Effect of Mulligan Concept Lumbar SNAG on Chronic Nonspecific Low Back Pain

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Abstract

Objective: The purpose of this study was to investigate the outcomes of adding lumbar sustained natural apophyseal glide (SNAG) to a conventional therapy program for chronic nonspecific low back pain (LBP).

Methods: Forty-two participants with chronic nonspecific LBP were randomly divided into 2 groups. The study group (aged 27.1 ± 8.3, 20 men, 3 women) received a conventional physical therapy program consisted of stretching and strengthening exercises plus SNAG (based on the Mulligan concept) on the affected lumbar levels, and the control group (aged 28.9 ± 7.7, 13 men, 6 women) received the same conventional program without SNAG 3 times per week for 1 month. Outcome measures were repositioning error (the primary outcome), pain, and function measured by an isokinetic dynamometer, visual analog scale, and the Oswestry Disability Index. Measurements were recorded before and after the end of the treatment period.

Results: The comparison between pretreatment and posttreatment test scores indicated that both study and control groups had significant improvement in all dependent variables ($P > .001$). However, adding SNAG to the conventional program resulted in higher improvement in terms of repositioning error, pain, and function ($P = .02$, .002, .008) respectively.

Conclusions: This preliminary study indicated improvement in both groups. Adding SNAG to conventional programs in the treatment of chronic nonspecific LBP may result in greater improvement of repositioning error, pain reduction, and improved function. (J Chiropr Med 2017;16:94-102)

Key Indexing Terms: *Low Back Pain; Proprioception; Postural Balance*

Introduction

Low back pain (LBP) is a major health problem because of its high prevalence worldwide.[1] It affects almost every adult person at least once throughout his or her life span.[2] Low back pain is considered a multidimensional medical problem having multiple risk and causative factors.[3-5] The most common type of LBP is the nonspecific type, which is lacking definite pathologic cause. This nonspecific type represents about 85% of the LBP population.[6]

Pain in the low back has gained considerable attention within the medical community because of its major socioeconomic impact. It is a major cause for seeking medical help, deterioration of functional ability, limitations in occupational activities, and work absence.[2]

There is no evidence suggesting the superiority of a specific treatment of LBP over others.[7] Moreover, most of the available treatments used in clinical practice have little or short-term effect.[6] Manual therapy is a common therapeutic approach used in the treatment of back problems. A recent systematic review reported medium to high evidence regarding the efficacy of manual therapies in the treatment of chronic LBP.[8] Different manual therapies, such as passive Maitland mobilization and Mulligan mobilization with movement, are used routinely in physical therapy practice.[9]

There is a gap in research concerning the efficacy of different manual techniques and their different physiological effects.[10] This is true regarding lumbar sustained natural apophyseal glide (SNAG), which is commonly used in the treatment of LBP.[11] SNAG is one of the Mulligan concept techniques performed from a weight-bearing position, with the mobilizing force applied over the affected spinous process while the patient is enacting the painful or limited movement. SNAG, when indicated, can provide immediate pain relief and improvement in range of motion (ROM) as it corrects the positional fault in facet joint.[9]

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The majority of the research concerned with SNAG techniques has concentrated on the study of peripheral joints[12-14] and the cervical region.[15-20] Few studies have been concerned with the effects of SNAG on the lumbar spine.[10,21,22] The rest of the available research was in the form of case reports or case series.[23,24]

Only 5 trials have investigated different effects of the SNAG technique when applied to the lumbar region, none of them concerned with its effects on proprioception. Range of motion was investigated in 4 out of the 5 studies. It was improved in 3 of them[10,25,26]; no change was reported in the fourth trial by Moutzouri et al.[21] The increase in ROM was reported only in the studies performed on LBP patients, and no improvement was reported when applied on healthy participants.

Pain was investigated in 3 studies.[10,25,26] It improved in 2 of them,[25,26] although in the third study, Konstantinou et al failed to report any significant change.[10] Pain was measured with a visual analog scale (VAS) in all studies and in the present study. The controversy in the available literature regarding effects of lumbar SNAG on pain measure necessitates further investigation, as we did in the present study.

Functional disability level was recorded in 2 studies using 2 different tools.[25,26] The Oswestry Disability Index (ODI) was used by Hidalgo et al,[25] whereas the back performance scale was used by Heggannavar et al.[26] On both occasions patients reported better improvement in the level of function in response to SNAG.

New explanations for the effects of the lumbar SNAG were investigated in one study. Moutzouri et al have investigated the changes in the sympathetic activity of the lower limbs in healthy participants after the application of SNAG on the lumbar spine. Their results did not indicate any significant effect.[22]

Sensorimotor control, spinal segmental function, dynamic joint stability, and good motor control all are integral parts of back function. They largely are affected by proprioceptive deficits. Improper proprioceptive inputs may play a role in the development of LBP.[27-31] A systematic review conducted recently reported a reduction in proprioception along with decrease in ROM and slowed movement in patients with LBP compared with normal counterparts.[32] The results of this study support the link between LBP and proprioception deficits.

Repositioning error (RE) was found to be limited around 30° of trunk flexion in patients with LBP, as reported by Hidalgo et al[33] and Georgy.[28] The importance of studying proprioceptive response to different manual therapies seems to be of great importance; however; Gong was the first to study the change in RE in response to manual therapies (Gong mobilization).[34] No research has studied the effect of SNAG technique on the lumbar RE.

Studying the effects of SNAG on different body systems provides more understanding of its underlying mechanism and helps practitioners to properly use it in clinical practice. Only a few studies have focused on neurophysiological effects of SNAG technique[12,22]; the majority have investigated its mechanical effect.[21,26,35,36] Some of the available reports cannot be used for generalization because of the limitations encountered in the study design.[23,37]

Therefore, the purpose of this study was to investigate the effect of adding Mulligan concept lumbar SNAG to a conventional LBP program on RE, pain, and function compared with a conventional LBP program alone in patients with chronic nonspecific LBP. We hypnotized that adding SNAG to the conventional LBP treatment would give more favorable results regarding the studied outcome measures.

Methods

Design

A randomized controlled trial was implemented to investigate the effect of adding Mulligan concept lumbar SNAG to conventional treatment of chronic nonspecific LBP on 3 dependent variables: RE of the lumbar spine, pain, and function. Data collection was performed on 2 occasions, before and after the end of the treatment program. The study was conducted between November 2015 and January 2016.

Participants

Forty-nine patients with back pain were recruited from the faculty of physical therapy outpatient clinic, Cairo University (Cairo, Egypt). They were referred for physical therapy by their orthopedist or orthopedic surgeon. After screening, 42 participants aged 17 to 50 years met the inclusion criteria and joined the study (details mentioned in Fig 1). Inclusion criteria were 3 months of continuous or intermittent LBP symptoms, ability to perform at least 40° of trunk flexion. Participants were excluded if they were pregnant, obese, had specific LBP, or had any contraindication to physiotherapy and manual therapy.

After signing a consent form, demographic data were collected and then the participants were randomly assigned into 2 groups. Randomization was simply performed by giving every participant an identification number. Using the SPSS program (IBM, Armonk, NY), these numbers were randomized into 2 groups.[16] The control group consisted of 19 participants (28.9 ± 7.7 years) who received the conventional program of stretching and strengthening exercises. The study group consisted of 23 participants (27.1 ± 8.3 years) who received the conventional program plus Mulligan concept lumbar SNAG. There was no dropout because all patients were able to complete the study. Ethical approval was obtained from the Cairo University Ethical Committee (approval no. P.T.REC/012/00861), and registered with the Australian and New Zealand clinical trials registry (ACTRN 12615001298505).

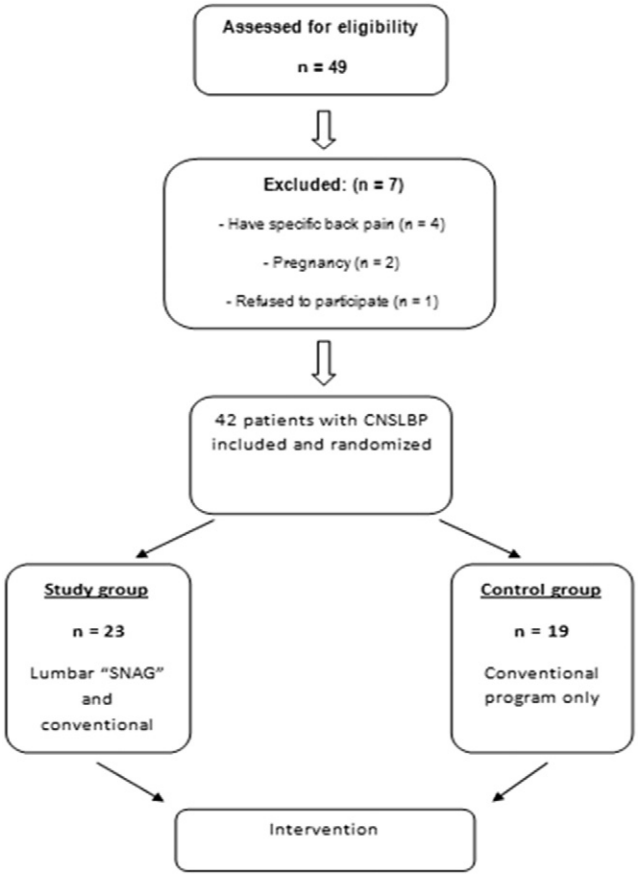

Fig 1. *Flow chart for the screening process and random assignment of the study participants.*

Materials and Outcome Measures

The main outcome was the lumbar RE; secondary outcomes were the pain level and functional disability.

Lumbar RE was measured by the Biodex System 3 Pro Isokinetic Dynamometer (Biodex Medical Inc., Shirley, NY). It is a valid and reliable device. This device is equipped with a special forward/backward reclined chair used for assessing trunk proprioception measured from seated compressed position.[28,38]

Pain was measured by VAS. The present study used a horizontal nonnumeric VAS with a 100-mm (10-cm) horizontal line with indicators at both ends of the line; one represented no pain, located at the left hand side; the other, located on the right-hand side, represented the most extreme pain that can be ever experienced.[39,40]

The functional level was assessed using a validated Arabic version of the ODI.[41] It is a 10-item questionnaire, with 6 responses to each item numbered from 0 to 5. These items include pain intensity, personal care, lifting, walking, sitting, sleeping, sex life (if applicable), and social life. The original version of the ODI has been revised since its original development and was translated into many languages. The most recent revision was introduced by Fairbank et al.[42]

Procedures

During the first meeting, demographic data (age, weight, height, body mass index) were collected. Screening for inclusion and exclusion criteria were performed, then clinical examination was performed to confirm the diagnosis. All participants signed a consent form.

For measuring the RE, the Biodex system was started. Initial calibration for the dynamometer was performed before each use, personal data of each participant was reported, and proprioception protocol then selected. Each participant was seated on the Biodex chair with his or her low back fitted backward against the lumbar pad. Both knees were fixed in place using 2 anterior curved leg pads. Legs were kept relaxed vertically with both feet off the ground. The upper trunk was fastened to the back of the chair using a belt. Both thighs were fastened to the chair using straps and both forearms were crossed over the chest. The seat was adjusted to allow the axis of rotation of the dynamometer to be at the level of L5/S1 disc space. Participants were instructed to close their eyes during test performance.

The limits of available ROM were determined for each participant by starting at the 0° position (neutral sitting with hips flexed 90°) and then instructing the participant to flex his or her trunk as much as possible to determine the

Fig 2. *Start and end positions for assessment of repositioning error.*

available ROM in flexion and examine his or her ability to reach the target position for the isokinetic test (30° of lumbar flexion). This angle was used previously to study the proprioception in the lumbar spine by Hidalgo et al[33] and Georgy.[28] Dysfunction in the RE around this angle was evident in both occasions.

The dynamometer was locked in the 0° position to provide a fixed starting position for all participants during all trials. The chosen protocol allowed the participants to perform 1 familiarization trial followed by 1 actual test; this step was repeated 3 times so that there were 3 familiarization trials and 3 actual testing procedures. The average of the 3 actual testing results was retrieved from the isokinetic device software. During the familiarization trial and after covering the eyes, participant was instructed to flex his or her trunk until it was stopped by the machine at 30° of flexion. This position was held for 5 seconds. The participants were instructed to remember this position in order to reproduce it as precisely as possible during the subsequent actual test procedure (Fig 2).

During the actual test procedure, the tested participants pressed a hold button when they assumed the target position to allow the device to record and save the reached angle. During the data collection process, no visual (eyes were closed) or verbal feedback was provided for the participants.[43,44]

The results of the test were recorded and printed by the isokinetic machine. It included the value of error of every trial and the average error of the 3 trials.[28,45]

For measuring the pain level, each participant was instructed to rate the current level of pain by placing a mark across the horizontal VAS line. The distance in millimeters from the lower limit was measured using a ruler.

For measuring the functional disability, participants were asked to check on the statement that represented their functional status. Inappropriate sections were left blank, such as sexuality for the unmarried participants. Because most of the participants in the current study had mild to moderate functional disability, we thought that using raw ODI score for data analysis could be more sensitive to reflect the small amount of change in the functional level scores compared with using the percentage score.

Interventions

Mulligan concept lumbar SNAG and conventional physical therapy protocol were performed by the same physical therapist. Eligibility for SNAG treatment was determined by applying SNAG for 3 repetitions during the initial screening session; patients who experienced no worsening or showed improvement of pain and ROM were considered good candidates. The technique was considered safe for patients who did not have immediate improvement. If adverse effects resulted after the application of SNAG even after modification of its direction, force, or handling, the patient would have been excluded from the study. SNAG technique was applied from a sitting position on the edge of the table while both feet were on a foot rest. A specialized Mulligan belt was used around the patient's waist and therapist's hips.[46] The mobilizing force was applied parallel to the facet joint plane (cephalic direction) and over the spinous processes of the respective symptomatic spinal levels (Fig 3). The patients were asked to lean forward as much as possible during application of the mobilizing force and then return to the starting position while the therapist maintained his mobilizing force until the end. The symptomatic level was determined clinically by using the standardized objective examination combining active trunk movements and posteroanterior mobilization of

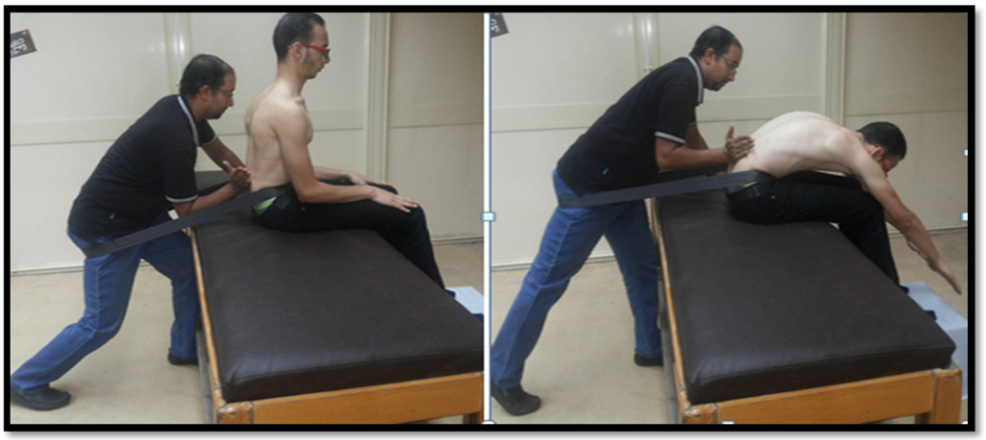

Fig 3. *Start and end positions for lumbar sustained natural apophyseal glide (SNAG).*

the lumbar vertebrae.[25] The SNAG dose for each level was 3 sets of 6 repetitions 3 times per week for 1 month.[22,46] It was performed before the conventional program.

The conventional program used in this study consisted of manual passive stretching exercises for hamstrings, iliopsoas, and back extensors. These exercises were performed from supine, prone, and cross-sitting positions, respectively. Each stretching position was maintained for 30 seconds and was repeated 3 times per session. Handling and procedures were performed as described in previous literature.[47,48]

Progressive strengthening exercises were applied for the abdominal and back extensors from crook lying and prone positions, respectively. One set of 10 repetitions was the target in the first week. The progression of the repetitions was controlled by the patient limits of fatigue and tolerance. During abdominal exercises, patient was placed in supine position with both hips and knees semiflexed. The therapist stabilized both feet, and the patient was asked to cross his hands over the chest and raise his head and shoulders off the bed before relaxing. Back muscle strengthening exercises were performed by asking the patient to raise the head and shoulders off the table then relax while the therapist stabilized the patient's lower limbs and pelvis. Pelvic rocking (anterior and posterior pelvic tilt) was performed from crook lying positions. The patient was asked to arch the low back, hold then relax, and repeat; and then press the low back against the treatment table and hold then relax, and repeat. The conventional protocol was applied 3 times per week for 1 month.

Statistical Analysis

All data were analyzed using Statistical Package of Social Science (SPSS) Version 19. Descriptive statistics including mean ± standard deviation (SD) were calculated for all variables. Unpaired *t* test was used for comparison of the mean age, weight, height, and body mass index between both groups. Mixed multivariate analysis of variance (MANOVA) was conducted to compare the interaction effects of treatments and time on the dependent variables together. When a significant interaction effect was detected, pairwise comparisons with Bonferroni correction were performed to detect the source of significance (within and between groups). The α level was set at $P < .05$. SPSS (partial η^2) was used to calculate the clinical effect size (ES) between groups.

Results

There were no significant differences between study and control groups regarding demographic data as shown in Table 1. Additionally, the male to female ratio was not significantly different between the study and control groups.

Mixed-MANOVA results revealed that there was a significant interaction effect of treatments and time on RE, VAS, and ODI ($P = .006$). Moreover, there was a significant main effect of time ($P > .001$) as both groups had an improvement in all outcome measures at the end of the treatment period. On the other hand, there was no significant main effect of treatment ($P = .4$).

As shown in Table 2, pairwise comparison of the mean ± SD of the RE scores reveled improvement in both study and control groups. Between-group comparison indicated that the higher improvement in RE was in favor of the study group compared with the control group ($P = .02$) with a large clinical effect size ($d = 0.78$). A higher percentage of change 64.1% was reported in the study group compared with only 49.3% in the control group.

Regarding pain scores, statistical analysis showed an improvement in pain VAS scores in both study and control groups after treatment ($P < .001$). The improvement was higher in the study group as compared to the control ($P = .002$) with a reported large clinical effect size ($d = 0.89$) (Table 3).

As shown in Table 4, both study and control groups had an improvement in their ODI raw score after the end of the

Table 1. *Mean ± SD of Participants' Demographic Data*

	Study Group	Control Group	
	N = 23	N = 19	
	Mean ± SD	Mean ± SD	*P*
Age (y)	27.1 ± 8.3	28.9 ± 7.7	.47
Weight (kg)	74.8 ± 9.3	75.8 ± 9.3	.71
Height (cm)	171.6 ± 7.5	171.84 ± 9.5	.93
BMI (kg/m^2)	25.5 ± 3.4	25.8 ± 3.2	.77
Sex distribution per group	20 men 3 women	13 men 6 women	.14

BMI, body mass index; *MD,* mean difference; *SD,* standard deviation.

treatment ($P < .001$). Between group comparison indicated higher improvement in functional disability in favor of the study group ($P = .008$) and a large clinical effect size ($d = 0.88$).

Discussion

To the authors' knowledge, this is the first trial concerned with the effects of lumbar SNAG on the RE of the lumbar spine as a primary outcome measure in patients with chronic nonspecific LBP. The results of the present study suggest improvements in RE, pain, and functional disability in both control and SNAG groups; however, greater improvement was identified in the SNAG group. According to these preliminary results, adding lumbar SNAG to a conventional low back program may help to obtain more favorable results when measured in terms of RE, pain, and functional disability.

The results on RE agreed with previous a previous recommendations.[34] This study investigated the effects of another manual technique (Gong's mobilization) on RE. The comparison between both studies was not accurate because the Gong study was performed on healthy participants, whereas the present study was conducted on chronic nonspecific LBP patients.

The observed effects might be attributed to the correction of the capsular strain of the lumbar facet joint. Such a strain increases during the flexion movements of the lumbar spine. As known, lumbar facet joints are involved in joint stability, pain, and proprioception.[49] Therefore, mobilizing the affected facet joints using SNAG could play a role in releasing strain on the capsule and improving the mobility of the joint, which influences the RE.[34]

Table 2. *Multiple Pairwse Comparison of Repsitioning Error Means ± SD in Both Groups Before and After Treatment (Measured in Degrees)*

	Study Group Mean ± SD	Control Group Mean ± SD	MD	*P*	ES *(d)*	CI (95%)
Pretreatment	5.0 ± 0.6	5.1 ± 0.9	0.1	.8		
Posttreatment	1.8 ± 1.1	2.6 ± 0.95	0.8	.02	0.78	0.46-1.1
MD	3.2	2.5				
P	<.001	<.001				

CI, confidence interval for effect size; *ES,* effect size; *MD,* mean difference; *P,* probability value; *SD,* standard deviation.

Table 3. *Multiple Pairwse Comparison of Pain Scores Means ± SD in Both Groups Before and After Treatment*

	Study Group Mean ± SD	Control Group Mean ± SD	MD	*P*	ES *(d)*	CI (95%)
Pretreatment	50.9 ± 8.6	48.26 ± 9.0	2.6	.340		
Posttreatment	23.4 ± 5.9	29.1 ± 5.0	5.7	.002	0.89	0.57-1.2
MD	27.4	19.2				
P	<.001	<.001				

CI, confidence interval for effect size; *ES,* effect size; *MD,* mean difference; *P,* probability value; *SD,* standard deviation.

The reported improvement in VAS scores was previously reported by Hidalgo et al[25] and Heggannavar et al.[26] This response could be attributed to multiple factors including the relief of the mechanical fault of the facet joint, which may allow easier and more pain-free movement.[9] SNAG might have a relieving effect of the facet joint capsular strain,[49] which might decrease the pain sensation experienced by the patients.

The theory of habituation and extinction may be a good explanation as well. According to this theory, patients who usually experience pain during flexion movement usually have a conditional fear of any activity involving that particular movement. During SNAG treatment patients were exposed to this fearful movement but in a graded manner, which results in no pain or even immediate improvement. Successful repetition of flexion movement causes habituation and extinction of the aversive memory (painful trunk flexion).[25]

The last proposed mechanism suggests that the SNAG technique might share the same effects with posteroanterior passive mobilization technique, including restoring the normal mechanics[50] and improving muscular function, mobility, and flexibility, as well as psychological response.[51]

On the other hand, Konstantinou et al[10] reported minimal improvement in pain score that did not reach statistical significance. They attributed these results to the heterogeneity of the recruited sample and the use of ROM rather than pain score as a base to calculate the required sample size.

Functional disability scores were greater in favor of the study group. These findings agree with those obtained by Hidalgo et al,[25] although they used the calculated percentage of the ODI score, whereas in the present study raw ODI score

Table 4. *Multiple Pairwise Comparisons of ODI Raw Scores Mean ± SD in Both Groups Before and After Treatment*

	Study Group Mean ± SD	Control Group Mean ± SD	MD	*P*	ES *(d)*	CI (95%)
Pretreatment	22.4 ± 6.1	23.86 ± 5.9	1.4	.44		
Posttreatment	8.1 ± 2.5	11.28 ± 4.7	3.2	.008	0.88	0.56-1.2
MD	14.3	12.6				
P	<.001	<.001				

CI, confidence interval for effect size; *ES,* effect size; *MD,* mean difference; *P,* probability value; *SD,* standard deviation.

was used. Heggannavar et al[26] reported an improvement in the ODI score after the application of the modified SNAG technique. They attributed this improvement to the correction of the positional fault of the facet joint, which might improve the ability of the patient to move trunk freely[9] and allow more mobility and function. Painless movement increases self-confidence and decreases psychological fear factors and depression signs encountered with LBP[52,53] so that, after pain reduction, the LBP patients are usually able to assume more postures and positions; hence, the ability to perform required daily activities and functions improves.

Limitations

This was only a preliminary study, and there were only a small number of participants, thus limiting the findings and generalizability. In addition, the demographic representation in each group did not necessarily represent the general population (eg, sex, age), thus our findings are limited.

The limited clinical experience of the therapist who applied the SNAG technique might have influenced the effectiveness of the technique, and not all practitioners may apply the technique in the same manner. Thus, this influences generalizability of the study findings. Further and larger studies are necessary to confirm and evaluate our findings.

Conclusions

This study provides preliminary evidence that adding lumbar SNAG to a conventional LBP program consisting of stretching and strengthening exercises might be more effective in the treatment of chronic nonspecific LBP in terms of RE, pain, and functional level.

Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

Contributorship Information

Concept development (provided idea for the research): H.M.H.
Design (planned the methods to generate the results): H.M.H., N.A.A., O.M.K.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): H.M.H., N.A.A., O.M.K.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): H.M.H., H.H.A.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): H.M.H.
Literature search (performed the literature search): H.M.H.
Writing (responsible for writing a substantive part of the manuscript): H.M.H., N.A.A., O.M.A.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): A.M.A., H.H.A.

Practical Applications

- This study showed that Mulligan lumbar SNAG may decrease the repositioning error found in patients with chronic nonspecific LBP.
- The findings suggest that lumbar SNAG, if added to the conventional treatment for LBP, may provide better results than using the conventional treatment only regarding repositioning error, pain, and function.
- The present study may provide a new dimension in the understanding of the physiological effects resulting from applying SNAG to the lumbar spine.

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