

# To Study the Effect of Muscle Energy Technique of Pectoral Muscle on Neck Pain and Cervical Range of Motion in Individuals with Forward Head Posture - An Experimental Study

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## ABSTRACT

There is growing evidence that MET can be used to release soft tissue shortening, but most of the studies for treatment of Forward Head Posture (FHP) have concentrated on Upper Trapezius tightness, Retractor muscle Strengthening and Deep Cervical Flexors strengthening but none concentrating on the PMi tightness associated with FHP. The pectoralis minor muscle (PMi) is the sole muscle connecting scapula and anterior side of the thoracic region and functions to depress the scapula. Therefore, shortening of this muscle is expected to restrain scapular motion in the superior and posterior direction. Thus, there is a need to examine the effectiveness of MET on PMi muscle in treating symptomatic subjects, and comparing its efficacy on conventional interventions. Twenty-six individuals were selected (13 participants in control group received conventional therapy and 13 participants of experimental group received Met along with conventional therapy). The study concluded that MET in addition to CT was found to be more effective in reducing VAS score, improving FHP and reducing PMi tightness. But there was no significant difference seen between the two groups in improvement of CROM. Thus, MET should be added to routine clinical practice.

**Keywords:** forward head posture (FHP), muscle energy technique (MET), pectoralis minor tightness

## INTRODUCTION

Proper posture is believed to be the state of musculoskeletal balance that involves minimal amount of stress and strain on the body. An ideal posture is considered to exist when external auditory meatus is aligned with vertical postural line. The vertical postural line as seen in a side view, passes slightly in front of the ankle joint and centre of the knee joint, slightly

behind centre of the hip joint and the external auditory meatus. FHP is one of the most common poor head posture seen in patients with neck disorders. <sup>[1]</sup>

FHP means that the head is in an anterior position in relation to the theoretical plumb line in frontal view, which is perpendicular to a horizontal line through the centre of gravity (COG) of the body. <sup>[1]</sup>

A FHP is commonly defined as the protrusion of the head in the sagittal plane so that the head is placed anterior to the trunk.

Therapists rate the severity of the anterior positioning of the head as minimal, moderate or maximal without any objective or numeric values. A decision regarding normality or otherwise is then based on clinicians experience and perception of what constitutes a normal or "ideal" posture, and is therefore considered to be a potential source of error. [1]

A FHP is often associated with rounded shoulders, a medially rotated humerus and a protracted scapula resulting in humeral head translating anteriorly, a tight posterior capsule, tightness of the pectoral, Upper Trapezius, and Levator Scapulae muscles, and weakness of the lower scapular stabilizers and deep neck flexors. [2]

The pectoralis minor (PMi) is the sole muscle connecting the scapula and anterior side of the thoracic region and functions to depress the scapula. Therefore, shortening of this muscle is expected to restrain scapular motion in the superior and posterior direction. A previous study indicated that the resting length of the PMi during standing with the arm at the side affected the scapular kinematics. [3]

Neck pain (NP) is a common problem affecting approximately 70% of the people at some point in their life. Cote and Cassidy (1998) reported lifetime prevalence of neck pain up to 67%. [6] A frequently seen cause of the neck pain is awkward occupational postures, heavy lifting and physically demanding work. [7]

FHP may result in physical stimuli and / or accumulation of algogenic substances that contribute to pain. Potential mediators of pain include stretching of anterior structures of the neck, shortening of the posterior muscles, fatigue and accumulation of algogenic substances in the muscles that counterbalance the head's tendency to tip

forward, and increase in the compressive forces on cervical apophyseal joints and posterior aspects of the vertebral bodies. [8]

The cause of FHP may be attributed to poor postural sense, muscle fatigue or weakness, use of bifocals, dysfunction of cervical spine etc. Self correction exercises like cervical retraction exercises, scapular retraction exercises, [9] deep cervical flexor training exercises [5] etc are more frequently used.

Muscle energy technique (MET) is a type of manual therapy which was founded by Dr. Fred L. Mitchell Sr. It can be used to lengthen a shortened, contracted or spastic muscle; to strengthen a physiologically weakened muscle or group of muscles; to reduce localized oedema, to relieve passive congestion; and to mobilize an articulation with restricted mobility. [10]

MET are classes of soft tissue osteopathic manipulation methods that incorporate precisely initiated, directed and controlled, patient initiated, isometric and/or isotonic contractions designed to improve musculoskeletal function and reduce pain. [10]

Post-isometric Relaxation (PIR) [10] refers to the assumed effect of reduced tone experienced by a muscle, or a group of muscles, after brief periods following an isometric contraction. The basic principle behind PIR lies that after a muscle is contracted, it is automatically in a relaxed state for a brief, latent period. Thus, MET is simply to increase the muscles tolerance to stretch.

## METHODOLOGY

The study was approved by Institutional Ethical Committee. All the subjects were treated once a day continuously for 2 weeks. Out of 54 participants screened only those participants were selected for the study who met the inclusion criteria and agreed to sign written consent form.

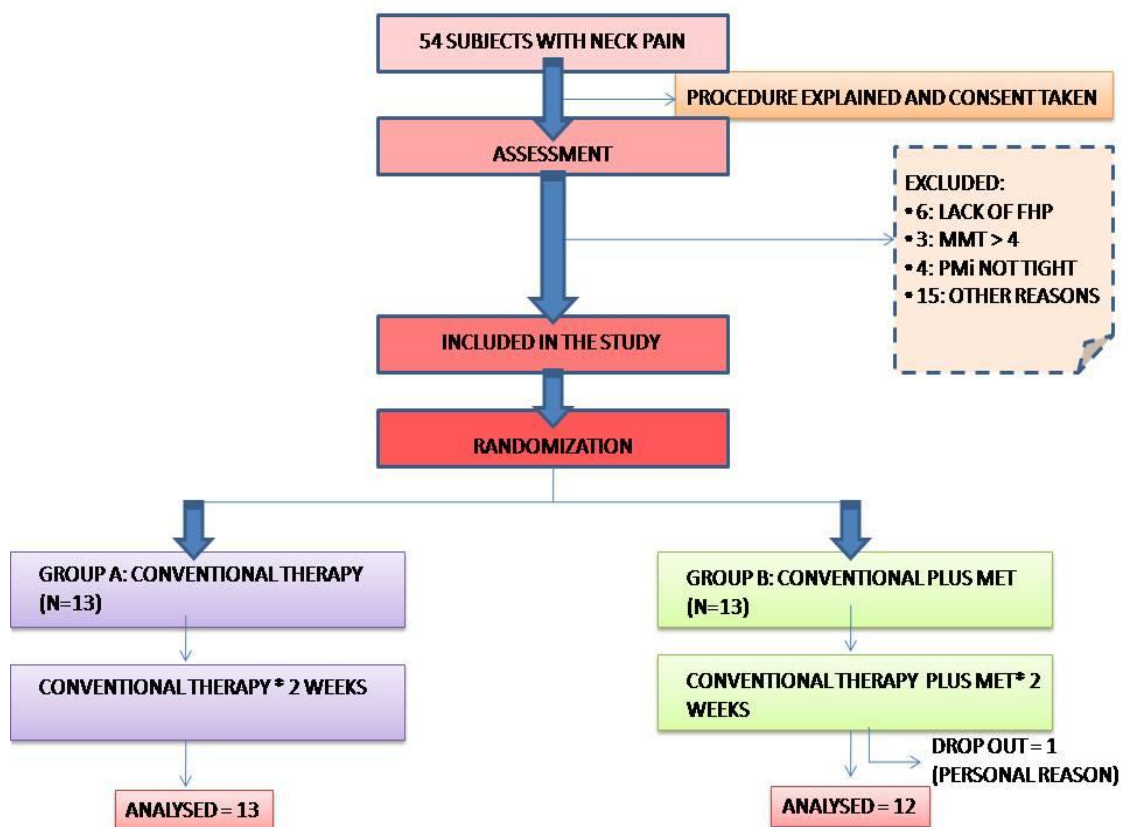


FIGURE 1: Flow chart of study design

### PROCEDURE:

All the participants with neck pain and fulfilling the inclusion criteria were selected and assessed before starting the intervention.

The assessment included evaluating Posture via Plumb Line (for FHP), PMi tightness, CROM and VAS

The whole procedure of the study and risks involved were explained to all the subjects and all their queries were answered in language convenient to the patient.

### MEASURING FHP:

Reference points like the lateral malleolus, mid knee joint line, acromion process and external auditory meatus were marked on subjects. Subjects were then asked to stand with reference to plumb line such that the plumb line fell slightly anterior to lateral malleolus. Subjects were selected if external auditory meatus was lying in front of plumb line and were considered to have FHP. [11]

After the patient was screened for FHP then the measure of FHP was taken using carpenter's tri-square scale where distance between tragus and wall was seen. If the distance was >10cm in men and >9.5cm in women then they were taken for the study.

### MEASURING PMi TIGHTNESS:

The patient was in supine lying position with his/her hands resting on abdomen and elbow in slight flexion. Then the therapist measured the distance between the acromion process and plinth. If the distance was greater than 2.5cm (1 inch) it was considered to be significant for tightness of PMi muscle. [4]

### CROM:

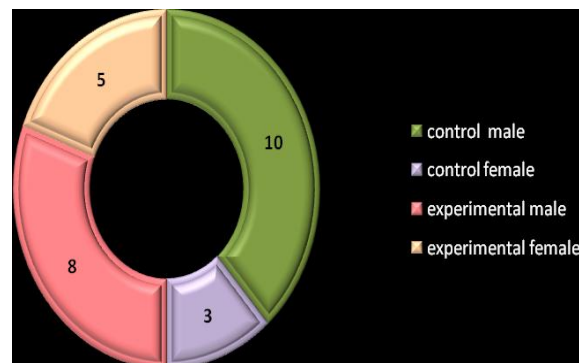
The patient was seated on a stool and all cervical range of motions were measured in degrees using goniometer.

## VAS

The intervention included conventional treatment to control group and conventional therapy along with MET to PMi in interventional group. The conventional therapy included isometric neck exercises, scapular retraction exercises and strengthening to middle and lower trapezius muscle. For MET the patient was asked to apply approximately 20% (or asked to match the therapist strength) of his strength to protract the shoulder girdle in supine position. This isometric contraction was maintained for a period of 7sec while holding the breath during this period and then the patient was asked to relax and exhale. During the period of relaxation the therapist stretched the PMi to its new length

and the stretch force was maintained for a period of 10 seconds. The procedure was repeated for a minimum of 3 times per session for a period of two weeks.

## RESULTS



GRAPH 1 GENDER DISTRIBUTION IN BOTH GROUPS

TABLE 1: CHANGES IN VAS BEFORE AND AFTER TREATMENT

VAS SCORE	CONTROL		EXPERIMENTAL		'Z' Value	'p' Value
	Pre Treatment Mean(±SD)	Post Treatment Mean(±SD)	Pre Treatment Mean(±SD)	Post Treatment Mean(±SD)		
Resting VAS	3.77 (±0.93)	1.69 (±1.20)	4.19 (±0.68)	1.19 (±0.57)	4.343	0.001
Activity VAS	5.92 (±1.10)	3.88 (±1.19)	5.65 (±1.69)	2.74 (±1.24)	4.310	0.001

TABLE 2 CHANGES IN PECTORALIS MINOR TIGHTNESS (in cm) IN BOTH THE GROUPS BEFORE AND AFTER TREATMENT

SIDE	CONTROL		EXPERIMENTAL		'Z' value	'p' value
	Pre Treatment Mean(±SD)	Post Treatment Mean(±SD)	Pre Treatment Mean(±SD)	Post Treatment Mean(±SD)		
Right	7.42 (±1.04)	6.65 (±0.92)	7.02 (±0.84)	5.48 (±1.55)	3.88	0.001
Left	7.50 (±1.26)	6.77 (±1.12)	6.99 (±0.72)	5.55 (±1.00)	4.187	0.001

TABLE 3 CHANGES IN FORWARD HEAD POSTURE (in cm) BEFORE AND AFTER TREATMENT

FHP Measure	CONTROL		EXPERIMENTAL		'Z' value	'p' value
	Pre Treatment Mean(±SD)	Post Treatment Mean(±SD)	Pre Treatment Mean (±SD)	Post Treatment Mean(±SD)		
FHP distance	13.04 (±1.33)	11.50 (±1.55)	12.92 (±1.24)	10.33 (±0.98)	4.340	0.001

TABLE 4 DIFFERENCE BETWEEN CHANGES IN PECTORAL LENGTH AND FHP MEASURE IN BOTH THE GROUPS

CHARACTERISTIC	CONTROL	EXPERIMENTAL	'U' value	'p' value
	MEAN ± SD	MEAN ± SD		
FHP	1.5±0	2.5±0.6	36.50	0.011
Right Pectoralis minor	0.76±0.52	2.54±0.81	8.00	0.00
Left pectoralis minor	0.73±0.56	2.37±0.67	9.00	0.00

TABLE 5 DIFFERENCE BETWEEN CHANGES IN CERVICAL ROM(in Degrees) IN BOTH THE GROUPS

CHARACTERISTIC	CONTROL	EXPERIMENTAL	'U' value	'p' value
	MEAN ± SD	MEAN ± SD		
Flexion	8.46±6.88	6.66±4.92	71.50	0.709
Extension	8.07±3.25	5.83±3.58	66.00	0.428
Right side flexion	6.92±4.34	10.41±5.41	47.50	0.054
Left side flexion	6.15±4.63	10±6.03	49.50	0.108
Right rotation	1.15±2.19	1.16±2.46	70.00	0.576
Left rotation	2.30±2.59	2.91±3.42	66.00	0.711

TABLE 6 COMPARISON OF DIFFERENCE BETWEEN VAS AT REST AND DURING ACTIVITY

CHARACTERISTIC	CONTROL	EXPERIMENTAL	'U' value	'p' value
	MEAN ± SD			
Resting VAS	2.076±1.07	3±0.45	38.00	0.004
Activity VAS	2.038±1.03	4.19±1.82	27.00	0.030

## DISCUSSION

The present study was carried out to see the additional effect of MET over CT alone in treatment of FHP demonstrated that both the techniques are statistically significant in reduction of pain and increasing the CROM during intra group comparison using Wilcoxon Signed Rank Test, but during inter group comparison which was done using Mann-Whitney Test, MET along with CT was found to be more effective than CT alone, in alleviating pain and correcting FHP together with releasing pectoralis minor. But there was no statistically significant difference between the two groups in improving CROM.

Within and between group analysis revealed that there was a significant reduction in patient reported pain scores when pre and post intervention scores were compared in both the groups. The possible mechanism for reduction of pain in MET group can be attributed to the hypoalgesic effects of MET. This can be explained by the inhibitory Golgi Tendon reflex, activated during the isometric contraction that leads to reflex Relaxation of the muscle. Activation of muscle and joint mechanoreceptors leads to sympathoexcitation evoked by somatic efferents and localised activation of the periaqueductal gray matter that plays a role in descending modulation of pain. [12] The results obtained in MET group were in consensus with the previous studies in which pain intensity reduced following MET over neck area [13-17] or other areas of the body. [12,18-20] Nagrale et al [13] demonstrated significant levels of improvement in MET group for pain intensity at 2 and 4 weeks follow-up. Rajarajeswaram et al [17] showed significant reduction in pain level in MET group.

The possible mechanism for reduction of pain in CT group by only isometric exercise regime might be due to

increase in endorphins that occur usually after training and better neuromuscular control. The strong muscle contractions that happen during isometric exercises which activate muscle stretch receptors cause endogenous opioids to be released and also causes the release of beta endorphins from the pituitary gland, these secretions may cause decrease in pain. [21]

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 alpha-motor neuron pool. [10] 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. [10]

Results of the present study for MET group for improvement in CROM were similar to previous studies conducted over neck area [13-15,17,22,23] and other muscles/joint. [19,20,24] Cassidy et al [14] found immediate increase in ROM of neck in all three planes in patients with mechanical neck pain in patients who were mobilised using MET. Burns and Wells [23] 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).

## CONCLUSION

This study concluded that both the treatment techniques, Muscle Energy Technique along with Conventional Therapy and Conventional Therapy alone were effective in alleviating neck pain in



terms of decreasing Pain intensity and increasing active cervical range of motion as there was no statistically significant difference between the two groups, however MET along with CT was superior than CT alone in decreasing pain, increasing active CROM, correcting FHP by correcting the biomechanical imbalance created by the same by stretching Pectoralis minor and strengthening the scapular retractor muscles.

#### Limitations of the Study

- Lesser number of female participants
- Blinding was not done
- No follow-up
- Inability to measure 20% strength during MET

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