

COMPARISON OF THE EFFECTS OF MULLIGAN SUSTAINED NATURAL APOPHYSEAL GLIDES VERSUS MUSCLE ENERGY TECHNIQUE ON PAIN, DISABILITY AND FUNCTION IN PATIENTS WITH CHRONIC CERVICAL SPONDYLOSIS

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DOI: 10.5281/zenodo.10963738

Abstract

Background: Cervical spondylosis (CS) refers to the degenerative changes in at least one functional unit. So, the cervical motion segments including the disc, two adjacent vertebrae, and facet joints are being affected. **Objective:** The objective of this study is to compare the effectiveness of conventional therapy plus, Mulligan Sustained Natural Apophyseal Glides SNAGs as group A and conventional therapy plus Muscle Energy Techniques (MET) as group B. **Method:** A clinical trial was designed in which two groups of total number 52 patients who suffered from Cervical Spondylosis (CS) for at least 6 months participated in this trial. The group A (N=26, age=45-65, both sex) received conventional therapy including electric hot pack, TENS with Mulligan SNAGs; the second group (N=26, age= 45-65, both sex) received conventional therapy with MET (12 sessions, three times a week). **Results:** The results showed improvement for both groups in all parameters. Furthermore, in MET (Group B), significant results were observed in NPRS (P = 0.041), Cervical Extension (P = 0.017), cervical left rotation (P = 0.041), left-hand grip strength (P = 0.022), craniovertebral angle (P = 0.003), and NDI (P = 0.004). However, our result showed improvement in Mulligan SNAGs (Group A) in right-hand grip strength (P value = 0.01) compared to Group B. The results indicated that there were no statistically significant differences in any of the outcome measures such as cervical joint position sense, including flexion (P value = 0.328), extension (P value = 0.371), right side bending (P value = 0.247), left side bending (P value = 0.810), right rotation (P value = 0.810), and left rotation (P value = 0.616) between group A and **Conclusion:** The results of the study provide strong evidence that both Mulligan SNAGs and MET are significantly effective methods for the management of chronic cervical spondylosis in terms of ROM and cervical joint position sense. For greater effect on improving NPRS, craniovertebral angle and neck disability, MET can be used. While Mulligan SNAGs may be used for improvement in hand grip strength.

Keywords: Cervical Spondylosis, Forward Head, Hand Held Dynamometer, MET, NDI, NPRS, Position Sense, SNAGs, and ROM.

INTRODUCTION

Cervical spondylosis refers to the degenerative changes in at least one functional unit. So, the cervical motion segments including the disc, two adjacent vertebrae, and facet joints are being affected. (1) These changes develop gradually with age, or secondarily as the result of trauma or other pathological conditions.

The earliest event is probably a biochemical change in the properties of the disc. This causes an alteration in the biomechanics of the spine due to the loss of the shock absorber-like action of the discs. As a result, secondary changes occur in the other component tissues (facet joints and ligaments) comprising the other elements of articulation between the vertebrae (2).

Consequently, these changes can include the intervertebral bodies, articular facets, and involvement of adjacent soft tissue structures. Many people over 45 years old might show some abnormalities on plain radiographs of the cervical spine, however, the boundary between normal aging and disease is difficult to define. Later on, the patient will complain of the signs and symptoms of vertebral spondylitis and therefore, seek medical or physical therapy services (2-4).

About two-thirds of the population of the world have neck pain at some time in their lives, and its prevalence is highest in middle age. Fejer et.al reported 25% and 20% of people (women and men respectively) who were referred to a General Practitioner complained of current neck pain (5). A Norwegian survey also reported a rather similar statistic in 10,000 adults who complained of neck pain in the previous year. (3)

Non-pharmacological therapies are an important part of the overall care of cervical spondylosis because they provide effective approaches to alleviate symptoms, improve neck function, and improve overall quality of life (4). Therefore, Physical therapy is a key component that involves tailored exercises and techniques which in return enhance neck strength, flexibility, and posture (5, 6). Physical therapy methods and in particular the more advanced approaches can help alleviate pain restore proper neck function and improve Activity of daily living.

Conventional physical therapy such as cervical traction, through mechanical devices, might help patients with cervical spondylosis (C.S.) by reducing the pressure on the spinal cord and nerve roots (7). Orthopedic Manual Physical therapy (OMPT) can serve as a crucial part of a comprehensive treatment plan that addresses musculoskeletal musculoskeletal musculoskeletal issues that contribute to the symptoms of CS.

The OMPT as a conjunction method with medication or alongside other physical therapy interventions might reduce pain, improve function, and enhance overall ADL. To ensure the most effective and personalized approach, individuals with cervical spondylosis should seek consultation with a qualified physical therapist who can evaluate their specific condition and develop a tailored treatment plan (8-17).

Among the advanced methods is the concept of Mobilization with Movement (MWM) introduced by Brian Mulligan. The MWM is the identification of a task that the patient has difficulty completing, usually due to pain or joint stiffness. In this method, during the task that was previously identified as being problematic, a sustained passive accessory force/glide to a joint is applied to the cervical region of the patient while actively performing the task at the onset of pain, or the end of available ROM or maximum muscle contraction (18).

Mulligan mobilization techniques (MMTs) include several methods, such as sustained natural apophyseal glides (SNAGs) and natural apophyseal glides (NAGs) that target the affected spinal segment. The application of SNAGS is similar to MWM. a total of 10 repetitions are carried out, and overpressure is applied at the last repetition. Muscle Energy Technique (MET) is a manual therapy technique used in physical therapy,

osteopathy, and other healthcare professions to address musculoskeletal issues and improve joint function and range of motion.

MET is a form of osteopathic manipulative treatment (OMT) that focuses on the active and voluntary contraction of a patient's muscles against a controlled counterforce provided by a therapist (19).

So, the current study aims to compare the effects of mulligan SNAGs versus Muscle Energy Technique on pain, joint position sense, forward head posture, range of motion, hand grip strength, and neck disability index in patients with chronic cervical spondylosis.

METHODS

A randomized double-blind clinical trial (RCT) study was designed for the treatment of patients with chronic cervical spondylosis. The trial was open to any participants with chronic cervical spondylosis who satisfied the inclusion criteria. The sample size was calculated using G-power software version 3.1.9.7 with an effect size of 0.80, error of 0.05, and power of study 0.80.

The sample size came out to be 52, 26 in each group. Data was collected from physical therapy clinics in Iraq. Inclusion criteria were as follows: patients with chronic cervical spondylosis, both sexes, ages between 45 – 65 years, referred to the physiotherapy clinics by an orthopedic surgeon diagnosed by examination and radiography an interview and examination were done for the participants and informed consent was taken.

The participants were allocated into 2 groups. To allocate participants randomly to the various intervention groups, the research team utilized random allocation software as the chosen sampling method.

Randomization was achieved using Random Allocation Software (version 1.0.0) as shown in Figure 1. (29). Both groups of patients (i.e. groups A and B) received 12 sessions, three sessions per week.

Group A received conventional physical therapy with Mulligan SNAGs, while Group B received conventional physical therapy with the Muscle Energy Technique.

The evaluation of outcomes included the Numeric Pain Rating Scale for Pain, Laser Tracker for cervical proprioception, Kinovea (version 0.9.5) for craniovertebral angle (forward head posture), Bubble Inclinator for cervical range of motion, Digital Hand-Held Dynamometer for hand grip strength, and the Neck Disability Index (NDI) to assess neck pain-related quality of life. Data collection occurred both at baseline and after the completion of the final session.

0001: B	0010: A	0019: A	0028: A	0037: A	0046: B
0002: B	0011: A	0020: A	0029: B	0038: A	0047: A
0003: B	0012: B	0021: B	0030: B	0039: A	0048: A
0004: A	0013: A	0022: B	0031: A	0040: B	0049: A
0005: A	0014: B	0023: B	0032: B	0041: B	0050: A
0006: B	0015: A	0024: B	0033: B	0042: B	0051: A
0007: B	0016: A	0025: A	0034: A	0043: B	0052: B
0008: B	0017: A	0026: A	0035: B	0044: A	
0009: B	0018: A	0027: B	0036: A	0045: B	

Figure 1: Randomization by using Random Allocation Software

The study was conducted as a double-blinded randomized clinical trial, signifying that during the study, both the participants and the research team conducting the study were unaware of which treatment group each participant was assigned to. In group A, the Mulligan SNAG protocol was conducted as follows. The patient assumed the sitting position, holding it for 8 to 10 seconds.

During this time, the patient took a deep breath in, and upon exhaling, the therapist advanced to the next barrier. After sustaining the new position for another 8 to 10 seconds, a 2 to 3-second relaxation period followed. This regime was then repeated 3 to 7 times during each session, with a total of 3 sessions per week and one session per day, spanning 4 weeks. Sustained natural apophyseal glides (SNAGs) were performed 7 to 10 times within a single session, with each hold lasting 10 seconds. These sessions were repeated three times a week (29-32).

However, in Group B, the Muscle Energy Technique Protocol was followed for example, in C3-C4, the patient was placed in a supine position with the neck slightly flexed passively by the therapist. The right middle finger was placed over the right pillars of C3-C4, and the neck was taken to the maximum position of side-bending rotation to the right, engaging the barrier.

The left hand was placed over the patient's left parietal and temporal areas. With this hand offering counterforce, the patient was invited to side-bend and rotate to the left, for 5 seconds. Post-isometric relaxation of these muscles followed the 5-7-second mild contraction, after which the neck was taken to its new barrier, and the same procedure was repeated 2 or 3 times.

For Upper Cervical vertebrae (C1-C2), the patient lay supine, and the therapist passively flexed the subject's head and neck approximately 45° until a sense of resistance was palpated. If the direction of restriction was on the left, then the head was rotated to the left until a restrictive barrier was palpated. The subject was then instructed to gently push into the practitioner's hand (rotate to the right) for 5 seconds, followed by 5 seconds of relaxation 3 times (31, 33, 34).

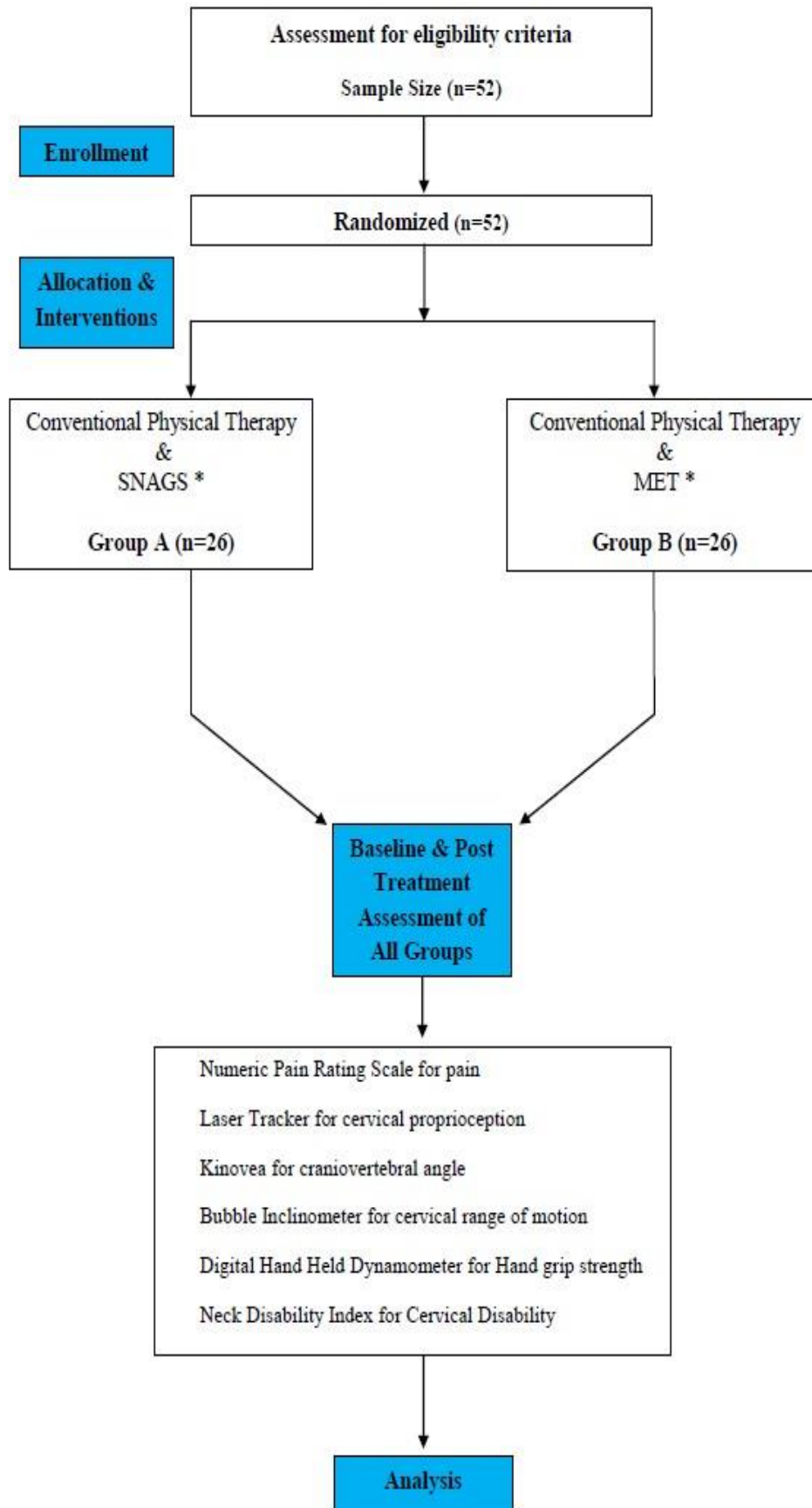


Figure 2: Flow Diagram of Participants in the Study

In the statistical package (SPSS) version (23.0), statistical data analysis techniques were employed to investigate and evaluate the study's findings. The normality of data distribution was determined by performing the Kolmogorov-Smirnov test. Then appropriate parametric and non-parametric tests were applied accordingly. P values less than 0.05 represented a statistically significant difference. Descriptive and Inferential statistics were also used. After checking the assumption, a paired T-test was used to determine significant differences for (NPRS, ROM, HGS, Head Posture CJPE, and NDI) within each group separately. After checking the assumption, an independent t-test was used to detect the significant differences in improvements for (NPRS, ROM, HGS, Head Posture CJPE, and NDI) between the two groups of intervention. P < 0.05 is considered statistically significant and at CI 95%. The research was conducted after obtaining ethical approval from the Tehran University of Medical Sciences ethical committee and registering the project in IRCT. Before the intervention, all the steps of the assessments and interventions, and the purpose of performing them were explained to the participants, and they read and completed the informed consent form. All the collected information was kept confidential and was only available to the researchers. In this study, the therapeutic intervention did not have adverse effects on the musculoskeletal system and did not pose a particular problem for the participants. All participants were free to withdraw from the study at any stage and for any reason, even without a specific reason. The researcher was obliged to compensate for any possible costs imposed on the participants due to their participation in this study.

RESULTS

Table 1 presents the baseline demographic characteristics of the participants and (SD) of Age, BMI, Weight, and height in both groups.

Table 1: Demographic Characteristics of Participants

Characteristics		Group A (n=26)	Group B (n=26)	P-Value
Gender	Male	17 (65.4%)	16 (61.5%)	0.779
	Female	9 (34.6%)	10 (38.5%)	
Age	Years	52.19 (5.678)	56.69 (6.479)	0.052
Weight	kg	84.57 (13.88)	80.26 (11.26)	0.225
Height	cm	174.34 (10.22)	171.19 (8.79)	0.239
BMI	(kg/m ²)	28.04 (3.89)	27.82 (3.32)	0.831

Responses to Interventions

Table 2: Changes in Outcome Measures of both Groups and Responses to Treatment

Measures	Groups	Baseline Mean (SD)	Post treatment Mean (SD)	P Value
Pain	SNAGs	69.0(10.87)	20.15(6.27)	0.000
	MET	73.11(7.92)	19.92(6.44)	0.000
Cervical Flexion	SNAGs	62.65(8.39)	78.88(4.607)	0.000
	MET	59.92(10.287)	78.15(6.162)	0.000
Cervical Extension	SNAGs	46.26(8.19)	62.34(6.88)	0.000
	MET	41.57(6.94)	61.34(6.57)	0.000
Cervical Right-Side Bending	SNAGs	20(7.59)	29.03(7.26)	0.000
	MET	18.38(6.14)	28.84(5.61)	0.000
Cervical Left Side Bending	SNAGs	22(7.18)	30.42(6.15)	0.000

	METS	19.19(6.89)	29.65(6.18)	0.000
Cervical Right Rotation	SNAGS	63.65(8.81)	79.96(6.12)	0.000
	METS	62.84(8.41)	80.65(5.31)	0.000
Cervical Left Rotation	SNAGS	64.73(8.62)	80.61(4.72)	0.000
	METS	60.65(8.202)	79.61(5.59)	0.000
Right handgrip strength	SNAGS	28.12(15.88)	31.70(16.27)	0.000
	METS	22.98(13.99)	25.23(14.19)	0.000
Left handgrip strength	SNAGS	28.99(15.59)	31.74(15.99)	0.000
	METS	19.74(12.94)	23.81(13.93)	0.000
Craniovertebral angle	SNAGS	38(3.37)	43.33(3.02)	0.000
	METS	37.40 (4.27)	44.09(3.96)	0.000
Flexion Cervical Joint Position Sense	SNAGS	6.67(1.471)	4.60(1.484)	0.000
	METS	7.15(1.15)	4.85(1.177)	0.000
Extension Cervical Joint Position Sense	SNAGS	6.64(1.26)	4.55(1.28)	0.000
	METS	7.87(1.44)	5.46(1.45)	0.000
Right Side Bending Cervical Joint Position Sense	SNAGS	5.07(1.005)	3.80(0.936)	0.000
	METS	5.81(1.32)	4.33(1.26)	0.000
Left Side Bending Cervical Joint Position Sense	SNAGS	5.32(1.05)	3.82(1.07)	0.000
	METS	5.82(1.36)	4.22(1.26)	0.000
Right Rotation Cervical Joint Position Sense	SNAGS	7.82(1.219)	5.63(1.221)	0.000
	METS	7.43(1.228)	4.98(1.303)	0.000
Left Rotation Cervical Joint Position Sense	SNAGS	6.98(0.892)	4.85(1.22)	0.000
	METS	7.15(1.33)	4.90(1.25)	0.000
Neck Disability Index	SNAGS	43.92(8.39)	19.53(8.805)	0.000
	METS	52.53(8.805)	21.23(5.57)	0.000

For those outcome variables that exhibited a normal distribution (as determined by the Kolmogorov-Smirnov test), independent t-tests were employed to compare means between groups. Conversely, for outcome variables that did not conform to a normal distribution, the Mann-Whitney U test was utilized to assess differences between groups. The normality tables were reported in the supplementary files.

Table 3: Comparison between the effectiveness of intervention techniques (improvement) between groups A and group B (Normally Distributed Variables)

		Levene's Test		t-test for Equality of Means						
Measures		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
Numeric Pain Rating Scale	Equal variances assumed	2.081	0.155	-2.100	50	0.041	-4.34615	2.06935	-8.50256	-0.18975
	Equal variances not assumed			-2.100	46.804	0.041	-4.34615	2.06935	-8.5096	-0.18271
Cervical Flexion Improvement	Equal variances assumed	1.828	0.183	-1.250	50	0.217	-2.00000	1.60059	-5.21488	1.21488
	Equal variances not assumed			-1.250	49.111	0.217	-2.00000	1.60059	-5.21632	1.21632
Cervical Extension Improvement	Equal variances assumed	0.038	0.846	-2.475	50	0.017	-3.69231	1.49175	-6.68858	-0.69603
	Equal variances not assumed			-2.475	49.858	0.017	-3.69231	1.49175	-6.68879	-0.69582
Cervical Right Side Bending improvement	Equal variances assumed	2.116	0.152	-1.545	50	0.129	-1.42308	0.92106	-3.27307	0.42692
	Equal variances not assumed			-1.545	48.826	0.129	-1.42308	0.92106	-3.27417	0.42802
Cervical Right Rotation improvement	Equal variances assumed	0.272	0.604	-1.026	50	0.31	-1.50000	1.46213	-4.43677	1.43677
	Equal variances not assumed			-1.026	48.122	0.31	-1.50000	1.46213	-4.43961	1.43961
Left Hand grip strength improvement	Equal variances assumed	0.014	0.906	-2.355	50	0.022	-1.31154	0.55681	-2.42992	-0.19315
	Equal variances not assumed			-2.355	49.967	0.022	-1.31154	0.55681	-2.42994	-0.19314
Left Rotation Cervical Joint Position Sense improvement	Equal variances assumed	0.063	0.802	-0.504	50	0.616	-0.11538	0.22886	-0.57506	0.34429
	Equal variances not assumed			-0.504	49.813	0.616	-0.11538	0.22886	-0.5751	0.34433

Table 4: Comparison between effectiveness of interventions techniques (improvement) between groups A and group B (Not Normally Distributed Variables)

Test	Measures	Sig.
Mann-Whitney U test	Cervical Left Rotation Group A-B	.041*
	Right Hand Grip Strength group A-B	.041*
	Craniovertebral angle group A-B	0.003*
	Flexion Cervical Joint Position Sense Group A-B	0.328
	Extension Cervical Joint Position Sense Group A-B	0.371
	Right Side Bending Cervical Joint Position Sense Group A-B	0.247
	Left Side Bending Cervical Joint Position Sense Group A-B	0.810
	Right Rotation Cervical Joint Position Sense Group A-B	0.810
	Neck Disability Index Group A-B	0.004*

DISCUSSION

This study was conducted to compare the effectiveness of two manual physical treatment strategies (i.e. Mulligan SNAGs versus MET) in conjunction with conventional physical therapy in patients with chronic cervical spondylosis, before and after twelve sessions, three times per week of interventions. These results showed both Mulligan SNAGs and MET (Groups A and B), were effective in the improvement of the outcome measures. Both methods were equally effective in the improvement of cervical flexion (P value = 0.217), cervical right side bending (P value = 0.129), cervical right rotation (P value = 0.310), flexion cervical joint position sense (P value = 0.328), extension cervical joint position sense (P value = 0.371), right side bending cervical joint position sense (P value = 0.247), left side bending cervical joint position sense (P value = 0.810), right rotation cervical joint position sense (P value = 0.810), and left rotation cervical joint position sense (P value = 0.616).

In the comparison of Mulligan SNAGs (Group A) and MET (Group B) on the outcome measures of the patients before and after interventions, our findings showed more effectiveness in favor of MET (Group B). In other words, NPRS (P value = 0.041), cervical extension (P value = 0.017) cervical left rotation (P value = 0.41), craniovertebral angle (P value = 0.003), left hand grip strength (P value = 0.022), and NDI (P value = 0.004) was more significant.

However, our results showed improvement in Mulligan SNAGs (Group A) in right-hand grip strength (P value = 0.41) was more effective than MET.

Although, there are some reports about the effects of SNAGs and MET independently on cervical spondylosis patients. However, to the best of our knowledge, no research has compared the effect of SNAGS and MET separately on the comprehensive outcome measures of CS. such as craniovertebral angle, hand grip strength, and the cervical joint position sense. Our comprehensive result showed similarity with Nasir Sultan, in terms of NPRS and NDI.(29)

CONCLUSION

The results of the study provided strong evidence that both Mulligan SNAGs and MET are effective methods for the management of chronic cervical spondylosis in ROM and cervical joint position sense. For a greater effect on improving NPRS, bcraniovertebral angle, and neck disability, MET can be used. While Mulligan SNAGs may be used for improvement in hand grip strength.

The Limitations and recommendations: the present study erewe could not manage to do a follow-up study. It would be beneficial to investigate the long-term effects of such intervention for the treatment of chronic cervical spondylosis, so further research is needed to determine the long-term effects of these treatment approaches. Studying the long-term effects of these treatment approaches is essential. It's worth considering the inclusion of patients with cervical spine radiculopathy, as this inclusion may contribute to improve results in hand grip strength over time. Additionally, incorporating exercises into a home exercise showed promising results, potentially leading to more significant and lasting improvements.

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