Effect of Facet Joint Mobilization and Muscle Energy Technique on Pain, Cervical Range of Motion and Functional Outcome in Subjects with Mechanical Neck Pain

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ABSTRACT

Background: Mechanical neck pain is defined as pain located in the cervical spine, including the cervicothoracic junction. The main feature is pain, restriction of range of motion and functional limitation. Cervical facet joint mobilization (FJM) reducing pain and normalizes function. Muscle spasm in the cervical region along with a minor positional fault in muscle guarding of the levator scapulae and upper trapezius which are all closely related with limitation of range of motion (ROM), of the persons with mechanical neck pain (MNP). Muscle energy technique (MET) can be used to lengthen muscles. MET can improve the range of motion and there by functional outcome. Main objective of the study to find out the effect of facet joint mobilization and MET along with conventional therapy on pain, cervical ROM and functional outcome in participants with MNP.

Methods: The study included 30 participants with MNP. All were randomly divided into 2 groups; experimental group (FJM & MET with conventional therapy) control group (MET with conventional therapy). Both groups treated for 5 sessions/week for 6 weeks. Statistical analysis was done for score of NPRS, ROM and NDI at the baseline and after treatment at the end of 6 weeks.

Result: This study shows statistical significance in both the group. Experimental group shows better improvement than control group in which along with conventional therapy MET and FJM was given.

Conclusion: FJM with MET were effective in reducing pain, improving cervical ROM and functional outcome in participants with MNP. FJM can apply in clinical setup in addition with MET plus conventional therapy in treating MNP.

Keywords: Mechanical Neck Pain, Facet Joint Mobilization, Muscle Energy Technique, Neck Disability Indexed, Cervical Range of Motion

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INTRODUCTION

Neck pain is the second most common disease after low back pain that occurs in the general population.1 Neck pain as defined by Mersky is the pain "anywhere within the region bounded superiorly by superior nuchal line, inferiorly by an imaginary line through the tip of first thoracic spinous process and laterally by sagittal plane tangential to the lateral borders of the neck".2 Mechanical neck pain (MNP) is defined as pain located in the cervical spine, including the cervicothoracic junction, which is exacerbated with cervical motion, sustained postures, and/or palpation of the cervical musculature.3 Its prevalence in the world ranges from 16.7% to 75.1%.4

One of the most common complications of mechanical neck pain is decreased cervical lordotic curve. Cervical lordosis and forward head posture are inversely proportional to each other. Healthy young adults with chronic mechanical neck pain have an increased forward head posture (FHP) and decreased cervical lordosis as compared to pain-free individuals. Forward head posture is associated with chronic neck pain and upper trapezius trigger points.5

A FHP is protrusion of the head with rounded shoulders, a

medially rotated humerus and a protracted scapula resulting in tight posterior capsule, tightness of the pectoral, Upper Trapezius, and Levator Scapulae muscles, and weakness of the lower scapular stabilizers and deep neck flexors that leads to locking of cervical facet joints associated with decreased range and increased pain on cervical backward bending and that is why facet joint mobilization can beneficial effect in terms of pain and ROM in patients with forward head posture.[5,6]

Physiotherapy management for neck pain includes electrotherapy modalities, exercises and manual therapy.[7] Cervical mobilization using Maitland technique relieves pain and normalizes function. Maitland mobilization is one of the most common manual therapy approaches used by physiotherapist. It is a passive oscillatory technique, applied over the hypomobile vertebra level, and the methods are considered valid.[8] Cervical mobilization is often used in combination with routine physiotherapy and is found to be effective in the management of neck pain and disability by reducing pain and improving cervical ROM in chronic patients with mechanical pain.[9]

MET as defined by Greenman is a manual procedure which involves voluntary contraction by the patient, against a directly executed counterforce applied by the therapist. MET can be used to lengthen muscles which are shortened, contracture or spastic.[10] Greenman outlines three types of muscle contractions utilized in MET as follows: 1. Isometric contraction - the distance between origin and insertion of the muscle is maintained at a constant length. 2. Concentric contraction - the origin and insertion approximate during contraction.3. Eccentric contraction - muscle tension allows a controlled separation of origin and insertion with a lengthening of the muscle.[11]

The mode of operation of MET was attributed to either post-isometric relaxation (PIR), which affects the tissues that were isometrically contracted, or reciprocal inhibition (RI), which affects antagonist tissues that have undergone contraction. It was reported that PIR and RI partially explain the benefits of MET, which are relatively pain-free joint and soft tissue motion after mild isometric contractions.[11] Thus, it is very important to adopt a biomechanical perspective in the management of mechanical neck pain. Evidence suggests that the forward head posture and cervical lordosis are clinically relevant outcomes for the management and prognosis of neck pain, thus improving the biomechanics and alignment of the cervical spine is very important in patients with mechanical neck pain.[5]

The muscle energy technique has been used to clinically restore range of motion in vertical segment of the spin to decrease pain to stretch the tight muscles and to strengthen the weak muscles. Therefore, MET can be useful to reduce the degree of neck disability and to correct the posture by working on abnormal biomechanics.

As forward head posture is associated with decrease in range and increase in pain on cervical extension as a result of locking of the cervical facet joint, perhaps this would be a reason for adding a facet joint mobilization to have a positive effect. Hence it is inevitable to have facet joint mobilization as a part of the comprehensive treatment in the participants with mechanical neck pain.

So, in the present study the objective is to improve the arthro- kinematics and alignment of the cervical spine by facet joint mobilization. While Muscle energy technique is used to reduce tightness in the muscles responsible for the upper cross syndrome, there by correcting the reason for the neck pain in a biomechanical perspective.

Main aim of this study was to determine the effect of facet joint mobilization with muscle energy technique on reducing pain, improvement in cervical range of motion and functional outcome in mechanical neck pain.

MATERIALS AND METHODOLOGY

Quasi experimental study conducted at C.U Shah Physiotherapy college, Surendranagar. Prior ethical approval was taken. Total 30 participants with mechanical neck pain included by purposive sampling technique and randomization done during group allocation. Treatment protocol applied for 6 weeks (5 days / week) in both the group.

Age between 18-45 years, male & female subjects diagnosed with mechanical neck pain including reduced cervical spine range along with pain and neck disability as well as Duration of symptoms between 6 weeks to 3 months included for the study.[1,2,5]

Subjects with active inflammation, history of trauma or surgery, vertebra-basilar insufficiency, cervical myelopathy, neck pain radiation into arms or upper extremity, any deformity (e.g., torticollis, scoliosis), Positive spurling's sign, positive ULTT excluded for the study. [5]

DATA COLLECTION PROCEDURE:

The selection of the subjects was done by convenience sampling with random allocation (by computer table method). A total 30 participants were randomly assigned into two groups, A (facet joint mobilization with MET plus conventional physiotherapy) and B (MET plus conventional physiotherapy). Participants who found suitable for the study were asked to sign consent form. The procedure was explained to all the participants.

TREATMENT PROTOCOL

All the participants were instructed to continue normal activities and avoid any other forms of treatment during the study. Subjects were provided the designated protocol and not permitted to administer any forms of electrotherapy or other technique during the intervention period of the treatment.

Group A (Experimental Group): Received Facet joint mobilization, Muscle Energy Technique, Conventional therapy

Group B (Control group): Received Muscle Energy Technique and Conventional therapy

Facet joint mobilization:[8] **Maitland Mobilization:** Unilateral posterior anterior (UPA) glides on the tender segment.

Patient and Therapist position: The patient lying in prone and the therapist stood at the head of the patient.

Procedure: Therapist's thumbs were placed in opposition at the level of the facet of the hypo mobile cervical vertebra and a unilateral posteroanterior (PA) oscillatory pressure was applied using Grade II and Grade III Maitland's manual therapy techniques.

Frequency and duration: This oscillatory mobilization was performed at a frequency of 2 Hz for 2 min and repeated 3 times. The rest time between each mobilization was 1 min.

Muscle Energy Technique for both the Group: [12] - Post isometric relaxation technique for Upper trapezius and Levator scapulae

Patient position: Supine lying

Procedure: The patient was instructed to make maximum isometric contraction against the therapist's hand and then 20% was determined. The contraction was sustained for 7 seconds, followed by 7 seconds of relaxation then passive stretching was held beyond resistance barrier and was sustained for 30 seconds followed by 30 seconds of relaxation. It was performed for 3 rep. of each side of the muscle per sessions.

3. Conventional protocol for Group A and B: [13,14,15]

1. Hydrocollator pack: 15 min.

2. Active ROM Exercises: For Flexion, Extension, Rotations, Side flexions with 10 repetitions each

3. Isometric neck exercises: For Flexion, Extension, Rotations, Side flexions with 10 repetitions each

4. Strengthening Exercises: For Deep neck flexors, Rhomboids**,** Middle and Lower trapezius Serratus anterior with progressive resisted exercise using Delorme protocol.

RESULTS

Analysis of the data was done using SPSS Software 26.0 version. Before applying statistical tests, data was screened for normal distribution using Kolmogorov Smirnov test. The data was first structured descriptively in terms of mean and standard deviation. Level of significance was kept at 95%

Intra group comparison of both groups scores of NPRS was tested by Wilcoxon signed ranked test, all cervical ROM were tested by Wilcoxon signed ranked test and paired t test and NDI was tested by paired t test and Inter group comparison of both group scores of pre and difference of improvement of NPRS were tested by Mann Whitney U test. Pre score of all cervical ROM were tested by unpaired t test and difference of improvement was tested by Mann Whitney U test and pre score of NDI was tested by unpaired t test and difference of improvement was tested by Mann Whitney U test.

Table 1 shows the pre and post treatment variables of group A, where the p value of all variable is < 0.05. It shows that there is statistically significant difference between the pre and post treatment score of all outcome of group A. Table 2 shows the pre and post treatment variables of group B, where the p value of all variable is < 0.05. It shows that there is statistically significant difference between the pre and post treatment score of all outcome of group B. Table 3 shows the comparison of mean of difference of improvement in variables of group A & B, where the p value of all variable is < 0.05. It shows that there is statistically significant difference between the difference of improvement in score of NPRS, cervical ROM & NDI between group A & B.

TABLE 1: MEAN AND STANDARD DEVIATION OF VALUES OBTAINED BEFORE AND AFTER TREATMENT FOR GROUP A

	PRE		POST			
VARIABLES	**MEAN**	**SD**	**MEAN**	**SD**	**t**	**p**
NPRS	5.46	1.12	1.86	1.06	-3.458	0.001
Cer. Fle	36.46	1.76	39.00	1.06	3.32	0.001
Cer. Ext	41.33	3.35	46.13	2.82	-15.401	0.000
Cer. Rot (RT)	37.86	1.99	43.40	1.68	3.45	0.001
Cer. Rot (LT)	38.93	2.34	44.00	1.64	3.42	0.001
Cer. Side Fle. (RT)	17.06	3.43	22.06	2.60	-15.448	0.000
Cer. Side Fle. (LT)	17.66	2.71	21.26	2.65	-15.317	0.000
NDI	17.40	1.18	13.26	1.48	19.19	0.000

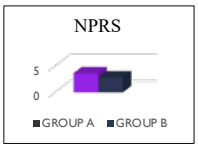
TABLE 2: MEAN AND STANDARD DEVIATION OF VALUES OBTAINED BEFORE AND AFTER TREATMENT FOR GROUP B

	PRE		POST			
VARIABLES	**MEAN**	**SD**	**MEAN**	**SD**	**t**	**p**
NPRS	4.66	1.83	2.26	1.22	-3.457	0.001
Cer. Fle	36.13	1.95	38.60	1.24	3.3	0.001
Cer. Ext	41.46	3.04	45.40	2.89	-19.071	0.000
Cer. Rot (RT)	38.20	2.14	42.40	2.41	0.661	0.031
Cer. Rot (LT)	38.60	2.55	41.93	2.46	-17.838	0.000
Cer. Side Fle. (RT)	16.60	3.24	20.06	2.57	-8.918	0.000
Cer. Side Fle. (LT)	17.00	3.38	19.60	2.87	-12.160	0.000
NDI	17.00	1.55	13.73	1.62	21.313	0.000

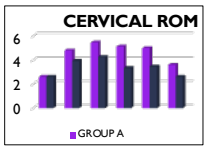
TABLE 3 POSTTEST COMPARISON OF NPRS, CERVICAL ROM & NDI BETWEEN GROUP A & B

	GROUP A		GROUP B			
VARIABLES	**MEAN**	**SD**	**MEAN**	**SD**	**t**	**p**
NPRS	3.60	0.82	2.80	0.86	2.311	0.029
Cer. Fle	2.60	1.63	2.60	1.24	-0.169	0.870
Cer. Ext	4.80	1.20	3.93	0.79	2.060	0.045
Cer. Rot (RT)	5.46	1.06	4.26	0.88	2.98	0.001
Cer. Rot (LT)	5.13	1.35	3.33	0.72	3.50	0.000
Cer. Side Fle. (RT)	5.00	1.25	3.46	1.50	2.82	0.005
Cer. Side Fle. (LT)	3.60	0.91	2.60	0.82	2.74	0.008
NDI	4.13	0.83	3.26	0.59	2.75	0.009

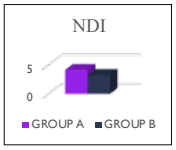
Between group comparison mentioned in the graphical presentation in the Graph 1, 2 and 3.



Graph 1



Graph 2



Graph 3

DISCUSSION

Both the groups received MET for upper trapezius and levator scapulae muscles. MET reduces perception of pain by improving tolerance to stretch. Combination of

stretching and isometric contraction stimulates muscle and joint mechano-receptors and proprioceptors would reduce the sensation of pain, making stretch stress-free and tolerable.[9] The reduction in pain in MET is as a result of painful inhibition, through both the ascending and descending neurological passageway, after the activation of muscle and joint mechano-receptors over the course of the isometric contractions. It is noteworthy to know that throughout the contractions, endogenous pain-inhibiting chemicals are released, including endocannabinoids, enkephalins, and endorphins.[11]

Joint mobilization has potential benefit in reducing pain in chronic neck pain. Joint mobilization would play a role on pain reduction by the mechanism of neurophysiological mechanisms which have been found to produce hypoalgesia following mobilization. Pain relief by the mobilization is due to altered inputs from the higher centers. Pain reduction could improve the mobility in the cervical region as well as the disability reduces. Joint Mobilization promotes activation of the mechanoreceptors which improves the awareness of the position sense and movement sense in the neck.[16]

The effects of MET component for increase in CROM post intervention can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility – reflex relaxation, viscoelastic changes, and changes to stretch tolerance. Reflex muscle Relaxation following contraction that has been proposed to occur by activation of Golgi tendon organs and their inhibitory influence on the α-motor neuron pool. Combination of contractions and stretches might be more effective for producing viscoelastic change than passive stretching, because greater forces could produce increased viscoelastic change and passive extensibility.[6] Burns and Wells conducted a study to compare the effect of MET on CROM in asymptomatic subjects and concluded significant improvements in CROM in all three planes (flexion/extension, side bending and rotation).[17]

Mechanisms by which Maitland mobilization improved ROM can be attributed to both mechanical and neurophysiological effects. Mechanical effects could involve a permanent or temporary change in the length of connective tissue structures such as joint capsule of the zygapophyseal joints, ligaments and muscle. Neurophysiological mechanisms have been postulated to account for changes in the mobility observed in response to application of PA forces by reducing the perception of pain and a reduction in muscle activity.[8] Studies that reported that mobilization applied to both the neck and spine at the same time improved cranial vertical angle and cranial rotation angle. This study also found that Maitland mobilization improve cervical extension, side flexion and side rotation range on patients with MNP. G. Shankar Ganesh et al. suggest that mobilization and exercises combined in reducing neck pain, improving ROM and related disability among participants with acute neck pain.[8] As the result of present study shows facet joint mobilization along with MET and conventional therapy (Group A) is statistically significant difference is effective in reduction of pain, CROM and functional outcome than in MET and conventional therapy (Group B).

CONCLUSION

The addition of facet joint mobilization with MET and conventional therapy shows significant greater reduction in pain, improvement in all cervical ROM except neck flexion and functional outcome in participants with MNP. The result for neck flexion range is significantly similar in both the groups.

CONFLICT OF INTEREST:

None

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