ORIGINAL ARTICLE

Comparison of muscle energy technique and facet joint mobilisation in the patient with chronic neck pain: A randomized controlled trial

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Abstract

Objective: To compare the effects of muscle energy techniques, facet joint mobilisation and conventional physical therapy on pain, disability, cervical lordosis and range of motion in patients with chronic neck pain.

Method: The parallel-design randomised controlled trial was conducted at the Physical Therapy and Rehabilitation Department of the Heavy Industries Taxila Hospital, Taxila Cantt, Pakistan, from December 2020 to May 2021, and comprised patients of either gender aged 35-50 years who had chronic neck pain, recurrent neck pain, and cervical spine curve. The participants were randomised into muscle energy techniques group A, facet joint mobilisation group B and conventional physical therapy group C. The outcome measures were cervical lordosis, pain intensity, neck disability index and cervical range of motions. Data was analysed using SPSS 21.

Results: Of the 115 patients initially assessed, 105(91.3%) were included; 67(63.8%) females and 38(36.2%) males. There were 35(33.3%) subjects in group A with mean age 40.09± 4.29 years, 35(33.3%) in group B with mean age 40.14±4.57 years and 35(33.3%) in group C with men age 39.26±5.19 years. There were no significant differences among the groups at baseline in terms of mean age, weight, height, body mass index, neck disability index, cervical lordosis and range of motion ($p>0.05$). Of the total, 6(5.7%) were lost to follow-up and the study was completed by 99(94.3%) subjects. Outcome variables in group A were superior to those in groups B and C with respect to flexion, rotation and side-bending ($p<0.05$). There was no significant difference between groups A and B related to numeric pain rating scale and neck disability index ($p>0.05$).

Conclusion: Muscle energy techniques and facet joint mobilisation showed significant improvement in neck pain, disability and cervical range of motions compared to conventional physical therapy. Muscle energy techniques and facet joint mobilisation produced similar outcomes with respect to pain intensity and functional disability.

Clinical Trial Number: The study was prospectively registered with clinicaltrials.gov (NCT05040477).

Keywords: Cervical lordosis, Facet joint, Mobilisation, Muscle energy techniques, Neck pain. (JPMA 73: 10; 2023)

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Introduction

In the developed world, the prevalence of the chronic neck pain is reported to be ranging from 7% to 22% among women and from 5% to 16% among men.[1] Prevalence studies showed that cervical pain is more prevalent among middle-aged women compared to their male counterparts.[2]

Chronic neck pain is one of the most common and debilitating forms of musculoskeletal dysfunction which is aggravated with neck movements, sustained neck posture and cervical muscle palpation.[3] Pain started after minor positional fault or malalignment in the cervical spine curve due to muscle guarding and tightness. Muscular activity also has a contribution to the magnitude and change in shape of the cervical lordosis. There is a significant association between the loss of cervical lordosis and the weakness of cervical extensor group of muscles.[4,5]

The natural biomechanical alignment of the spine is essential to distribute most of the load posteriorly. Therefore, any deviation from this natural alignment might lead to the development of cervical pathology.[6] A sustained forward head posture is mostly adopted during repetitive workload that would lead to long-standing neck pain and stiffness which causes loss of cervical lordosis or cervical straightening.[7]

The most common approaches used for evaluation of the biomechanical orientation of cervical curve are the Cobb angle method and the posterior tangent method.[8] As compared to the Cobb angle method, the standard error rate of posterior tangent method is lower and it gives more accurate measurements than the Cobb angle method, as posterior tangent slopes along the curve and can provide an analysis of any buckled area of cervical curve.[9]

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Conservative treatment approaches for cervical pain include management plan by a general practitioner, manual physical therapy, exercise therapy, graded strengthening and endurance programmes by physiotherapists and combinations of these.[10]

In terms of preference of techniques for the management of neck pain, exercise therapy and manual therapy are mostly applied by physiotherapists. Manual therapy techniques include joint mobilisation and soft tissue mobilisation techniques. Restoration of joint arthrokinematics is achieved by joint mobilisations, whereas soft tissue techniques, such as muscle energy techniques (MET) and static stretching, focus on flexibility of soft tissues, like extensibility of muscle and connective tissues.[11] Conventional static stretching is commonly applied in the management of neck pain and other mechanical disorders, but it directs effect only on the passive component of muscle, like connective tissues or perimysium, whereas METs focus on the active component of muscle tone in addition to the passive component.[11]

MET is also known as post-isometric relaxation (PIR) technique or post-facilitation stretch (PFS), as it is a direct active post-facilitating technique.[12] MET promotes reflex relaxation of hyperactive and tight deep cervical extensor muscles through autogenic or reciprocal inhibition, thereby increasing extensibility and viscoelasticity of the muscles.[13] However, Joint mobilisation promotes activation of mechanoreceptors which promotes proprioception of neck muscles.[14] Maitland's application involves rhythmical and oscillatory mobilisations along with stretching techniques to reduce muscle spasm and pain prior to mobilisations.[15,16] Sustained natural apophyseal glides (SNAG) is one of the best sustained mobilisation techniques as it improves the range of motion (ROM) of the patient by correcting the biomechanics of the joint, unlocking a jammed facet, and releasing the entrapped meniscoid between the joints.[17]

Literature suggests that in comparison to Kaltenborn's mobilisation techniques, after 2 weeks of treatment, oscillatory Maitland's mobilisation appeared to be superior with respect to functional disability and cervical ROM (CROM).[18] Moreover, in comparison to conventional physical therapy (CPT), evidence suggests METs to be superior in relieving pain and improving disability among the patients with non-specific neck pain.[19]

However, to our knowledge, no evidence exists regarding the comparison of MET and facet joint mobilisation (FJM) on cervical lordosis. The current study was planned to fill the gap by comparing the effects of MET, FJM and CPT on pain, disability, cervical lordosis and ROM in patients with chronic neck pain.

Patients and Methods

The parallel-design randomised controlled trial (RCT) was conducted at the Physical Therapy and Rehabilitation Department of the Heavy Industries Taxila (HIT) Hospital, Taxila Cantt, Pakistan, from December 2020 to May 2021.

After approval from the ethics review committee of Riphah International University, Islamabad, Pakistan, the RCT was prospectively registered (Sept 2021).

The sample size was calculated using OpenEpi tool with confidence interval 95%, power 80% in line with literature.[11] The sample was raised using purposive sampling technique. The subjects were randomised using sealed envelope method into MET group A, FJM group B and CPT group C. The participants were kept blinded to the group orientation.

Both male and female patients with age 35-50 years, having chronic neck pain for more than 12 weeks ranging from 4-8 on Numeric Pain Rating Scale (NPRS), patients having recurrent neck pain aggravated at least once in the preceding month, and those with cervical spine curve straightening on X-rays and limited and painful CROM (flexion <80^o, extension <70^o, rotation <90^o to both sides, lateral flexion <35^o) were included after taking informed consent from each of them. Patients with any history of tumour, recent trauma, acute inflammation, vertebrobasilar insufficiency, cervical radiculopathy or myelopathy and any serious systemic underlying pathology were excluded.

All patients received moist hot pack of 14/15′ over cervical region for 15 minutes. Hydro collator temperature, according to standardised hot pack, is 40-45 degree Celsius along with application of transcutaneous electrical nerve stimulation with frequency of 120Hz at low intensity below the local painful sensory threshold with pulse width 50-200 micro-sec was applied for 10 minutes followed by treatment through particular intervention.

Group A received METs. Based on 3-5 repetitions of the post-isometric relaxation (PIR), 30-50% isometric contraction of the agonist muscle was performed for 7-10 seconds while holding the breath during isometrics. The patients were then asked to exhale and relax for 5 seconds and then repeat the movement in new restrictive barrier with a gentle stretch of 10-60-second hold.[12,14] The whole procedure was repeated for a minimum of 3 times during each session for a period of 2 weeks. The technique was applied to the shortened muscles of the cervical region, which get shortened due to static abnormal posture muscles, including anterior scaleni, middle scaleni, posterior scaleni, sternocleidomastoid (SCM), the levator

scapulae and the upper fibres of trapezius muscles.

Group B received FJM. Treatment was based on 3 sets of 15 repetitions of the unilateral poster-anterior glides (UPA) on the cervical spine C2-C7.[18] Initially grade I and II mobilisations were used, followed by grade III of Maitland manual therapy on selected tender and painful cervical vertebral segments. While on hypomobile segments, 5 repetitions of extension SNAGs were applied.[20]

Group C controls received CPT to improve flexibility of short muscles by sustained stretching and strengthening of weak musculature by isometrics. Treatment approach based on 2 sets of 5-10 repetitions of isometric exercises for muscles which are prone to weakness, including serratus anterior, middle and lower fibres of trapezius, deep cervical flexors, and major and minor rhomboids, and 5 repetitions with holding time of 20 seconds tagetted stretching exercises for the short muscles prone to tightness, including pectoralis muscles, suboccipital, levator scapulae and upper trapezius.

Outcome measuring tools included NPRS[21] for pain, neck disability index (NDI)[21] for neck disability, and goniometry for CROM, while cervical lordosis was measured through radiograph using posterior tangent method C2-C7.[22,23]

Data was collected at baseline, after 2 weeks of treatment, and after 4 weeks. The home exercise programme was given to all the patients during the 4-week study. All groups received a 2-week interventional plan. The patients in all groups received 20-30-minute sessions on 3 alternate days for two consecutive weeks, making it a total of 6 sessions. Patients were advised to revisit after 4 weeks (1 month from the baseline) for follow-up.

Data was analysed using SPSS 21. Shapiro-Wilk test was used to determine data normality. Parametric testing included one-way independent-measure analysis of variance (ANOVA) for intergroup comparisons, followed by Bonferroni test for post-hoc analysis of NDI, cervical lordosis and CROM. Non-parametric testing included Kruskal-Wallis test for intergroup comparison to analyse effects on NPRS. P<0.05 was considered significant. The statistical analysis for those lost to follow up post-intervention was performed on an intention-to-treatment basis.

Results

Of the 115 patients initially assessed, 105(91.3%) were included. Of them, 6(5.7%) patients were lost to follow-up and the study was completed by 99(94.3%) subjects (Figure). There were 67(63.8%) females and 38(36.2%) males. In group A, there were 35(33.3%) subjects with mean age 40.09± 4.29 years, 35(33.3%) in group B with mean age 40.14±4.57 years and 35(33.3%) in group C with men age 39.26±5.19 years. There were no significant differences among the groups at baseline in terms of mean age, weight, height, body mass index (BMI), NDI, cervical lordosis and CROM (p>0.05) (Table 1).

Among the participants, 39 (37.4%) reported onset of neck pain 3 months before presentation, 58 (55.4%) said 6 months, and 8 (7.2%) said 12 months. In general, 67 (63.8) participants were housewives, 18 (17.1%) labourers, 5

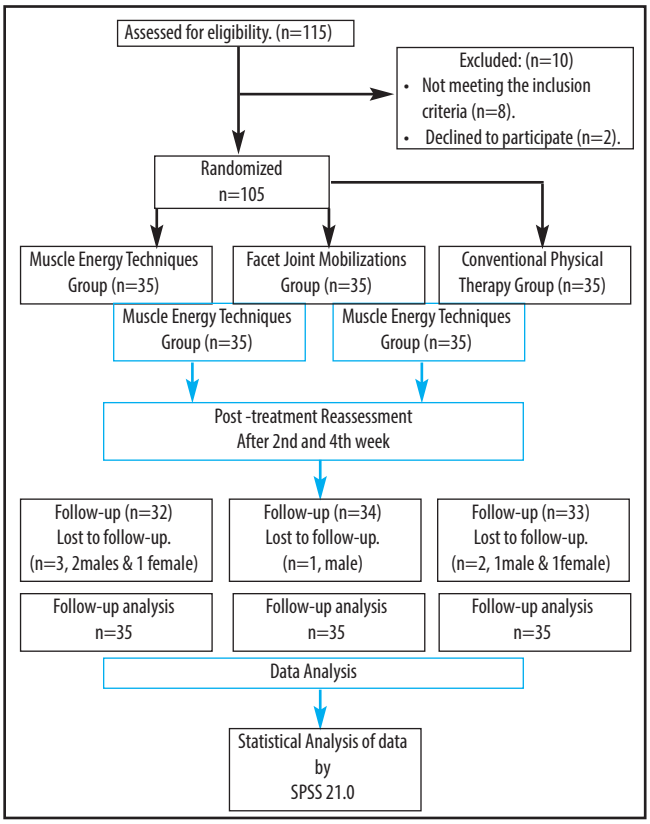

Figure: Consolidated Standards of Reporting Trials (CONSORT) flow chart.

Table-1: Baseline comparison of the study groups.

Variables	Mean±S.D			*p*-value
	MET Group	FJM group	CT group	
Age (years)	40.09± 4.29	40.14±4.57	39.26±5.19	0.715
Weight (kg)	70.86±5.56	69.87±5.80	71.20±4.60	0.921
Height (in feet)	5.24±0.56	5.83±0.63	5.18±0.12	0.930
Body mass Index (BMI)	25.25±1.20	24.39±1.73	25.09±1.60	0.635
Neck Disability Index (NDI)	47.83±9.97	43.06±7.88	44.06±9.55	0.161
Cervical Lordosis	21.23±3.25	22.20±3.06	20.97±3.55	0.260
Cervical Range of Motions				
Flexion	38.53±3.79	39.89±3.29	39.57±3.30	0.114
Extension	40.06±3.43	39.80±3.54	40.09±3.76	0.972
Right Rotation	55.26±3.03	56.46±2.63	56.43±2.68	0.144
Left Rotation	56.09±2.41	57.17±2.54	57.49±2.33	0.063
Right side Flexion	29.54±2.46	30.63±2.32	29.75±2.65	0.150
Left side Flexion.	30.53±2.06	31.74±2.29	30.69±2.67	0.061

SD: Standard deviation, MET: Muscle energy techniques, FJM: Facet joint mobilisation, CT: Conventional physical therapy.

Table-2: Follow-up inter-group comparison of NPRS.

Variables	Median	Interquartile Range (26)	Mean Rank MET Group	Mean Rank FJM group	Mean Rank CT group	*p*-value
NPRS Baseline	7	1	56.86	51.66	50.49	0.632
NPRS after 2 weeks	4	1	42.86	48.86	67.29	0.001
NPRS after 4 weeks	3	2	43.91	41.59	73.51	<0.001

NPRS: Numeric pain rating scale, MET: Muscle energy techniques, FJM: Facet joint mobilisation, CT: Conventional physical therapy.

Table-3: Follow-up inter-group comparison of outcome variables after 4 weeks.

Variables	Mean±S.D MET group	Mean±S.D FJM group	Mean±S.D CT group	*p*-value	Post hoc (*p*-value) MET vs FJM	FJM vs CT	MET vs CT
Neck disability Index (NDI)	10.37±4.06	10.97±2.77	16.94±2.48	<0.001	1	<0.001	<0.001
Cervical Lordosis	26.34±3.81	33.46±4.50	26.60±4.27	<0.001	<0.001	<0.001	1
Cervical Range of Motions							
Flexion	58.51±5.72	56.01±6.95	47.46±3.58	<0.001	0.001	<0.001	<0.001
Extension	50.43±3.58	59.03±4.26	45.09±3.06	<0.001	<0.001	<0.001	<0.001
Right Rotation	75.11±5.17	71.97±5.11	63.89±3.40	<0.001	<0.001	<0.001	<0.001
Left Rotation	74.29±5.10	72.57±4.85	64.20±3.41	<0.001	0.005	<0.001	<0.001
Right side Flexion	44.71±2.91	41.74±3.28	39.66±2.89	<0.001	0.001	0.015	<0.001
Left side Flexion.	44.02±2.47	42.40±3.72	39.29±2.57	<0.001	0.009	<0.001	<0.001

SD: Standard deviation, MET: Muscle energy techniques, FJM: Facet joint mobilisation, CT: Conventional physical therapy.

(4.8%) office workers and 15 (14.3%) in the others category.

In term of pain intensity, there was significant intragroup differences in all the 3 groups post-intervention compared to the baseline ($p<0.05$). There was no significant difference between groups A and B related to NPRS and NDI ($p>0.05$), but both groups were superior to group C (Table 2).

In relation to flexion, rotation and side-bending, a significant intragroup improvement was observed in all the groups ($p<0.05$). Group A had better outcomes compared to group B with respect to ROM in flexion, rotation and side-bending towards both sides ($p<0.05$). For extension ROM and cervical lordosis, group B did better than group A ($p<0.05$). No significant difference was found between groups A and B for NDI ($p>0.05$). Group B overall did better than group C($p<0.05$). Group A was superior to group C with respect to NDI and CROMs, but there was no significant difference for cervical lordosis ($p>0.05$) (Table 3).

Mean cervical lordosis in group A increased from the baseline score of 21.23 degrees to 26.34 degrees, whereas mean cervical lordosis in groups B and C increased from the baseline scores of 22.20 degrees and 20.97 degrees to 33.46 and 26.60degrees, respectively. Hence, all groups showed significant improvement in cervical lordosis, but group B was superior to the other groups ($p<0.001$).

Discussion

The findings indicated that MET and FJM were efficient in improving chronic neck pain intensity, cervical lordosis, ROM and NDI. In terms of neck pain intensity and functional disability, both MET and FJM were superior to CPT with non-significant difference among the three. An earlier study combined the effects of MET and FJM on cervical spine curvature, and concluded that there was a significant improvement in patients with respect to cervical spine lordotic curve, pain intensity, functional disability score, CROMs and isometric strength of muscle. However, there was no comparative group in that pilot study.[20] An RCT concluded that adding manual therapy to the conventional protocol significantly improved neck pain, disability, ROM and perception of movement.[24] The current study also reported that the manual FJM showed significant improvement in outcome measures as compared to conventional therapy. However, there was no MET group in the earlier study and the effects on cervical lordosis were not observed either.[24]

The current findings are supported by a study showing cervical SNAGs to be superior over the control group in terms of pain intensity, disability score and CROM, but due to the absence of MET group, it is not possible to compare between MET and manual therapy.[25]

In line with the current findings, a study comparing CPT with and without MET concluded that both protocols were beneficial in improving pain and NDI scores, but MET was superior to CPT.[26] On the other hand, contrary to the current results, a three-group comparative study of myofascial release, MET and manual therapy demonstrated no significant difference ($p>0.05$) in terms of ROM, disability and proprioception in patients with postural neck pain.[14] Based on the review of existing literature, it is important to mention that prior to the current study, no evidence existed regarding the comparison of MET and FJM on cervical lordosis.

The results of the current study are in accordance with an RCT which demonstrated significant MET results compared to passive sustained static stretching for improving pain intensity and disability level among patients with neck pain. However, there was no FJM group in the earlier study and the effects on cervical lordosis and CROM were not observed either.[3]

The current study suggested a significant improvement in cervical spine lordosis with FJM among patients with chronic neck pain, unlike previous studies which

demonstrated an improvement in cervical spine lordotic curvature after use of spinal manual therapy techniques and cervical manipulation along with mechanical traction.[22,23]

The current study demonstrated FJM to be superior to MET for improving cervical lordosis and extension ROMs. The findings can be explained in a physiological perspective as both techniques improve muscle balance and joint integrity, but MET improves muscle flexibility by reducing tension on targeted structures, whereas FJM promotes activation of mechanoreceptors which promote proprioception of cervical structures[14] thus suggesting FJM to be superior to MET for improving cervical lordosis.

The current study has limitations as there was no long-term follow-up of interventions to assess the sustainability of treatment effects. Besides, the sample was also small. Future studies should focus on long-term follow-up of interventions with larger sample sizes. Future studies should also look into the effects of each interventional technique in terms of curve measurement via quantitative angle measuring software and addition of electromyography (EMG) for muscle strength analysis.

Conclusion

MET and FJM were found to be more effective for reducing neck pain and disability via improved CROMs compared to CPT, except for cervical lordosis and extension ROMs where FJM was superior to both groups. While MET was superior to FJM with respect to flexion, rotation and side-bending towards both sides, there was no significant difference between FJM and MET with respect to pain intensity and functional disability.

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Author Contribution:

HT: Conceptualization and design, data analysis, drafting, critical revision, review, and approval.
MM: Editing, reviewing, critical analysis, supervision, final approval.
KSG: Date compilation, interpretation, material support.