Effects of Slider, Tensioner Neurodynamic Mobilization Techniques and Stretching Exercises in Treatment of Chronic Discogenic Sciatica: A Comparative Study

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Abstract

Background: Sciatica is a critical musculoskeletal disorder affecting many people and its related disabilities disturb their lives.

Methods: The study purpose was to see which one of two neurodynamic techniques and stretching exercises has a better effect on improving symptoms and dysfunction for cases of sciatica due to disc herniation. There were 36 unilaterally affected participants. They were assigned at random into three groups; participants in the first were treated by the slider technique, while participants in the second were treated by the tensioner technique, and participants in the third were treated by stretching. The treatment program was set to be 6 successive sessions in 2 weeks. The therapist assessed the participants pre and post-program.

Results: The statistical analysis revealed that there were significant differences in favor of the slider and tensioner techniques compared with stretching. Furthermore, there were found significant differences in favor of the slider as compared to the tensioner technique regarding range of motion (ROM).

Conclusion: Slider and tensioner techniques have better clinical results than stretching exercises in improving symptoms and dysfunction with a greater effect for the slider technique in enhancing ROM.

Trial registration: This study was executed under the ethical guidelines of 1964 declaration of Helsinki and was registered in the clinical trial registry with clinical trial.gov on 10/02/2021, ID: NCT04746690.

Introduction

Low back pain (LBP) and sciatica has a growing clinical interest for many people due to their consequences on personal behavior and productivity at work (1). Sciatica refers to a set of symptoms including pain, numbness, muscular weakness, and movement limitations due to compression and irritation of the sciatic nerve. Pain is usually felt in the lower back, buttocks, and several dermatomes of affected thigh, leg, and foot (2). It affects many people and its related disabilities disturbs their lives (3). Sciatica affects females more than males and affects people with sedentary life style more than active ones (4). It may appear either suddenly with aggressive activity or gradually, and in most cases it comes unilateral (5).

Sciatica may be caused by disc bulge or herniation, lumbar canal stenosis, spondylolisthesis, trauma, piriformis syndrome, and spinal tumors (6). In about 90% of cases, sciatica results from sciatic nerve compression as a result of a herniated disc (7). Discogenic sciatica may be accompanied by LBP of variable intensity. Increased pain with coughing, sneezing, straining, or other forms of the Valsalva manoeuvres indicate a disc lesion (5). Nerve root compression due to disc herniation induces nerve inflammation and decreases nerve blood flow, which accumulates inflammatory mediators and induces pain (8, 9). Furthermore, there is block of neural conduction, oedema, and mechanical sensitization (10).

Physiotherapy is considered a golden standard for treatment of sciatica (11). Neurodynamic mobilization can greatly reduce inflammatory mediators and consequently pain after sciatic nerve compression (12). Furthermore, mobilization of the sciatic nerve, after experimentally induced sciatica in rats, reduced intraneural oedema and adhesions and finally recover nerve mechano-sensitivity (13). Neurodynamic mobilization plays a great role in restoring the neural tissue ability to withstand the stress or tension via inducing reconstruction of normal physiological functions, reduction of pain, and improvement of function (14).

The slider neurodynamic mobilization technique produces sliding movement of the neural tissue in relation to its adjacent structures, which distributes tension and compression along the nervous system instead of one specific region. The tensioner neurodynamic mobilization technique produces tension in the neural tissue but without exceeding the tissue elastic capacity which increase viscoelastic properties of the nerve. This is obtained via bringing the nerve into an elongated position, end-range movement, holding this position for a short period, and then completely releasing this tension (15). Stretching exercises represent a good treatment to reduce pain and increase range of motion (ROM). It represents an essential component of physiotherapy programs for treatment of chronic LBP (16). Poor ergonomics and assuming poor posture during activities of daily living led to restrictions of the spinal mobility, which induce disc herniation and LBP. The musculoskeletal restrictions impair normal muscle synergies which increase the energy needed to maintain stable posture (17). Ergonomic advices can greatly reduce painful symptoms and help patients to live and work pain free (18).

Neurodynamic mobilization is very effective in reducing symptoms and limitations in discogenic sciatica (19). It significantly reduced sciatic pain and restored sciatic nerve mobility (20, 21). The current work took a step in getting an evidence of the best treatment modalities in the management of sciatica and its related disabilities. Up to the authors knowledge, there is no previous study directly compared the slider technique, the tensioner technique, and stretching exercises for chronic discogenic sciatica. Therefore, the aim of this study is to determine which intervention is most effective in reducing pain, increasing ROM, and improving functional disability. It was hypothesized that there are no significant differences between slider technique alone, and tensioner technique alone or stretching exercises alone on pain intensity, ROM of hip flexion from straight leg raising position, knee extension from slump position, lumbar flexion, and functional disability in patients with chronic discogenic sciatica.

Materials And Methods

Study design and sample size calculation

This study was a comparative randomized, single blinded (Only the therapist knows which technique or exercise was given to each patient without informing patients which group they were in), controlled clinical trial. It was conducted at the Kafrelsheikh University physical therapy faculty outpatient clinics from September 2020 to March 2021. Using G-power version 3.1.9.7 for windows to make a preliminary power analysis and regarding F-test study, alpha level of 0.05, confidence interval 95% and effect size of 0.25, the total sample size was 36 patient (twelve in each group).

Inclusion criteria

Patients were eligible for participation in this study if their age ranged between 21–50 years, both genders, diagnosed by magnetic resonance imaging to confirm disc lesion, had radicular pain for more than 12 weeks up to 1 year with no acute episodes in the last 4 weeks, had a positive slump test with reproduction of neurological symptoms, and had functional disabilities in certain daily tasks as in lifting or walking.

Exclusion criteria

Patients were excluded if they had sciatica due to other pathologies (e.g. lumbar canal stenosis or piriformis syndrome), had any prior spinal surgery (e.g. unilateral hemilaminectomy or microdiscectomy), had a negative slump test, had progressive neurological symptoms (e.g. hyperirritable and unstable symptoms), history of vertebral fracture or trauma, had systemic disorders (e.g. diabetes mellitus), or were pregnant.

Patients preparation and randomization

To reach the specific sample size, 47 patients were enrolled (to consider the drop-out from the time of randomization to the end of the treatment protocol) and assessed using the inclusion/exclusion criteria. Patients who are not eligible or did not adhere to the study assumptions or the ergonomic advice were excluded. The flow chart of this study is shown in figure (fig.) (1).

To avoid selection bias, the patients were randomly allocated by simple random method via choosing one of three wrapped cards representing the three treatment groups. Group (A) received the slider neurodynamic mobilization, while group (B) received the tensioner neurodynamic mobilization, and group (C) received stretching exercises of back extensors, hamstrings and gastrocnemius muscles. Furthermore, ergonomic advices were given to all groups.
To provide safe and effective treatment, all interventions, evaluation and recording of all measurements pre- and post-treatment were performed by the primary investigator (the same therapist). He has more than 5 years of experience in physical therapy and underwent formal training in clinical neurodynamics including techniques application from professors in faculty of physical therapy Cairo University. All patients, eligible for the study by the inclusion criteria, were given explanation of the treatment protocol in a simple language and they had the willing and the ability to participate in the study. It was assumed that all patients were directed by the therapist to stop taking pain-relieving drugs or perform any stressful physical work that may interfere with the treatment effectiveness during participating in this study. Furthermore, they all adhered to the precautionary measures against the pandemic Corona virus disease-2019 (Covid-19) during the sessions.

Clinical evaluation

The slump test:
The slump test resembles the straight leg raising (SLR) test performed in sitting position combined with spinal flexion that induces more neural tension (22). Patient is in sitting position on the edge of a plinth, asked to flex thoracic and lumbar spine first, then asked to flex his neck to get his chin on his chest. The examiner's hand is placed on the top of the patient's head and his elbow on the patient's thoracic spine maintaining this position. The patient is asked to actively extend his knee and dorsiflex his ankle until reproduction of his pain/symptoms or until his end range is reached. Finally, as a structural differentiation manoeuvre, the examiner removed his hand from the head of the patient and asked him to look up; if the neural tissue is affected, the symptoms will decrease which indicate a positive slump test (23).

Assessment procedures

Measurement of pain intensity using the visual analogue scale (VAS):

Asking the patient to put a horizontal mark on a continuous 10 cm line that represents his pain intensity, ranging from zero, which indicates no pain, or discomfort to 10, which indicates the worst possible pain he could feel (24). It has good validity and reliability for pain intensity measurement (25).

Measurement of hip flexion ROM during passive SLR using the universal goniometer:

From the supine position, the hip is flexed until symptoms was reproduced or until the limit of motion while keeping the knee extended and the ankle relaxed in plantar flexion. The patient's non-tested lower limb is fixed on the plinth using a strap for pelvic stabilization (26).

Measurement of knee extension ROM during the slump position using the universal goniometer:

The patient is in the same position of slump test and his cervical spine is in the neutral position. A strap is fastened across his thighs to stabilize it and avoid substitutions. The patient is asked to flex his neck until his chin touch his chest, maintaining this position, then the examiner applied ankle dorsiflexion and passively extends the knee joint until the onset of reproduction of symptoms. The ROM of knee flexion at this limit is measured relative to the operationally defined zero position (27).

Measurement of lumbar flexion ROM by Modified-Modified Schober Test (MMST):

From standing position with feet are shoulder width apart, a marker and measurement tape were used to measure the distance between two points; the first is the midpoint of the line connecting the posterior superior iliac spines, while the second point lies 15 cm above the first. After that, the patient was asked to flex his trunk as much as he could. A second measure was taken to measure the distance between the same points. The difference between the two measures indicates the lumbar flexion ROM (26). MMST has high validity (28) and excellent reliability (29), for lumbar flexion ROM measurement.

Assessing functional disability using the Oswestry disability index (ODI):

ODI is a self-administered questionnaire, which includes 10 items; each contains six levels ranging between 0–5. Its items include pain intensity, personal care, lifting objects, walking, sitting, standing, sleeping, sex life, social life, and travelling. A total score is calculated, divided by 50 and multiplied by 100. It ranges between 0% indicating no disability to 100% indicating complete disability. Interpretation of ODI based on scores as following: from 0 to 20% indicates minimal disability; from 20 to 40% moderate disability; from 40 to 60%: severe disability; from 60 to 80% crippled and greater than 80%: the patient has excessive incapacity (30). Arabic version of ODI is simple to understand and has high validity and reliability for assessment of functional disability (31).

Treatment procedures

The treatment protocol in each group consisted of three sessions per week for two weeks.

The slider neurodynamic mobilization technique:

In the slump position, the patient was sitting at the edge of the plinth with the thighs parallel to each other and arms crossing behind the back. The examiner asked the patient to move actively and conversely from a position of neck and trunk flexion, knee flexion, and ankle plantar flexion, to a position of neck and trunk extension, knee extension, and ankle dorsiflexion (15).

The tensioner neurodynamic mobilization technique:

In the slump position, the patient was sitting at the edge of the plinth with the thighs parallel to each other and arms crossing behind the back. The examiner asked the patient to move actively and conversely from a position of neck and trunk extension, knee flexion, and ankle plantar flexion, to a position of neck and trunk flexion, knee extension, and ankle dorsiflexion (15).

Both techniques (slider and tensioner) were provided three sets in every session; the first: 10 repetitions, while the second: 15 repetitions, and the third: 20 repetitions. The repetitions were gradually increased to assure patients tolerance and to eliminate any adverse response during the techniques. The end position is hold for 5 seconds and the rest between sets is 5 minutes.

Stretching exercises:

Stretching of back extensor muscles:

The patient assumed cross sitting position and asked to place his hands behind his neck adducting his scapulae and extending his thoracic spine to lock the thoracic vertebrae. The examiner stabilized the patient's pelvis via pulling back on the anterior-superior iliac spines and asked the patient to lean the trunk anteriorly flexing only at the lumbar spine (32).

Stretching of the hamstrings muscle:

The patient assumed long sitting position and asked to lean forward as much as he could and the examiner press down with his hands against the femur just above (not on) the patella to maintain knee extension (22).

Stretching of the gastrocnemius muscle:

The patient is standing on an inclined board with the patient's toes pointing upward and heels downward, and asked to lean forward as much as he could. Little effort is needed to maintain this stretching position for extended periods (22).

Each muscle stretching was hold for 30 seconds, then a relaxation period of 30 seconds, three repetitions every session. Furthermore, one minute rest was given between stretching of each muscle.

Ergonomic advice:

Ergonomic advice was given to each patient to help him live, work and sleep comfortably, as the following:
A. Maintain good posture, and stand up erect without deviations.
B. Avoid sitting or standing for long time and take regular breaks with standing or walking around during work. Furthermore, put one foot on a footrest with switching your feet along work hours.
C. Maintain proper sleeping posture to minimize stress on your back via sleeping on one side or on your back with bending the knees slightly over a pillow.
D. Lift objects safely; make sure you lift anything from the squatting position and the weight is near to the body as much as you can.
E. Avoid wearing high heels: greater than 1½ inches high may predispose you to pain or injury due to anterior shift of the body weight.
F. Do swimming regularly to strengthen muscles (6).
The examiner provided written notes and pictures illustrating these advices to all patients.

Data collection and statistical analysis

Demographic data of all patients in the three groups were collected. They included age, weight, height, body mass index (BMI), radicular pain duration, gender, and affected side. In addition, pre- and post-treatment measurements of pain intensity (VAS), ROM of hip flexion, knee extension, and lumbar flexion, and functional disability (ODI). The statistical analysis was performed using SPSS, version 26 for windows (Armonk, NY: IBM Corp). Descriptive statistics (mean and standard deviation) of the demographic data of all patients in the three groups. One-way analysis of variance (ANOVA) and chi-square tests were used for comparison of demographic data between the three groups. Paired t-test was used to compare between the pre- and post-treatment mean values of all variables in the three groups.

One-way multivariate analysis of variance (MANOVA) test was used to compare all the dependent variables pre- and post-treatment between the three groups. Post hoc analysis was done for multiple comparisons using Tukey test. Level of significance for all tests was set at p-value $\leq$ 0.05.

Results

All data were normally distributed as assessed by Shapiro–Wilk test and histograms and revealed homogeneity of variance as assessed by Levene's test with p-value □ 0.05. No univariate or multivariate outliers in the present data as tested using Mahalanobis distance and no multicollinearity as assessed by correlation analysis.

There were no significant differences between the mean values of age (p = 0.59), weight (p = 0.45), height (p = 0.85), BMI (p = 0.43), and radicular pain duration (p = 0.76) for all groups as assessed by one-way ANOVA test. No significant difference were founded between the three groups for gender (p = 0.89) and affected leg side (p = 0.43) as assessed by Chi-square test, table (1).

Table 1
Descriptive statistics of all patients in the slider, tensioner, and stretching groups.

Items		**Mean ± SD**			**P-value**
		Slider group	**Tensioner group**	**Stretching group**	
Age (years)		35.83 ± 7.18	32.92 ± 7.33	34.92 ± 6.46	0.59
Weight (kg)		78.25 ± 6.58	78.92 ± 5.92	81.17 ± 4.88	0.45
Height (cm)		170.83 ± 7.33	172.5 ± 6.92	171.25 ± 7.79	0.85
BMI (kg/m^2)		26.83 ± 3.71	26.42 ± 1.93	27.92 ± 2.75	0.43
Radicular pain duration (months)		5.92 ± 2.47	6.17 ± 2.69	5.42 ± 2.39	0.76
Gender	Males (%)	5 (41.7)	5 (41.7)	4 (33.3)	0.89
	Females (%)	7 (58.3)	7 (58.3)	8 (66.7)	
Affected side	Right (%)	8 (66.7)	9 (75)	6 (50)	0.43
	Left (%)	4 (33.3)	3 (25)	6 (50)	

BMI = Body mass index, SD = Standard deviation, P-value = probability.

Pain intensity (VAS):

Paired t-test Pre- and post-treatment mean comparison for each group founded significant differences in the slider (p = 0.0001*), tensioner (p = 0.0001*), and stretching (p = 0.0001*) groups as shown in table (2) and figure (2).

Table 2
Paired t-test comparison for pre and post-treatment mean values of pain intensity (VAS) for all patients in the slider, tensioner, and stretching groups.

Items	Pain intensity (VAS) Mean ± SD		Mean difference	% of improvement	T-value	P-value	Sig.
	Pre	Post					
Slider group	7.42 ± 1.17	2.75 ± 1.36	4.67	62.94%	18.21	0.0001*	**S**
Tensioner group	6.83 ± 1.53	3.08 ± 1.24	3.75	54.9%	10.69	0.0001*	**S**
Stretching group	7.08 ± 1.24	4.83 ± 1.64	2.25	31.78%	7.39	0.0001*	**S**
VAS = Visual analogue scale, SD = Standard deviation, % = Percentage, T-value = t-statistic, P-value = Probability, Sig. = Significance, * = Statistically significant, S = Significant.							

VAS = Visual analogue scale.

Hip flexion ROM:

Paired t-test Pre- and post-treatment mean comparison for each group founded significant differences in the slider (p = 0.0001*), tensioner (p = 0.0001*), and stretching (p = 0.0001*) groups, as shown in table (3) and figure (3).

Table 3
Paired t-test comparison for pre and post-treatment mean values of hip flexion ROM for all patients in the slider, tensioner, and stretching groups.

Items	Hip flexion ROM Mean ± SD		Mean difference	% of improvement	T-value	P-value	Sig.
	Pre	Post					
Slider group	52.58 ± 5.35	82.83 ± 4.13	-30.25	57.53%	-17.24	0.0001*	**S**
Tensioner group	52.08 ± 4.21	75.67 ± 4.96	-23.58	45.28%	-23.5	0.0001*	**S**
Stretching group	54.08 ± 5.35	69.33 ± 6.04	-15.25	28.2%	-14.2	0.0001*	**S**
ROM = Range of motion, SD = Standard deviation, % = Percentage, T-value = t-statistic, P-value = Probability, Sig. = Significance, * = Statistically significant, S = Significant.							

ROM = Range of motion.

Knee extension ROM:

Paired t-test Pre- and post-treatment mean comparison for each group founded significant differences in the slider (p = 0.0001*), tensioner (p = 0.0001*), and stretching (p = 0.0001*) groups, as shown in table (4) and figure (4).

Table 4
Paired t-test comparison for pre and post-treatment mean values of knee extension ROM for all patients in the slider, tensioner, and stretching groups.

Items	Knee extension ROM Mean ± SD		Mean difference	% of improvement	T-value	P-value	Sig.
	Pre	Post					
Slider group	31.92 ± 3.37	14.08 ± 3.32	17.83	55.86%	37.62	0.0001*	**S**
Tensioner group	33.83 ± 4.15	19.08 ± 3.61	14.75	43.6%	16.93	0.0001*	**S**
Stretching group	31.08 ± 4.32	24.25 ± 3.84	6.83	21.98%	15.5	0.0001*	**S**
ROM = Range of motion, SD = Standard deviation, % = Percentage, T-value = t-statistic, P-value = Probability, Sig. = Significance, * = Statistically significant, S = Significant.							

ROM = Range of motion.

Lumbar flexion ROM:

Paired t-test Pre- and post-treatment mean comparison for each group founded significant differences in the slider (p = 0.0001*), tensioner (p = 0.0001*), and stretching (p = 0.002*) groups, as shown in table (5) and figure (5).

Table 5

Paired t-test comparison for pre and post-treatment mean values of lumbar flexion ROM for all patients in the slider, tensioner, and stretching groups.

Items	Lumbar flexion ROM Mean ± SD		Mean difference	% of improvement	T-value	P-value	Sig.
	Pre	Post					
Slider group	4.75 ± 1.14	7.25 ± 0.97	-2.5	52.63%	-8.66	0.0001*	**S**
Tensioner group	4.67 ± 1.07	6.17 ± 0.94	-1.5	32.12%	-6.51	0.0001*	**S**
Stretching group	4.17 ± 1.19	4.92 ± 0.98	-0.75	17.99%	-4.18	0.002*	**S**

ROM = Range of motion, SD = Standard deviation, % = Percentage, T-value = t-statistic, P-value = Probability, Sig. = Significance, * = Statistically significant, S = Significant.

ROM = Range of motion.

Functional disability (ODI):

Paired t-test Pre- and post-treatment mean comparison for each group founded significant differences in the slider (p = 0.0001*), tensioner (p = 0.0001*), and stretching (p = 0.0001*) groups, as shown in table (6) and figure (6).

Table 6

Paired t-test comparison for pre and post-treatment mean values of functional disability (ODI) for all patients in the slider, tensioner, and stretching groups.

Items	Functional disability (ODI) Mean ± SD		Mean difference	% of improvement	T-value	P-value	Sig.
	Pre	Post					
Slider group	44.42 ± 4.79	18 ± 3.52	26.42	59.48%	30.21	0.0001*	**S**
Tensioner group	42.08 ± 3.37	21.08 ± 2.68	21	49.9%	30.64	0.0001*	**S**
Stretching group	43.83 ± 2.92	28.08 ± 4.94	15.75	35.93%	19.05	0.0001*	**S**

ODI = Oswestry disability index, SD = Standard deviation, % = Percentage, T-value = t-statistic, P-value = Probability, Sig. = Significance, * = Statistically significant, S = Significant.

ODI = Oswestry disability index.

One-way MANOVA for the pre-treatment means of all outcomes between the three groups revealed no significant differences between the slider, tensioner, and stretching groups for pain intensity (VAS) ($p = 0.6$), hip flexion ROM ($p = 0.61$), knee extension ROM ($p = 0.24$), lumbar flexion ROM ($p = 0.41$), and functional disability (ODI) ($p = 0.3$).

One-way MANOVA for the post-treatment means of all outcomes between the three groups revealed significant differences between the slider, tensioner, and stretching groups for pain intensity (VAS) ($p = 0.002$*), hip flexion ROM ($p = 0.0001$*), knee extension ROM ($p = 0.0001$*), lumbar flexion ROM ($p = 0.0001$*), and functional disability (ODI) ($p = 0.0001$*).

Post hoc tests (Tukey) for multiple comparisons between post-treatment means of all outcomes between the three groups, (Table 7), revealed significant differences in the slider group as compared to the stretching group in all outcomes. Furthermore, there were significant differences in the tensioner group as compared to the stretching group in all outcomes. Moreover, there were significant differences in the slider group as compared to the tensioner group in ROM of hip flexion, knee extension, and lumbar flexion.

Table 7
Multiple comparisons: post hoc tests (Tukey).

Groups	Mean difference	P-value	Sig.
Pain intensity (VAS)			
Slider - Tensioner groups	-0.33	0.84	**NS**
Slider - Stretching groups	-2.08	0.003*	**S**
Tensioner – Stretching groups	-1.75	0.01*	**S**
Hip flexion ROM			
Slider - Tensioner groups	7.17	0.004*	**S**
Slider - Stretching groups	13.5	0.0001*	**S**
Tensioner – Stretching groups	6.33	0.01*	**S**
Knee extension ROM			
Slider - Tensioner groups	-5	0.005*	**S**
Slider - Stretching groups	-10.17	0.0001*	**S**
Tensioner – Stretching groups	-5.17	0.004*	**S**
Lumbar flexion ROM			
Slider - Tensioner groups	1.08	0.03*	**S**
Slider - Stretching groups	2.33	0.0001*	**S**
Tensioner – Stretching groups	1.25	0.009*	**S**
Functional disability (ODI)			
Slider - Tensioner groups	-3.08	0.14	**NS**
Slider - Stretching groups	-10.08	0.0001*	**S**
Tensioner – Stretching groups	-7	0.0001*	**S**

VAS = Visual analogue scale, ROM = Range of motion, ODI = Oswestry disability index, P-value = probability, Sig.= Significance, *= Statistically significant, NS = Non-significant, S = significant.

Discussion

The current work compared the effectiveness of slider and tensioner neurodynamic mobilization techniques and stretching exercises on pain, function, and ROM of patients with chronic discogenic sciatica. The main finding of this clinical trial is that slider and tensioner neurodynamic mobilization techniques were more effective compared to stretching exercises in reducing pain, increasing hip flexion, knee extension and lumbar flexion ROM, and improving functional disability. Furthermore, it was founded that the slider technique had a greater effect as compared to the tensioner technique regarding ROM and succeeded to improve mobility of hip flexion, knee extension, and lumbar flexion.

This study results supported the effectiveness of neurodynamic mobilization in the management of discogenic sciatica concerning pain alleviation and sciatic nerve mobility restoration. After nerve root compression, the nerve induces oedema and hypoxia which compromise microcirculation. Neurodynamic mobilization techniques associated with short, sustained movements was effective to reduce oedema and alleviate hypoxia which further reduced the associated symptoms and dysfunctions (15).

Slider techniques are very effective in the treatment of neural disorders in which the pain is the chief complain. It removes the inflammatory exudates and facilitates tissue oxygenation which help to restore the normal physiological status of the nerves. On the other hand, tensioner techniques are used to induce viscoelastic, movement related and physiological reactions in the neural tissues. Tension is applied to the neural tissues via increasing the distance between both ends of the nerve (15).

Slider techniques mobilize the nerve over their distal root while relieve stress over their proximal attachment and vice versa. On the other hand, tensioner techniques further mobilize the nerve over their proximal and distal attachment at the same time. Thus, slider techniques induce less nerve strain than tensioner techniques (33).

The findings of this study are in line with the results of the in vivo trial using ultrasound imaging conducted by Ellis et al., (34) who measured longitudinal sciatic nerve movement during the slider and tensioner neurodynamic mobilization techniques. He founded that both techniques induced improvement in sciatic nerve mobility and excursion with a more significant effect for the slider technique.

Moksha et al., (35) compared the effectiveness of the slider and tensioner neurodynamic mobilization techniques combined with home exercise program on 60 patients with Non-specific LBP associated with radicular lower limb symptoms. He founded that both techniques have better positive effects on reducing pain intensity, increasing hip flexion ROM, and improving functional disability with more significant effect for the slider neurodynamic mobilization technique in all outcomes measured. This results are in contrast to our findings of this study regarding the pain intensity and functional disability, which may be attributed to differences in sample size being double of the sample used in current work.

The slider technique had immediate effect on improving knee extension ROM in patients with sciatica (36). It improved knee extension and hip flexion ROM more than the tensioner technique group or the control joint mobilization group in patients with short hamstring syndrome in a recent randomized controlled trial (RCT) with a large sample size of 105 participants (37).

The findings of the current study differs from the trial conducted by Herrington (38), who applied both slider and tensioner neurodynamic mobilization techniques and founded that both techniques increased

ROM of knee extension with no statistical significant difference between them. It may be attributed to the participants age and activity level being young healthy female subjects. Another comparison for the healthy subjects with hamstring tightness was applied in the three-armed RCT conducted by Sharma et al., (39) who combined the slider and tensioner neurodynamic mobilization techniques with static hamstrings stretching in two separate experimental groups, while the third control group received only static hamstrings stretching. He founded that both techniques have better effects than static stretching in improving knee extension ROM but with no statistically significant difference between them.

The slider technique, when applied in combination with conventional physiotherapy (CP), was founded to be more effective in reducing pain intensity, improving hip flexion ROM, and improving functional capabilities more than the CP alone for patients with chronic discogenic sciatica (40). Furthermore, pain intensity, hip flexion ROM, functional disability, and lumbar flexion ROM measured by MMST were improved when slider technique combined with CP compared to CP alone in patients with sub-acute discogenic sciatica (41).

The current work took a step in getting an evidence of the best treatment modalities in the management of sciatica and its related disabilities, but it faced some limitations. Pain intensity measurements may be affected by the patient's psychological conditions during assessment. Furthermore, variations in individual's commitment to the study assumptions and ergonomic advice may have affected the results. The patient's commitment in this critical time while the pandemic Covid-19 invades the whole world was affected, which made some patients involuntarily not capable to complete the treatment protocol.

Further studies should be conducted including large sample sizes with long-term follow up. Furthermore, more objective tools e.g., electro goniometer or computer assisted video motion analysis system to measure ROM should be used. Ultrasonography, to assess nerve excursion, should be applied in well-designed trials.

Conclusions

Slider and tensioner neurodynamic mobilization techniques are more effective than stretching exercises in terms of reducing pain intensity, increasing ROM of hip flexion, knee extension, and lumbar flexion, and improving functional capabilities for patients with chronic discogenic sciatica. the slider technique has a greater effect than the tensioner technique in enhancing ROM of hip flexion, knee extension, and lumbar flexion. The findings of the current study demonstrate that the slider and tensioner neurodynamic mobilization techniques should be included in the physiotherapy programs in treatment of patients with chronic discogenic sciatica noting that the slider technique has better effects and more comfortable for patients.

Abbreviations

ANOVA: Analysis of variance; BMI: Body mass index; Covid-19: Corona virus disease-2019; CP: Conventional physiotherapy; Figure: Fig.; LBP: Low back pain; MANOVA: Multivariate analysis of variance; MMST: Modified-modified schober test; ODI: Oswestry disability index; RCT: Randomized controlled trial; ROM: Range of motion; SLR: Straight leg raising; SPSS: Statistical package for social sciences; VAS: Visual analogue scale.

Declarations

Ethics approval and consent to participate

All patients were invited to join the study and signed informed consent form for their approval and the study was approved by the Ethical Committee for Human Research at the Faculty of Physical Therapy, Cairo University, Egypt (Reference number: P.T. REC/012/002874).

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare no conflict of interest.

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Authors' contributions

The first author, Haytham Ibrahim Morsi, put the research concept and design, collected the data, analyzed and interpreted them, and finally wrote the article. The critical revision for the article and final approval was done by the second author, Bassem Galal Eldein El Nahass, and the third author, Mona Mohamed Ibrahim.

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Figures

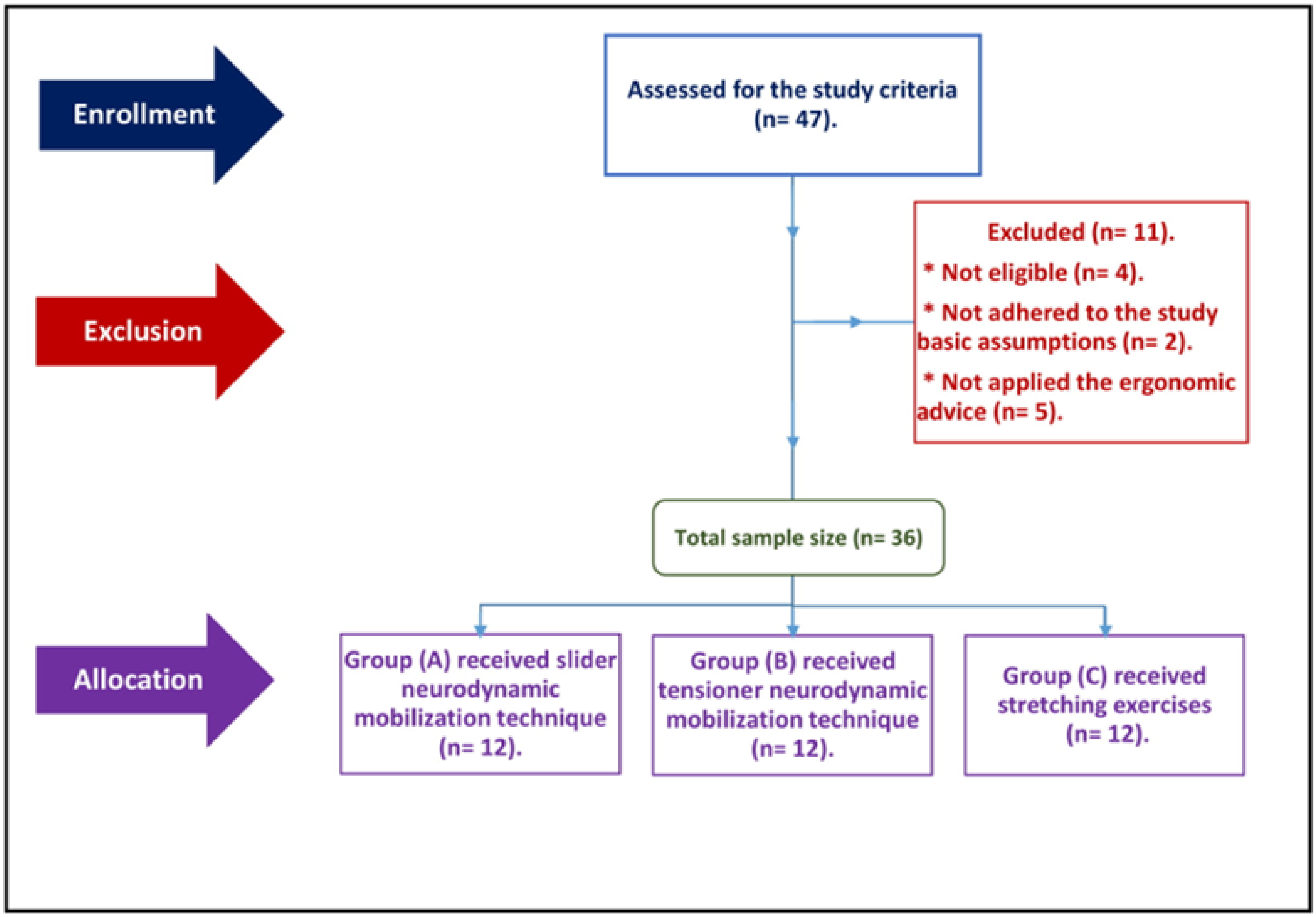
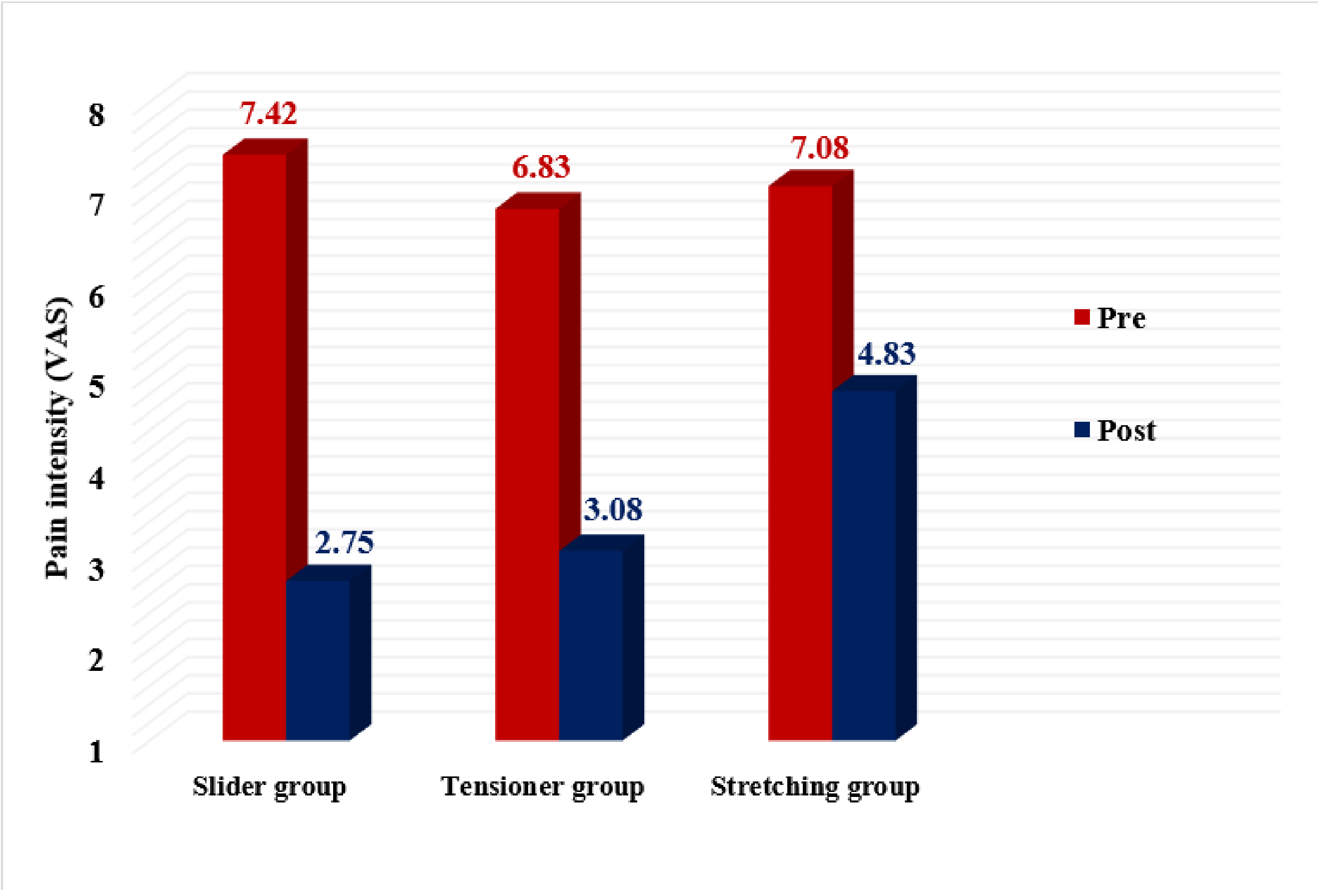


Figure 1

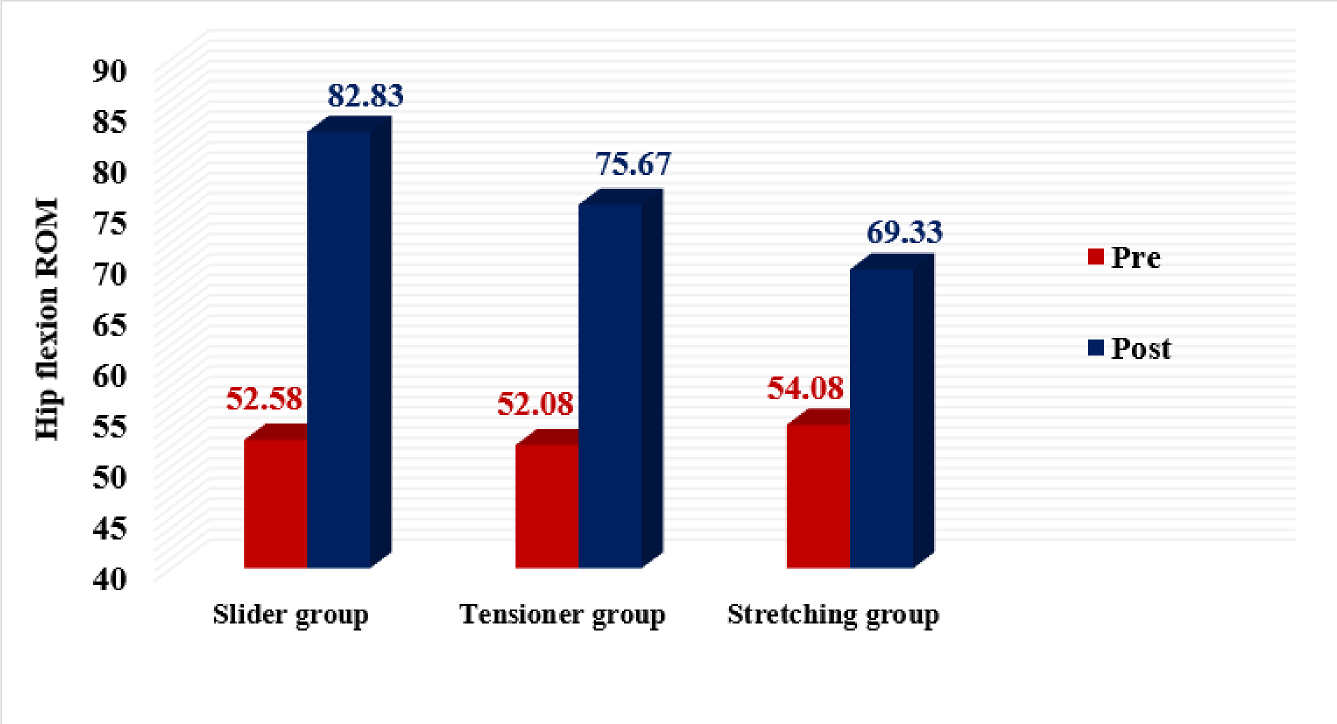
The study flow chart.



VAS= Visual analogue scale.

Figure 2

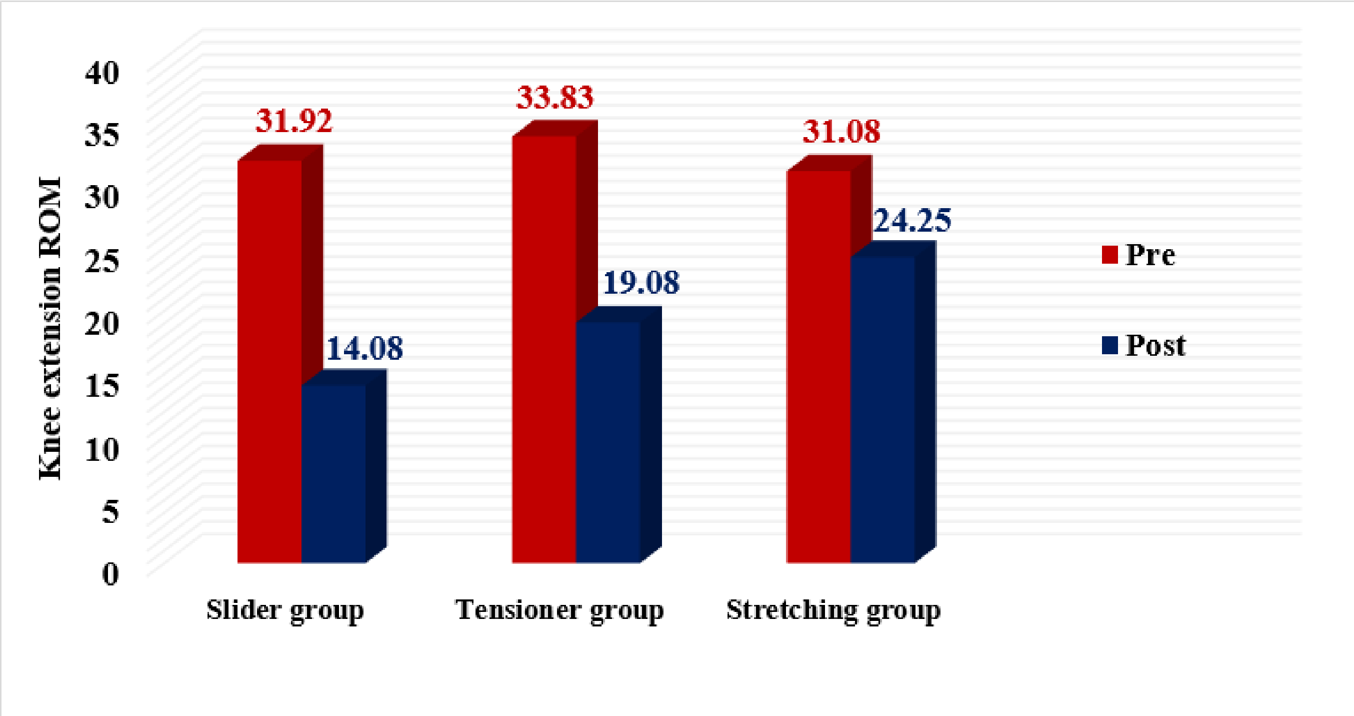
Pre and post-treatment mean values of pain intensity (VAS) for all patients in the slider, tensioner, and stretching groups.



ROM= Range of motion.

Figure 3

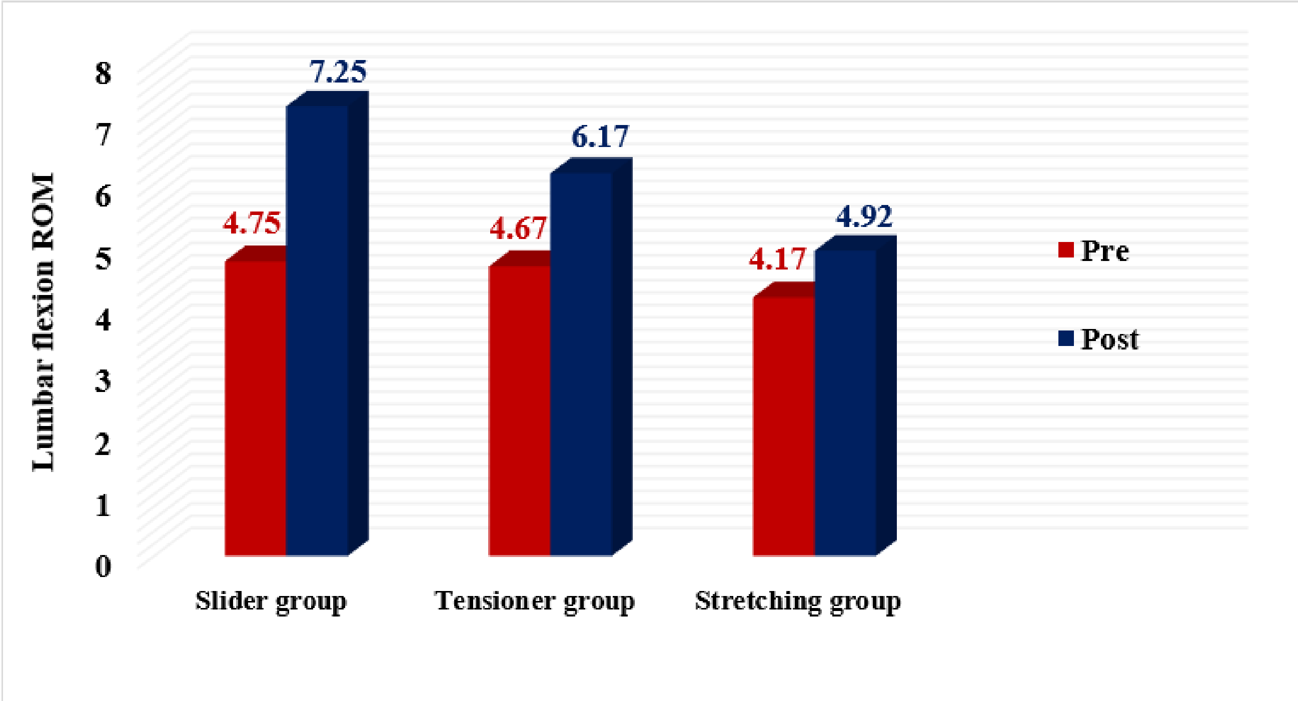
Pre and post-treatment mean values of hip flexion ROM for all patients in the slider, tensioner, and stretching groups.



ROM= Range of motion.

Figure 4

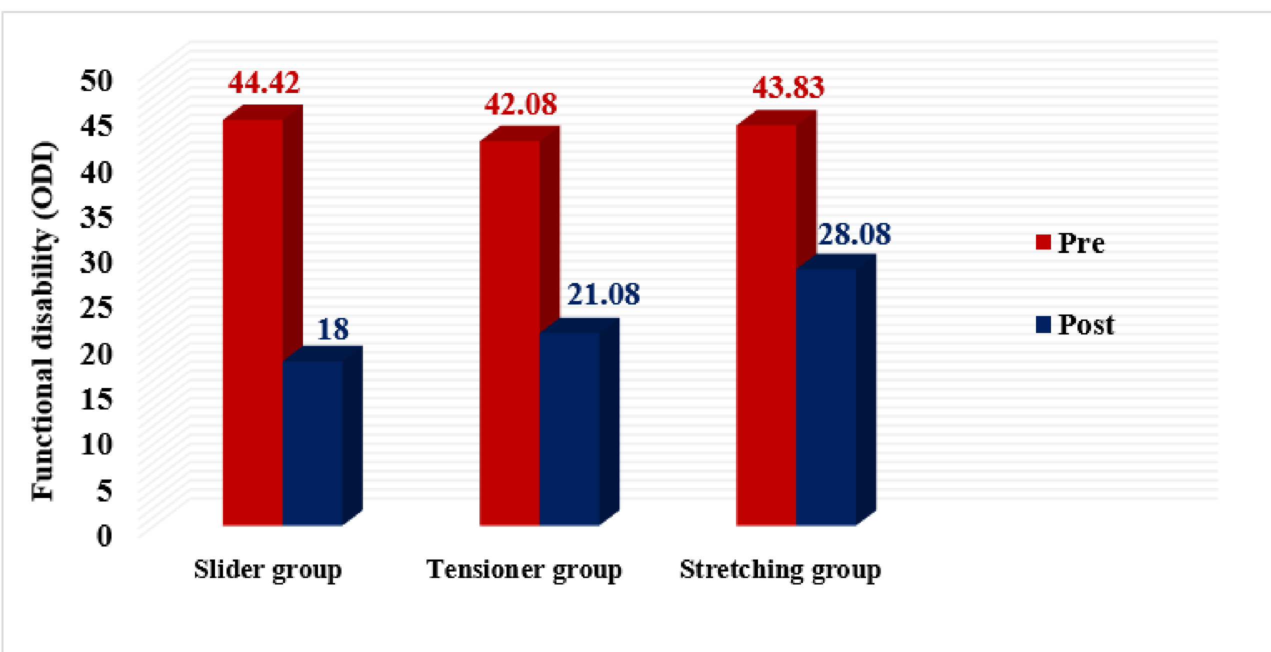
Pre and post-treatment mean values of knee extension ROM for all patients in the slider, tensioner, and stretching groups.



ROM= Range of motion.

Figure 5

Pre and post-treatment mean values of lumbar flexion ROM for all patients in the slider, tensioner, and stretching groups.



ODI= Oswestry disability index.

Figure 6

Pre and post-treatment mean values of functional disability (ODI) for all patients in the slider, tensioner, and stretching groups.