation. Studies have supported the effectiveness of SNAGS in reducing lumbar pain and have also demonstrated that Pilates-based exercises improve ROM, flexibility, and pain perception in individuals with lumbar disc pathology (17). The results of this study corroborate these findings, reinforcing the notion that SNAGS and Pilates are viable therapeutic interventions for managing lumbar disc bulge symptoms (15,17).

Although both interventions resulted in pain relief, spinal mobility improvements were more pronounced in the SNAGS with Pilates group. Pilates emphasizes controlled, low-impact movements that enhance muscle endurance and spinal stability, which may explain the greater ROM gains observed. Previous research has highlighted the benefits of Pilates in promoting lumbar-pelvic motion control, reducing disability, and increasing muscle tolerance, supporting the hypothesis that Pilates serves as a valuable adjunct to manual therapy in spinal rehabilitation (18). Additionally, the combination of SNAGS and Pilates may accelerate recovery by addressing both joint dysfunction and muscular imbalances, leading to a more comprehensive therapeutic effect. The findings suggest that integrating Pilates into rehabilitation programs may be particularly beneficial for patients with lumbar disc bulge, as it enhances functional capacity and facilitates improved movement patterns (19). SNAGS alone were effective in reducing pain, but the inclusion of Pilates further amplified improvements in ROM. The role of Pilates in improving spinal mobility has been widely supported, with studies indicating its efficacy in reducing pain intensity and increasing flexibility in individuals with lumbar disorders (20). Moreover, Pilates has been shown to enhance neuromuscular coordination, which could contribute to long-term functional gains in patients with chronic lower back conditions.

Despite the promising findings, several limitations must be acknowledged. The study was limited by a small sample size of 44 participants, which may restrict the generalizability of the results. A larger, more diverse sample could improve external validity and provide a more comprehensive understanding of the intervention's efficacy. Additionally, the study focused solely on patients with lumbar disc bulge, limiting its applicability to individuals with other lumbar pathologies. The intervention period was relatively short, lasting only three weeks, which may not be sufficient to assess the long-term benefits of SNAGS and Pilates. Future studies should consider extended intervention durations to evaluate the sustainability of therapeutic outcomes. Furthermore, the convenience sampling method may introduce selection bias, potentially affecting the study's representativeness. Expanding the study to include a broader

patient population with varying spinal conditions could enhance the applicability of the findings. Future research should explore the effects of long-term SNAGS and Pilates interventions and assess their impact on functional outcomes such as quality of life and disability indices. Additionally, adopting a multicenter approach would help validate the findings across different clinical settings. Systematic long-term follow-up assessments are necessary to determine the durability of pain relief and ROM improvements observed in this study.

The results indicate that both SNAGS and Pilates are effective in reducing pain and improving ROM in lumbar disc bulge patients. However, the combination of SNAGS with Pilates yielded superior improvements in spinal mobility, suggesting that Pilates serves as a valuable adjunct to manual therapy in lumbar rehabilitation. These findings support the integration of Pilates into physiotherapy protocols for managing lumbar disc bulge and highlight the need for further research to optimize treatment strategies for individuals with spinal disorders.

CONCLUSION

The study concluded that both Sustained Natural Apophyseal Glides (SNAGS) and the combination of SNAGS with Pilates were effective in reducing pain and improving range of motion in patients with lumbar disc bulge. While pain relief was observed in both groups, the addition of Pilates resulted in greater improvements in spinal flexion, highlighting its role in enhancing mobility and functional movement. These findings suggest that incorporating Pilates into rehabilitation programs may provide additional benefits for patients with lumbar disc bulge by promoting spinal stability and flexibility. The results support the integration of Pilates alongside manual therapy techniques to optimize treatment outcomes and improve overall physical function in individuals with lumbar disc pathology.

Author Contribution

Author	Contribution
Ammar Javeid	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Faiza Ashraf	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
Anum Fatima	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Maryam Nasim	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Sarfraz	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Samia Khaliq	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Amna Masood	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Rafia Imtiaz*	Writing - Review & Editing, Assistance with Data Curation

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