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

Ammar Javeid

Senior Lecturer at Bakhtawar Amin Medical and Dental College Multan

Email: aj.physio32@gmail.com

Dr. Saeed Ullah

Assistant Professor at University Institute of Physical Therapy Ibadat International

University Islamabad Email: saeed.ullah@uipt.iiui.edu.pk

Maria Hussain

Consultant Physiotherapist at Salam Medical Complex

Email: mariahussain225@gmail.com

Saman shams

Gulab Devi Educational Complex Lahore

Email: samanomar1415@gmail.com

Amna Shabbir

Gulab Devi Educational Complex Lahore

Email: amnashabbir209@gmail.com

Ifrah Rubat

Clinical Physiotherapist at Skin and Spine Clinic Gujranwala

Email: iffrah@icloud.com

Dr. Nayab Khan

Foundation University College of Physical Therapy (FUCP)

Email: nayab.khan@fui.edu.pk

ABSTRACT

Background: Many people encounter the issue of dealing with a broad and incapacitating lumbar disc bulge, which causes functional impairment and discomfort due to the protrusion or displacement of intervertebral discs in the lower back. Lumbar disc bulges can cause varied degrees of discomfort and impairment, affecting daily activities significantly. According to studies, people with lumbar disc bulges may have difficulty bending, lifting, sitting for long periods of time, and walking. Lumbar disc bulges can cause immobility and restricted range of motion in the lumbar spine. This

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can have an impact on activities of daily living that include bending, twisting, or reaching, such as clothing, grooming, and housework.

Objective: To compare effects of Sustained Natural Apophyseal Glides with and without Pilates on pain, range of motion and disability in patients with lumbar Disc Bulge

Study design: It was a randomized clinical experiment.

Place and duration of study: This Study was conducted in Bakhtawar Amin hospital Multan and the study was completed within 8 months after synopsis approval from ethical committee of Riphah College of Rehabilitation & Allied Health Sciences.

Methods: The research, which used a Randomized Clinical Trial design and lasted eight months at Bakhtawar Amin Hospital in Multan, was authorized by the Riphah College of Rehabilitation & Allied Health Sciences' ethics board. 44 individuals were split evenly between Group A (the experimental group) and Group B (the control group), with the sample size determined using G power. Group A was given TENS, Pilates, sustained natural apophyseal glides, and therapeutic ultrasound; Group B received TENS, sustained natural apophyseal glides, and therapeutic ultrasound. The participants were chosen using the Convenient Sampling Technique. Data collection tools included an inclinometer to quantify lumbar range of motion, the Modified Oswestry Disability Index (ODI), and the Numeric Pain Rating Scale (NPRS). The data was examined using SPSS version 26.

Results: According to the study's findings, patients with lumbar disc prolapse who were in Group A (SNAGS with Pilates) and Group B (SNAGS) experienced statistically significant improvements in their pain, range of motion, and impairment. However, when comparing the two groups, the ODI score improved more in Group A than in Group B, the spinal flexion range of motion improved more in Group A, and the spinal extension range of motion improved equally in both groups.

Conclusion: SNAGS with Pilates is more effective in reducing pain and disability in patients with lumbar disc bulge.

Key Words: Disability, Endurance, Exercise, Flexibility, Lumbar Disc Bulge, Quality Of Life, Spine, Snags

INTRODUCTION:

Lumbar region Disc degeneration is one of the main causes of LBP (LDD), and treating LBP entails considerable medical costs in developed countries. One of the disc degeneration disorders most commonly associated with sciatica and low back pain is herniated nucleus pulposus (1). Disk herniation and disk bulging are two typical disc lesions of the intervertebral area that can result in lower back discomfort as well as numbness and tingling in the legs. In order to diagnose disk diseases, MRIs and other radiological procedures are essential (2). Both young people and older people frequently experience pain of lower back region. It is frequently associated with canal stenosis of spine, facet joint arthropathy, herniation of disc, and disease of disc degeneration. Compression of the nerve roots was typical for both genders. Herniation of disc was more prevalent in the age range of 19 to 21 and nerve root compression in the 22–24 age group. L1/L2 was more severely impacted by disc degeneration. In nerve

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root compression, L2/L3, L3/L4, L4/L5, and L5/S1 experienced more significant effects (3).

Treatment for lumbar disc bulges includes therapeutic activities. There is evidence that specific activities, like aerobic, flexibility, and core stability exercises, can help reduce pain, strengthen muscles, and improve functional outcomes for lumbar disc bulging. Manual therapy techniques are also helpful for those with lumbar disc bulges. It has been demonstrated that spinal manipulation and mobilization help to improve function and lessen pain (4). In the early 1900s, Joseph H. Pilates created the body-mind exercises that are now known as the Pilates method. Pilates developed his own approach by incorporating elements from ancient Greek and Roman exercises, yoga, martial arts, ballet, and Zen meditation (5). Recent years have seen a rise in the popularity of the Pilates method, a fitness regimen that combines stretching and muscle-strengthening movements based on Contrology. During World War I, Joseph Hubertus Pilates created the method to improve and rehabilitate physical capacities. It is founded on six principles: breathing, fluidity, control, precision, centralization or powerhouse, concentration, and breathing. It can be performed on the ground or inside equipment. Although there is clear evidence that the Pilates method is better than other workout regimens, the usual signs and symptoms of these people are reduced because it avoids applying too much force and impact to the muscles, joints, and tissues (6).

Pilates emphasizes strengthening the core and increasing flexibility through whole-body exercises, much like yoga, which calls for the application of prolonged pressure utilizing SNAGs to restore joint mobility and reduce pain in vertebral joints. Research on how these treatments interact and impact people with a lumbar disc bulge has been lacking, despite the fact that both have been shown to be helpful for those with spinal disorders (7). Sustained Natural Apophyseal Glides (SNAGs), a frequently used approach for resolving joint dysfunctions and decreasing associated pain, can help treat a variety of spine disorders with manual treatment. Additionally, prior research on individuals with illnesses like cervical and thoracic aches has demonstrated that the usage of SNAGs can result in favorable outcomes including reduced pain levels and increased mobility. Understanding the potential benefits of SNAGs in this particular population is essential for improving treatment approaches, but more study is required to determine the precise efficacy of SNAGs on people with lumbar disc bulges (8).

The goal of the study is to improve the efficacy of treatments and results for individuals with lumbar disc bulge. Despite the condition's high prevalence, little is known about the impact of SNAGs and Pilates combined on those who have it. To better treat individuals with lumbar disc bulge, it's critical to comprehend how the use and effectiveness of SNAGs alone and in conjunction with Pilates vary. For medical practitioners that treat these individuals, such as physical therapists and chiropractors, this can provide evidence-based recommendations. Those with lumbar disc disease can also benefit from a comprehensive evaluation that provides information on possible pain management techniques, range of motion enhancement techniques, and measures to lessen impairment. Examining the effects of combining SNAGS and Pilates on patients with lumbar disc bulges adds to the growing body of evidence supporting a multimodal approach to treatment. It is important to keep in mind that the selection and application of treatment modalities must be based on an individual assessment and

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tailored to the particular needs and preferences of the patient. Furthermore, to guarantee the safe and efficient application of various treatment approaches, the participation of qualified medical professionals—such as physical therapists—is essential. by combining Sustained Natural Apophyseal Glides (SNAGs), one of the more widely accepted physiotherapy techniques, with Pilates.

MATERIALS AND METHODS

It was a clinical trial that was randomized. Using a sealed opaque enveloped labeled method, patients were randomly assigned to one of two groups after being recruited using a non-probability convenient sampling methodology. The Bakhtawar Amin Hospital in Multan served as the study's location. Following approval by Riphah International University's research ethics council in Lahore, the study was finished in eight months, from July 2023 to December 2024. The Consolidated Standards of Reporting Trials (CONSORT) statement's standards were followed in the reporting of this finished study. G power, 44, was used to determine the sample size (22 in each group). The effect size of the post-treatment pain variable (pain rating scale) in two groups was used to determine the sample size.

Among the requirements for inclusion were patients between the ages of 40 and 60, regardless of gender, who have unilateral radiating pain along the course of the sciatic nerve, who have had the pain for at least three months, who have limited lumbar mobility, who are willing to participate in the study and who can understand instructions, and who have a positive slump test that fits the location of the pain and validates the pain descriptions, passive Lumbar Extension: The Straight Leg Raise (SLR) test is considered positive if the patient reports severe low back pain, heaving in the lower back (9), or a sensation that the lower back is about to "come off" and radiating discomfort below the knee and along the sciatic nerve course, occurring between 30 and 70 degrees of hip flexion (10). The exclusion criteria included rheumatoid arthritis, systemic disorders such as psoriatic arthritis, allergies, fibromyalgia, cancer, chronic pain syndrome, systemic lupus erythematosus, and prior experiences with lower extremity injuries, dislocation, and subluxation (11). individuals with a history of lumbar spine surgery, a diagnosis of cancer, neurological disorders like occipital or trigeminal neuralgia, a doctor's confirmation of a primary headache, such as a migraine or tension headache, clinically confirmed lumbar radiculopathy or myelopathy, and a history of lumbar physical therapy interventions within the previous six months.

Sustained Natural Apophyseal Glides and the Pilates technique were performed on Group A. Specific sessions were planned for each patient in the experimental group, focusing on head and neck positions, chest, shoulder alignment, pelvic lumbar area, and breath control. If a patient successfully finished a session, they were eligible for group training. Three days a week for three weeks, the 45–60 minute workouts included a warm-up, the main exercises, and a cool-down. Exercises included the following: Hundreds, 100 1-2, Shears, the one-leg stance, stretching with both legs together, shoulder bridge, arm gaps, hip twist, side kick, clam, Swan Diving, and one-leg kick (12).

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The NPRS scale, which has an 11-point rating system with '0' representing the least amount of pain or "no pain" and '10' representing the highest level of pain or "pain as severe as you can imagine," was used to quantify the severity levels of the pain. This scale's score range of 0 to 10 made it helpful to patients 48. It was a legitimate and trustworthy tool.(13).

Oswestry Disability Index Modified To determine a patient's degree of disability at a certain point in their acuity and monitor changes over time, a disease-specific disability measure known as the ODI is utilized.

Using an inclinometer to measure lumbar range of motion

Statistical Analysis

SPSS version 21 was used to analyze the data, and the Shapiro-Wilk test was used to look at the data distribution. The results were compared both within and between groups using parametric and non-parametric tests. Descriptive statistics including frequency, mean, and standard deviation were used in the study to look at the demographics of the participants in both groups. The paired samples T-test was used for the intragroup comparison. The groups were compared using the independent samples T-test.

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CONSORT Diagram:

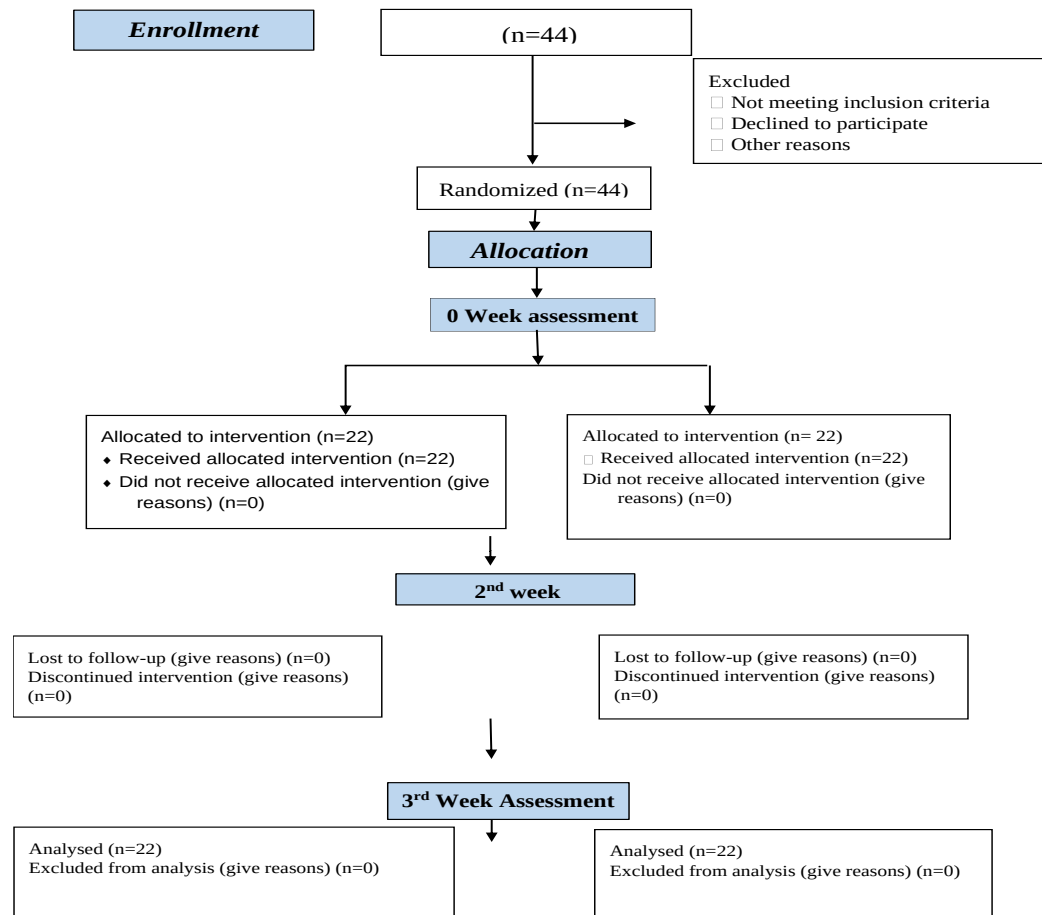


Figure 1: Study Flow Diagram

RESULTS

The participants in group A ranged from 40 to 60 years old, with a mean age of 49.22 ± 6.15 years. Individuals in group B were between the ages of 40 and 58, with a mean age of 48.22 ± 6.19 years, respectively. In group A, there were 12 (54.5%) females and 10 (45.5%) males. Group B consisted of 9 (40.9%).

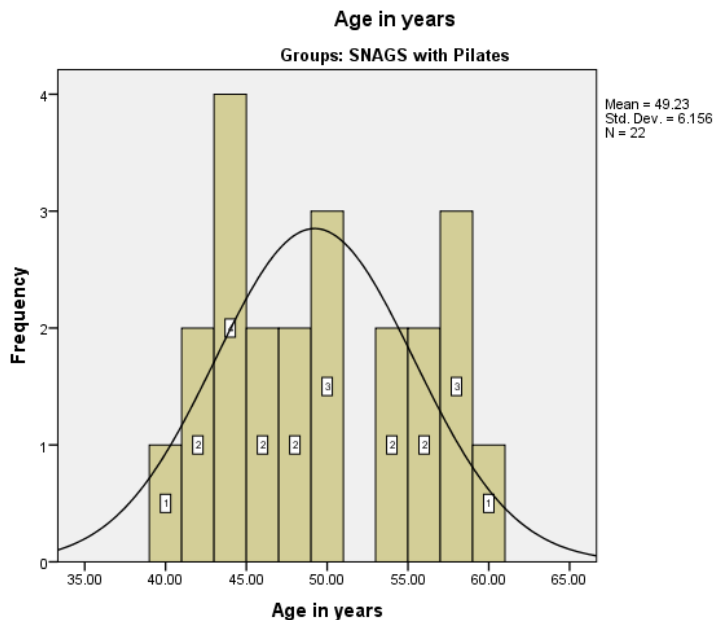
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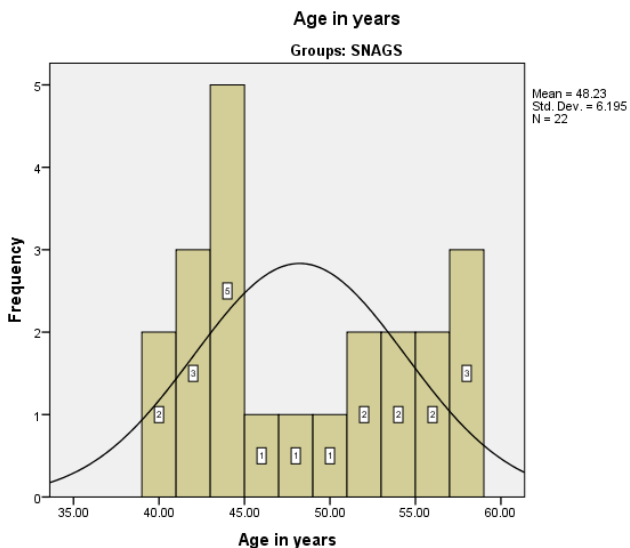
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The study participants in Group A had a mean age of 49.23 ± 6.15 years ($n = 22$), as indicated by the histogram in Figure 2.



The study participants in Group B had a mean age of 48.23 ± 6.19 years ($n = 22$), as indicated by the histogram in Figure 3.

Inferential statistics

The Shapiro-Wilk test was used to verify that each variable was normal. A population with a normal distribution provided the data, according to the results, as indicated by the p -value > 0.05 .

Table 1: Within the Group Analysis of Group A (SNAGS with Pilates) and Group B (SNAGS)

Variables	Groups	Treatment Values	Mean $\pm$ S.D	P-Value
NPRS	SNAGS with Pilates	Pre	7.95 $\pm$ 1.32	0.000
		Post	3.86 $\pm$ 1.20	
	SNAGS	Pre	7.54 $\pm$ 1.10	0.000
		Post	4.54 $\pm$ 1.33	
Flexion of spine	SNAGS with Pilates	Pre	40.90 $\pm$ 4.93	0.000
		Post	51.68 $\pm$ 3.74	
	SNAGS	Pre	38.31 $\pm$ 5.80	0.000
		Post	46.95 $\pm$ 4.67	
Extension of spine	SNAGS with Pilates	Pre	8.50 $\pm$ 1.71	0.000
		Post	13.77 $\pm$ 2.15	
	SNAGS	Pre	8.50 $\pm$ 1.71	0.000
		Post	13.59 $\pm$ 2.08	
Oswestry disability index	SNAGS with Pilates	Pre	61.09 $\pm$ 5.34	0.000
		Post	29.81 $\pm$ 6.80	
	SNAGS	Pre	61.54 $\pm$ 6.41	0.000
		Post	40.31 $\pm$ 8.33	

Table 2: Across the Group Comparison of Group A (SNAGS with Pilates) and Group B (SNAGS)

Outcome Measures	Time Points	Group A Mean $\pm$ S.D	Group B Mean $\pm$ S.D	P-Value
NPRS	Pre	7.95 $\pm$ 1.32	7.54 $\pm$ 1.10	0.272
	Post	3.86 $\pm$ 1.20	4.54 $\pm$ 1.33	0.083
Flexion of spine	Pre	40.90 $\pm$ 4.93	38.31 $\pm$ 5.80	0.118
	Post	51.68 $\pm$ 3.74	46.95 $\pm$ 4.67	0.001
Extension of spine	Pre	8.50 $\pm$ 1.71	8.50 $\pm$ 1.71	1.000
	Post	13.77 $\pm$ 2.15	13.59 $\pm$ 2.08	0.778
Oswestry disability index	Pre	61.09 $\pm$ 5.34	61.54 $\pm$ 6.41	0.800
	Post	29.81 $\pm$ 6.80	40.31 $\pm$ 8.33	0.000

DISCUSSION

This study investigated the benefits of Pilates and prolonged natural apophyseal glides on the range of motion, discomfort, and impairment of patients with lumbar disc bulges. This randomized clinical trial was conducted at the Bakhtawar Amin Hospital in Multan. The convenience sampling method was used to collect the data. The sample size consisted of 44 patients, evenly divided between the two groups. Group B received Sustained Natural Apophyseal Glides, while Group A received Sustained Natural Apophyseal Glides with Pilates. Lumbar range of motion was measured using an

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inclinometer, functional disability was measured with the ODI, and pain was measured with the NPRS. Data were collected at baseline and three weeks into the intervention. To analyze the data, SPSS version 21 was utilized.

The results of our study indicate that the discomfort, range of motion, and disability of lumbar disc prolapse patients who were enrolled in Group A (SNAGS with Pilates) and Group B (SNAGS) improved statistically significantly. Group A's spinal flexion and extension ranges of motion had improved more than Group B's, and Group B's ODI score had reduced less than Group A's, despite the fact that both groups' pain levels had decreased similarly.

In our research, lumbar disc bulge patients' pain decreased in both the SNAGS with Pilates and SNAGS alone groups. Pilates and SNAGs have been shown to effectively relieve pain in patients with lumbar disc bulges. SNAGs reduce pain and restore normal joint mechanics by applying steady pressure to a specific spinal section. Conversely, Pilates seeks to strengthen the core and enhance general body alignment, which can reduce lumbar spine stress and alleviate discomfort. According to a study by AsrulSani et al., patients with grade I and II lumbar pain experienced quicker pain reductions in patients with ruptured pulposus nucleus when SNAGS was added to conventional therapy (14). They used VAS to assess pain. In a study, Muzammal Ahmed et al. found that prolonged spontaneous apophyseal glide is better than mechanical traction for treating individuals with lumbar radiculopathy (15).

SNAGS considerably reduced pain in both groups of lumbar disc bulging patients in our study. In one study, Amal A. Abdelbaky et al. found that applying lumbar SNAGS significantly reduced pain. SNAGs and Mc Kenzie are more successful than manual traction for reducing pain and lumbar impairment in patients with HNP, according to a study by Asrul San et al (16).

According to our research, SNAGS significantly reduced pain, range of motion, and impairment in patients. This has been found by concentrating on specific joint limitations. By applying sustained gliding forces, SNAGs can help mobilize the damaged segment and restore normal movement patterns. Pilates, which emphasizes regulated movements and flexibility, promotes muscle and flexibility, which increases range of motion. In a study, Preethi B. Shetty et al. found that patients with non-specific chronic low back pain responded well to Interference treatment (IFT) that combined modified lumbar snags with Mc Gill stabilizing exercises. greatly reduce disability, ROM, and pain (17).

Range of motion and discomfort were shown to have improved in both the SNAGS with pilates and SNAGS alone groups, but the SNAGS with pilates group saw more improvement. Thus, pilates was added to SNAGS, and the outcomes were better. In a study, Ana Carla Schimidt et al. found that Pilates had a positive impact on perception and intensity of pain, range of motion, and flexibility. In one study, Gulsan et al. discovered that clinical Pilates exercises were a safe and efficient strategy to help lumbar disc herniation patients who were having symptoms by increasing their flexibility and reducing their pain levels. The results mirrored our findings (18).

Both groups in our study demonstrated a significant improvement in spinal disc prolapse-related pain, range of motion, and disability. On outcome metrics, however, SNAGS with Pilates produced better benefits. Our outcome measures were the ODI for

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impairment, the inclinometer for range of motion, and the NPRS for pain. According to a study by Mahmoud Abo Alfa et al., both groups showed significant improvement on the end measures after the intervention, with the kinetic control group demonstrating better improvement for the Oswestry Disability Index, pain using VAS, and lumbar range of motion using an inclinometer. The kinetic control retraining intervention was superior to Mulligan's mobilization technique in terms of improving functional outcomes for patients with lumbar radiculopathy (19). According to a study by Jamali Brayjani et al., Pilates training may improve range of motion and muscular endurance in people with lumbar spine spondylolysis. Therefore, it could be suggested as a useful treatment for spondylolysis and rehabilitation (20).

For lumbar disc prolapse, our study found that three weeks of pilates training combined with SNAGS improves discomfort, range of motion, and impairment. In a study, Na-Eun Kwon et al. found that pregnant women with lumbar pain experienced less lower back pain following eight weeks of Pilates exercise. This difference may arise because SNAGS and Pilates work together to accelerate pain and discomfort treatment (21). According to a study by Atefe Askari et al., modified Pilates movements helped with lumbar-pelvic motion control, pain and disability reduction, and enhanced muscle tolerance. Thus, Pilates exercises can help people with chronic low back pain that has no apparent cause, and these results support the findings of our study (22).

According to the study's findings, both groups' lumbar disc prolapse-related discomfort, range of motion, and disability improved. However, SNAGS with pilates worked better. Pilates and SNAGs may help patients with lumbar disc bulging, as they both have the potential to reduce impairment. SNAGs can reduce disability and enhance everyday activities by restoring normal joint mechanics and functional movement patterns. Pilates' focus on core stability and general body strength can enhance functional capacity and enable people to perform daily duties with less discomfort and restriction. Patients with lumbar radiculopathy respond better to SMWLM when it comes to ROM restoration, according to a study by Bushra Ashraf et al. that found that both exercises and mobilizing the spine with leg movements were beneficial in reducing pain, increasing severity, and rising MODI scores (23).

Sample Size Limitation: The results of the study may be impacted by the extremely small sample size of 44 participants—two groups. A larger and more varied sample size could increase the results' generalizability to a larger group of individuals with bulging lumbar discs. **Application to Other Circumstances:** Because the study solely looks at patients with lumbar disc bulging, its findings cannot be used to treat patients with other lumbar conditions. The reported effects may not be instantly beneficial to patients with various spinal disorders or ailments. **Brief Intervention Time:** Three weeks may be considered a brief intervention time. A longer duration of consistent natural apophyseal glides, with and without Pilates, could provide more detailed information on the treatment's effectiveness and potential long-term consequences. **Convenient Sampling Technique:** Selection bias may result from the use of convenient sampling when participants were chosen based on their accessibility and ease of participation. The external validity of the study may be impacted, and the results may not be representative of all lumbar disc bulging patients.

To further understand the long-term benefits of natural apophyseal glides, both with

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and without Pilates, on pain, disability, and range of motion in patients with lumbar disc bulges, extends the length of the intervention. Integrating a broad patient group that reflects a range of lumbar pathologies will enable the findings to be applied to a larger population with a variety of spinal problems. External legitimacy will be enhanced as a result. Selecting a multicenter approach to conduct trials across many healthcare settings will guarantee a more representative evaluation of the effects of sustained natural apophyseal glides with and without Pilates on patients in a range of demographics and clinical scenarios. Conduct methodical long-term follow-up assessments following the intervention to see whether the observed effects are sustainable. Important information regarding the duration of pain relief, improved range of motion, and reduced impairment will be provided by these assessments.

CONCLUSION

In terms of lumbar disc prolapse patients' discomfort, range of motion, and disability, the study's findings indicated that Group A (SNAGS with Pilates) and Group B (SNAGS) had statistically significant improvements. However, when comparing the two groups, spinal flexion range of motion (ROM) and spinal extension range of motion (ROM) improved more in Group A than in Group B, and the ODI score improved more in Group A than in Group B. When combined with Pilates, SNAGS is more successful in lowering pain and impairment in lumbar disc bulging patients.

REFERENCES

- Hung IY-J, Shih TT-F, Chen B-B, Guo YL. Prediction of lumbar disc bulging and protrusion by anthropometric factors and disc morphology. *International Journal of Environmental Research and Public Health*. 2021;18(5):2521.
- Pan Q, Zhang K, He L, Dong Z, Zhang L, Wu X, et al. Automatically diagnosing disk bulge and disk herniation with lumbar magnetic resonance images by using deep convolutional neural networks: method development study. *JMIR medical informatics*. 2021;9(5):e14755.
- Singh RR, Kumar M, Sinha S. Prevalence of disc degeneration in Lumbar Spine in young adults using MRI. *Journal of advanced medical and dental sciences research*. 2019;7(12):184-7.
- Scarcia L, Pileggi M, Camilli A, Romi A, Bartolo A, Giubbolini F, et al. Degenerative disc disease of the spine: from anatomy to pathophysiology and radiological appearance, with morphological and functional considerations. *Journal of Personalized Medicine*. 2022;12(11):1810.
- Luoma K, Riihimäki H, Luukkonen R, Raininko R, Viikari-Juntura E, Lamminen A. Low back pain in relation to lumbar disc degeneration. *Spine*. 2000;25(4):487-92.
- Grabovac I, Dorner TE. Association between low back pain and various everyday performances: Activities of daily living, ability to work and sexual function. *Wiener klinische Wochenschrift*. 2019;131(21-22):541-9.
- Atlas SJ, Chang Y, Kammann E, Keller RB, Deyo RA, Singer DE. Long-term disability and return to work among patients who have a herniated lumbar disc: the effect of disability compensation. *JBJS*. 2000;82(1):4-15.
- Kirnaz S, Capadona C, Wong T, Goldberg JL, Medary B, Sommer F, et al.

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

- Fundamentals of intervertebral disc degeneration. *World Neurosurgery*. 2022;157:264-73.
- Cossin J. Improving Shoulder Pain and Range of Motion in an Adult With Shoulder Impingement Syndrome via the Cervicothoracic Junction: Azusa Pacific University; 2018.
- Powell M, Szypryt P, Wilson M, Symonds E, Worthington B. Prevalence of lumbar disc degeneration observed by magnetic resonance in symptomless women. *The Lancet*. 1986;328(8520):1366-7.
- Mistry J, Heneghan NR, Noblet T, Falla D, Rushton A. Diagnostic utility of patient history, clinical examination and screening tool data to identify neuropathic pain in low back related leg pain: a systematic review and narrative synthesis. *BMC Musculoskeletal Disorders*. 2020;21(1):532.
- Manzoor T, Arshad N, Nasir N, Zia A. Effect of modified lumbar-sustained natural apophyseal glides (Snags) in nonspecific low back pain. *Saudi Journal of Sports Medicine*. 2019;19(3):86-91.
- Young IA, Dunning J, Butts R, Mourad F, Cleland JA. Reliability, construct validity, and responsiveness of the neck disability index and numeric pain rating scale in patients with mechanical neck pain without upper extremity symptoms. *Physiotherapy theory and practice*. 2019;35(12):1328-35.
- Sani A, Purnawati S, Sugijanto S, Samatra DP, Adiatmika I, Widiyanti IA. The addition of snags is faster to reduce pain and disability comparing with conventional therapy only among HNP lumbar grade I and II. *Health Notions*. 2022;6(8):362-7.
- Ahmed M, Anwar N, Tauqeer S, Khalid K, Shakeel H. EFFECTS OF LUMBAR SNAG AND MECHANICAL TRACTION IN PATIENTS WITH DISCOGENIC LUMBOSACRAL RADICULOPATHY. *Pakistan Armed Forces Medical Journal*. 2021;71(4):1265-68.
- Abdelbaky AA, Hussein HM, Raoof NAA. Efficacy of SNAGs on dynamic balance level and pain intensity on chronic non-specific low back pain. *balance*. 6:9.
- Shetty PB, Balasaravanan R, Ravish V, BN PK. Study on short term effect of modified lumbar snags with conventional program in non-specific chronic low back pain patients. *Int J Physiother Res*. 2020;8(5):3639-47.
- Taşpınar G, Angın E, Oksüz S. The effects of Pilates on pain, functionality, quality of life, flexibility and endurance in lumbar disc herniation. *Journal of comparative effectiveness research*. 2023;12(1):e220144.
- Abo Alfa M, Elsayed E, Shendy W, Elawady M, Elkafrawy N. Kinetic control versus Mulligan mobilization effect on functional outcomes in patients with lumbar radiculopathy: Randomized comparative study. *Egyptian Journal of Chemistry*. 2021;64(10):5597-606.
- Jamali Brayjani S, Rahnema N, Abrishamkar S. The Effect of Pilates Exercises on Muscular Endurance of the Central Part of Body and the Range of Motion of Lumbar Spine in Patients with Spondylolysis. *Journal of Paramedical Sciences & Rehabilitation* 2019;8(1):7-16.
- Kwon N-E. Effects of Pilates Exercise on Pelvic Angle, Back Pain, and Physical Fitness in Pregnant Woman with Lumbar Pain. *PNF and Movement*. 2020;18(3):351-63.

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

- Askari A, Ashtianiy A, Ghiasi F, Hosseinifar M, Akbari A. Modified Pilates versus general exercises effectiveness on lumbopelvic motor control, trunk muscles endurance, in nonspecific chronic low back pain women. J Adv Pharm Educ Res. 2020;10:8-13.
- Ashraf B, Ahmad S, Ashraf K, Kanwal S, Ashraf S, Khan N, et al. Effectiveness of spinal mobilization with leg movement versus McKenzie back extension exercises in lumbar radiculopathy. Pakistan Journal of Medical and Health Sciences. 2021;15(5):1436-40.