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RESEARCH ARTICLE

Effect of integrated neuromuscular inhibition, muscle energy and strain counter strain technique in the management of mechanical neck pain

Zainab Mahmood[1], Lal Gul Khan[2], Danish Latif[3], Ghazal Azhar[4], Bushra Zahid[1], Uzair Javaid[5]

ABSTRACT

Background: One of the most prevalent musculoskeletal conditions worldwide is neck pain. Neck pain is associated with disability and is a risk factor for decreased productivity.

Objective: To compare the effects of neuromuscular inhibition, muscle energy and strain counter strain techniques in management of pain, disability and range of motion in patients with mechanical neck pain.

Methods: This randomized clinical trial (RIPHAH/RCRS/REC/Letter-01064) was conducted in Pakistan Railway General Hospital and Ali Ahmad Physiocare clinic, Islamabad from December 2021 to March 2022. Both gender participants from 30-60 years with mechanical neck pain (> 3 months) were enrolled through non-probability convenience sampling. Strain Counter Strain Technique, Muscle Energy Technique, and Integrated Neuromuscular Inhibition Technique are administered to Group A, B and C respectively three times a week for four weeks with conventional treatment. SPSS version 23 was used to evaluate data of VAS, neck disability index, and goniometer that were taken before, after two and four weeks of treatment.

Results: Within group analysis of Integrated Neuromuscular Inhibition (INIT) Group, Strain Counter Strain (SCS) Group and Muscle Energy Technique (METS) Group shows that the results were significant ($p<0.05$). Group differences were noted at conclusion of 4th week for VAS($P<0.005$). There were no group differences at the end of 4th week for NDI ($P = 0.186$) and Goniometer($P=0.071$). But statistical comparison of results of the techniques showed that INIT group had greater improvement than the SCS and METS.

Conclusion: By reducing pain, improving range of motion, and decreasing disability, INIT, METS, and SCS were found to be effective in treating individuals with mechanical neck discomfort.

Keywords: Cervical pain, integrated neuromuscular inhibition, muscle energy, neck pain, strain counter strain, trigger points.

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Introduction:

Neck pain is a musculoskeletal issue that is associated with disability and leads to significant medical expenses. Worldwide health burden of disease shows neck pain is at the 4th number of causing major activity limitations and disabilities also its overall burden ranking is at 21st.(1) Mechanical neck pain is characterized as nonspecific cervico-thoracic joint pain that is made worse by neck movements. Neck pain at such beginning points might be a significant obstacle to daily activities and overall personal enjoyment. According to the records of World Health Organization (WHO), there is somewhere around half of population reports experiencing neck pain once in their lifetime. (2)

Neck pain is the most prevalent site of musculoskeletal discomfort in healthy young people, with a prevalence of roughly 75.7%. Annual prevalence of mechanical neck pain is around 30–50% among the general and work populations.(3) The prevalence of neck pain in females is 43% and male is 30%. Asia represents 13% prevalence of neck pain. More than 50% of people have a reoccurrence of the pain in the

Affiliations: [1]Physiatrics-The Physiotherapy Clinic, Islamabad, Pakistan. [2]Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Islamabad, Pakistan. [3]Rawal Institute of Health Sciences, Islamabad, Pakistan. [4]The Children Hospital, Lahore, Pakistan. [5]Movement for Life Physiotherapy, Islamabad, Pakistan.

Correspondence: Zainab Mahmood

Email: zainabmehmood789@gmail.com

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next few years.(4) The prevalence of neck pain in Pakistan is 84%, which is a very high rate.(5) Almost 11% to 14% of workers reported absentees, limited activity and function.(6) Educational-related people are also one of the major affected populations due to neck pain. Most recent data indicates that around 45% of students complain of neck pain in a year.

Multimodal and different risk factors are clearly recognized for neck pain. It is recommended that neck pain is much of the time non traumatic in nature, emerges from individual and numerous ergonomic risk factors. In addition, repetitive movements, neck strain and sprain, poor workstation design, prolonged periods of the same posture, deteriorating strength and endurance of the cervical muscles, and genetic predisposition are all associated with mechanical neck pain.(6)

Patients with mechanical neck pain experience pain and tightness in the cervical muscles. Because of the tension, both superficial and deep muscles are affected, and the shoulder region is also painful. The occiput, head, and neck area are painfully affected by painful stimulation of the upper cervical joints. Other common signs of mechanical neck pain include decreased neck movements, headache, stress manifestation, and trigger points in upper trapezius and suboccipital muscles.(7)

Non-opioid analgesics such NSAIDS (including oral and topical both), paracetamol, and opioids are the drugs that are most frequently reported.(8) However, they don't provide enough evidence to establish their viability or to rule out the possibility of gastrointestinal upset and lethargy, respectively.(9)

When treating mechanical neck discomfort, chiropractors and physiotherapists frequently employ manual therapy techniques and modalities. Several manual and electrotherapy treatments are available to eliminate Myofacial trigger points such as spray or stretch, trigger point injection, ischemic compression, muscle energy techniques, ultrasound, LASER and transcutaneous electrical nerve stimulation. However no conclusive findings to support the use of any specific modality in the management of MTrPs.(8) Techniques used in manual therapy include joint and tissue mobilization. Additionally, the conventional static stretching method is used to treat mechanical neck pain. Using either autogenic or reciprocal inhibition approaches, METS focuses on the passive and active components of muscle tone, which are diminished.(9)

Method of manual therapy, i.e. (INIT) integrated neuromuscular inhibition technique, is employed to deactivate MTrPs. INIT is a single session that combines the strain-counter strain technique, the ischemia compression technique, and the muscular energy technique. The pressure pain threshold caused by MTrPs in chronic mechanical neck pain can be decreased by INIT. In order to alleviate muscular spasms in painful places, INIT is based on the reciprocal inhibition and post-isometric relaxation phenomenon. It utilizes a combination of manual therapy approaches to address trigger points and muscle imbalances by modulating neural and muscular responses. Additionally, it has been suggested that INIT can increase cervical range of motion, lessen pain, and reverse neck dysfunction. INIT has been approved as an effective treatment for MTrPs in which three techniques are used in a single and coordinated manner.(10)

By combining isometric contractions, the Muscle Energy Technique (MET) mobilizes soft tissue. This technique is used to return the structure of soft tissues to normal. Joint dysfunction is indirectly influenced by muscular dysfunction; hence METs are employed to restore normal joint mobility in unhealthy soft tissue structures. Applying MET lessens discomfort, enhances range of motion, and lessens the severity of neck impairment. The International Classification of Functioning, Disability, and Health (abbreviated as ICF) standards have determined that MET improves neck movement by assessing the pain score and threshold, functional performance, range of motion, and muscle thickness.(11)

A non-direct method of osteopathy Positional Release Technique (PRT) is another name for strain counter strain (SCS). When treating musculoskeletal dysfunctions, dysfunctional joints and associated muscles are shifted away from their restrictive boundaries and into postures of ease. Strain counter strain approach shortening or "folding-over" of abnormal tissues results in therapeutic alterations through both proprioceptive and nociceptive pathways. By automatically resetting muscle spindles, which serve to control the length and tone of the afflicted tissues and lengthen sarcomeres, SCS is able to provide its benefits. Due to the manual contact aspect of the treatment and the stimulation of fibers, which can result in pain blockage, local pain intensity and PPT improved after the administration of SCS. In SCS, after the pressure on the trigger points is released, the tissue's blood and lymphatic circulation increases, removing the hypoxic conditions in the muscle and causing cellular metabolism, which eliminates inflammatory chemicals like prostaglandins, histamine, and bradykinin. Additionally, the sensitization of nociceptors is reduced. One of the advantages of SCS

is breaking the cycle of pain-spasm-pain.(12)

Results of this previous study indicate beneficial effects on pain, functioning, and health-related quality of life in people with chronic mechanical neck pain when an integrated neuromuscular inhibition method is added to a therapeutic exercise program. The literature review revealed a lack of studies reporting on the comparative effectiveness of integrated neuromuscular inhibition, strain counter strain, and muscle energy techniques. The efficiency of integrated neuromuscular inhibition, muscle energy, and strain counter strain approach has to be studied. These three research methods will be evaluated to see which interventional method is most effective at treating mechanical neck pain.

Methods:

This study is a Randomized Clinical Trial (REC / NCT05262062). G Power 3.1.9.7 was utilized to determine the sample size. Priori power analysis was performed with three groups. With an effect size of 0.458, a significance level of 0.05, and power of 0.80, the required sample size was calculated to be 51 participants (17 in each group). The sampling technique used was non-probability convenience sampling. Randomization was done through the sealed envelope method.

Following the research board's clearance, the trial ran for six months, from December 2021 to March 2022. The study was conducted in Pakistan Railway General Hospital, and Ali Ahmad Physiocare Rehabilitation Clinic, F7 Markaz Islamabad.

Inclusion criteria were: participants with mechanical neck pain (symptoms > 3 months), Both genders between the age group of 30 – 60 years, participants having at least one active trigger point at upper trapezius, levator scapulae, sternocleidomastoid, and a score of more than 3 on Visual analogue scale (VAS). Participants having severe mechanical neck pain (>8 on VAS), any systemic joint pathology, inflammatory joint disease (e.g. rheumatoid arthritis, psoriatic arthritis gouty arthritis) myelopathy, any neurological deficit, or mental illness, or participants on medication like corticosteroid, antidepressants were excluded from the study. Ethical Clearance was obtained from the Research Ethical Committee of Riphah International University (Ref: RIPHAH/RCRS/REC/Letter-01064) and a written consent was signed from the participants.

After randomization into 3 groups, Group A receives Strain Counter Strain Technique, Group B Muscle energy technique, Group C Integrated Neuromuscular Inhibition Technique. Conventional treatment was given to all participants. A detailed intervention protocol is shown in table 1. For four weeks, each subject received treatment three times a week. There were three outcome measures, Visual analogue scale (VAS) for pain, neck disability index for disability, and Goniometer for ranges was taken before, after 2 weeks and after 4 weeks of the intervention. All the patients undergo their respective intervention protocol selected through randomization. At the end of session, we compare the differences in the values between the three groups to see which intervention was more effective in treating mechanical neck pain.

Table 1: Detail Intervention Protocol

Baseline examination protocol (Conventional treatment)		After the baseline examination will complete hot pack and tens at 2 to 10Hz frequency and intensity according to patient tolerance level will be applied for 10 to 20 minutes according to patient tolerance.	
	Integrated neuromuscular inhibition technique (Group A)	**Muscle energy technique (Group B)**	**Strain counter strain technique (Group C)**
WEEK 1-4	Group A received combination of exercises i.e. strain counter strain, muscle energy & ischemic compression.	After MTrPs identification, in an easy position for 20 to 30 seconds and then subjected to an isometric contraction.	Painful upper trapezius, levator scapulae and SCM were placed in an ease position (20 to 30 sec).
	After MTrPs identification, the patient received compression in ischemic compression in an intermittent manner for 2 minutes.	After holding an isometric contraction for seven to ten seconds, a soft-tissue stretch was performed (15 sec* 3 times) then relaxes (30 sec) during the treatment session.	After MTrPs identification, moderate digital pressure was applied and participants were asked to rate their level of discomfort on a scale of 1 to 10.
	Direct digital pressure or pincer grip on the upper trapezius, levator scapulae and SCM muscle) in supine or upright position was used with the patients	Treatment was performed on the upper trapezius, SCM, and levator scapulae muscles.	The position of ease was identified once and than held for 20 to 30 seconds.

Data analysis was done with SPSS version 23. The mean, median, and mode were used to descriptively examine the data, and a bar chart was used to visually represent the results. The normality of the data was checked by using Shapiro-Wilk test. Within-group analysis was done by using parametric and non-parametric test according to the normality results.

Results:

Normality testing with Shapiro-Wilk test showed that none of the variables were normally distributed ($P<0.05$) so non parametric testing was considered. The Shapiro-Wilk test was used to determine the normality of the data distribution at a 95 percent confidence interval with α level of 0.05. Comparison between groups was done by Kruskal Wallis test and within group comparison was done by Friedman test.

The total sample included in the analysis was 51 with 17 participants in each group i.e. Group A (Integrated Neuromuscular Inhibition), Group B (strain counter strain technique) and Group C (Muscle energy). The mean age of group INIT was 41.94± 8.370, mean age of group SCS was 44.71± 8.461 and the mean age of group METS was 42.41± 8.307 respectively. Gender distribution in the groups was 8(47.1%) males and 9 (52.9%) females in Integrated Neuromuscular Inhibition group(INIT), 5(29.4%)males and 12(70.6%) females in strain counter strain technique group (SCS), and 8(47.1%) males and 9(52.9%) females in Muscle energy group(METS).

13 participants were employed in INIT group and 4 were not. In SCS group 7 were employed and 10 were not. In METS 12 participants were employed and 5 were not. The frequency distribution of sedentary job style among groups was 15 participants did not have sedentary job style while 2 have in INIT group. In SCS all the participants did not have sedentary job style. The frequency in METS was 14 did not have sedentary job and 3 have it. The frequency of participants involved in sports was only 1 out of 17 in INIT group. SCS group frequency of involved participants is 2 and 0 participants were involved in METS group. The frequency of participants who received physiotherapy previously in the INIT group was 11, 17 in SCS group and 12 were involved in the METs group out of 17 in each group

Within-group analysis for VAS, NDI and Goniometer was carried out by using Friedman Test as shown in tables 2 and 3.

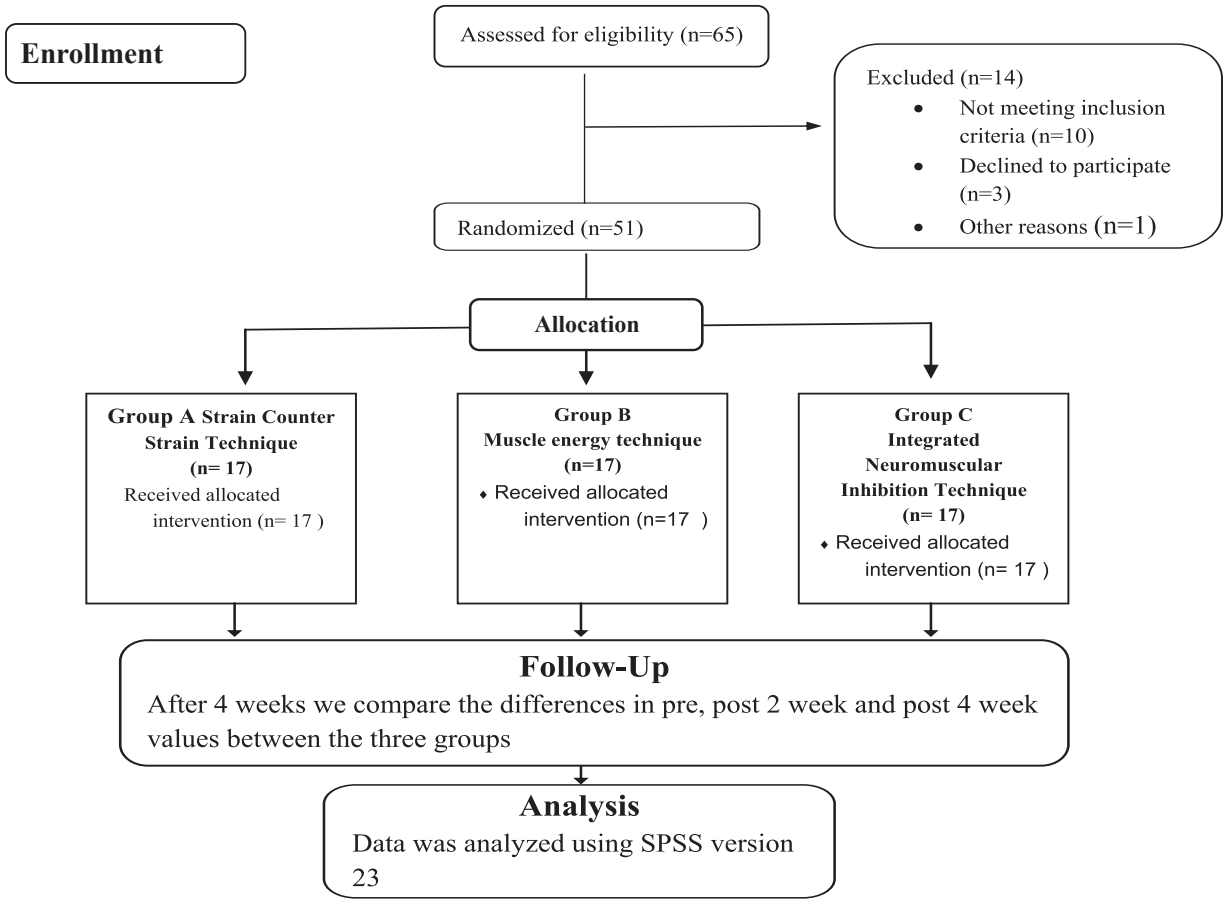

Figure 1: Consort Diagram

Table 2: Within-group analysis VAS and NDI

	Group		Pre Assessment	Post 2 weeks	Post 4 weeks	P-value
VAS Within Group Comparison	INIT	Median (IQR)	8(1)	5(1)	.00(5)	<0.001
		Mean Rank	3	2	1	
	SCS	Median (IQR)	8(1)	4(2)	1(0)	<0.001
		Mean Rank	3	2	1	
	MET	Median (IQR)	7(0)	4(1)	1(1)	<0.001
		Mean Rank	3	2	1	
NDI comparison within groups	INIT	Median (IQR)	50(16)	28(10)	8(7)	<0.001
		Mean Rank	3	1.97	1.03	
	SCS	Median(IQR)	48(21)	24(12)	10(17)	<0.001
		Mean Rank	2.91	1.85	1.24	
	MET	Median (IQR)	48(30)	28(26)	10(18)	<0.001
		Mean Rank	2.88	2	1.12	

Table 3: Goniometer reading comparison within group

Goniometer reading within groups								
		Median (IQR)			Mean Rank			
Group	Muscles involved	Pre assessment	Post 2 weeks	Post 4 weeks	Pre assessment	Post 2 weeks	Post 4 weeks	P- Value
INIT	Upper trapezius	30(12.5)	50(7.5)	70(0)	2.79	6.03	7.85	<0.001
	Levator scapulae	30(15)	60(10)	90(0)	3.12	6.97	9	<0.001
	Sternocleidomastoid	15(10)	30(10)	45(0)	1.03	3.18	5.03	<.001
SCS	Upper trapezius	25(12.5)	50(10)	70(2.5)	3.21	5.82	7.88	<0.001
	Levator scapulae	30(10)	55(12.5)	90(5)	3.09	6.94	8.97	<0.001
	Sternocleidomastoid	15(7.5)	25(7.5)	45(5)	1.18	2.74	5.18	<0.001
METS	Upper trapezius	35(10)	60(7.5)	70(5)	2.85	6.38	7.91	<0.001
	Levator scapulae	45(10)	60(7.5)	90(10)	4.24	6.68	9.00	<0.001
	Sternocleidomastoid	15(5)	30(7.5)	45(0)	1	2.47	4.47	<0.001

Using the Kruskal Wallis test, the groups were compared. In the fourth week, the INIT group's VAS Median (IQR) drops from an 8 on the pre-assessment to zero. Comparing this group to others, the improvement is more pronounced. With a change from the pre-assessment value of 50 to 8, the NDI group's median (IQR) value after the fourth week of therapy indicates better improvement than others'. Similarly the mean rank of range of motion in INIT group is improved as compared to other groups. Upper Trapezius mean rank goniometer reading increased significantly from 23.65 at pre-assessment to 29.12 at 4th week, levator scapulae improved from 21.59 to 30.03 and sternocleidomastoid improved from 21.85 to 28. Significant progress has been made over time within each group, as indicated by the p-value (0.000). The comparison between the groups is displayed in figures 2 and 3 below.

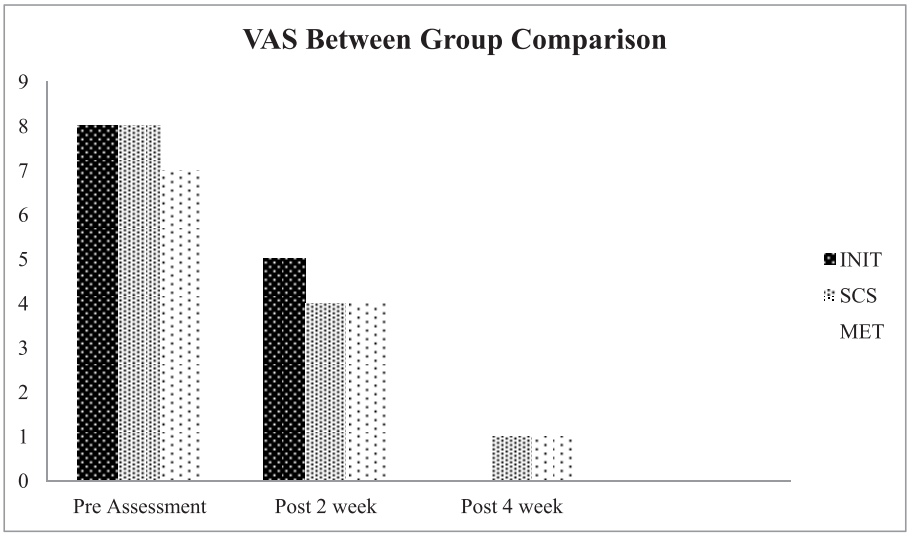

Figure 2: VAS Between Group Comparison

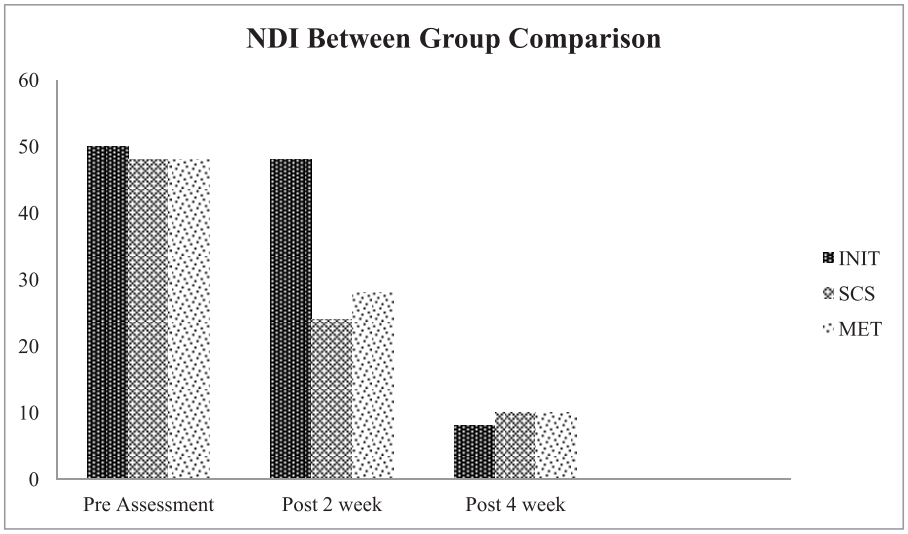

Figure 3: NDI Between group Comparison

Discussion:

The purpose of the study was to compare the effects of INIT, METS, and SCS approaches on mechanical neck pain management in terms of pain, disability and range of motion.

Regarding the first objective of the study in the study population the pain was measured with VAS and all three groups were compared at pre-assessment level and were homogenous to each other (P = 0.133). VAS compared after post second and fourth week revealed that significant difference existed between the groups overall (P = 0.002, P = 0.000).INIT group shows better improvement compared to others. While within-group analysis showed that all the three interventions were effective in reducing pain (P<0.001). Similar results were reported by the research conducted by Al-Najjar et al (2022) which shows that INIT was found effective in reducing pain in the mechanical neck pain population. By boosting circulation during the pressure release and activating A-beta fibers, which affect the pain gate during pressure, this technique helps in reducing pain.(13) Similarly, Lytras et al (2019) also find that METS (as used in INIT) is effective to limit the pain in mechanical neck pain.(14)

Next objective of the study was about the disability that is assessed with NDI and all the three groups were compared at the assessment level and were homogenous to each other (P = 0.637). NDI compared after post second and fourth week revealed that no significant difference was observed between the groups overall (P = 0.576, P = 0.410) showing that all groups showed efficacy in total NDI scores but, in post second and

fourth week INIT showed some better improvement as compared to METS and SCS. While within-group analysis showed that all the three intervention were effective in reducing pain (P<0.001). The research findings of this study regarding the NDI scale are supported by a study by Nugraha et al (2020) found that METS in patients with mechanical neck pain, NDI scale show better improvement.(11)

Regarding the neck ROM, all three group muscles were compared at the assessment level and were homogenous to each other (0.116, 0.000 and 0.289). The INIT showed greater improvement in the Upper trapezius (P=0.005) after the fourth week revealing that no significant difference was observed between the groups overall showing that all groups showed efficacy in total goniometer muscles scores. While within-group analysis showed that all three interventions were effective in reducing ROM (P<0.001). A study by Kumar et al (2015) also shows the efficacy of SCS by improving ROM.(15) Research conducted by Gohil et al (2020) reported that in patients with myofascial trigger points of the upper trapezius, both methods were equally successful in lowering discomfort, increasing cervical lateral flexion range of motion, and improving NDI score.(16)

The study had limitations, including the absence of physical testing for physical function, the lack of blinding by the care provider and participants, and the intervention only targeting three muscles. More research with a larger sample size in multiple metropolitan city centers is advised for better treatment approaches.

Conclusion:

The study's findings indicate that all interventional protocols—INIT, SCS, and METS—are successful in helping patients with mechanical neck pain manage their pain, range of motion, and disability. Comparing INIT to METS AND SCS, the group comparison revealed a greater statistical improvement with time interaction. Clinically, the INIT also showed greater improvement across all metrics. However, after follow up till post 4th week all groups showed similar efficacy in outcomes in mechanical neck pain. Thus, INIT is a more effective treatment for mechanical neck discomfort than METS and SCS, according to this study.

Disclaimer: None to declare.

Conflict of interest: None to declare.

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Author's Contribution:
Mahmood Z: Research concept and design
Khan LG: Conception of work and acquisition
Latif D: Critical revision of the article, data analysis
Azhar G: Assembly of data, drafting of work
Zahid B: Data collection and analysis
Javaid U: Refining the methodology and final approval