

Research Article

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Effect of positional release technique (SMI and INIT) and muscle energy technique (contraction-relaxation) on craniovertebral angle, pressure pain threshold and neck functions in forward head posture subjects having neck pain- a comparative study

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Abstract

Keywords

forward head posture, muscle energy technique, CVA angle, neck pain, positional release technique, pain pressure threshold.

Background & Introduction - Forward head posture (FHP) is a posture in which there is malalignment of head-on-trunk causing excessive anterior positioning of the head in relation to a vertical reference line. Due to malalignment in forward head posture there is pain in neck and shoulder region. ¹ In forward head posture patient complains of neck pain so for checking pain and functional disability is NPAD (neck pain and disability) scale in subjects with forward head posture. Muscle energy technique and Positional Release technique along with conventional therapy are included in study.

Aims & Objective- To determine the effect of Muscle Energy Technique and positional release technique on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture having neck pain individually and to compare the effect of positional release technique and Muscle Energy Technique on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture.

Methods: In the present comparative study, total thirty-six patients with upper forward head posture and neck pain with age between 20-35 years age were included. Sample size calculated was 34, with a drop out chances of 5% the total sample size was 36, 18 samples in Group 1 and 18 samples in Group 2. Both group received conventional treatment, in addition Group-1 received Positional Release technique and Group-2 received Muscle Energy Technique. Patients were evaluated pre-intervention (0 week) and postintervention (4 week) for pressure pain threshold (by means of algometer) of trapezius and suboccipital muscle, for CVA angle (by means of Web Plot Digitizer software) and for neck function (by means

of Neck Pain and Disability Scale (NPAD) Gujarati Version). Statistical analysis was done by using SPSS 20 version. Significance level was set at $p = 0.05$.

Result: Paired 't' test as a parametric test was applied for intra-group comparison and results showed that there were statistically significant difference in mean of CVA, PPT of trapezius and suboccipital muscle and NPAD in both the groups during four week intervention period ($p = 0.05$). Independent sample 't' test was used as a parametric test was applied between group comparison and result showed that there were statistically significant difference between PRT group and MET group in mean difference of PPT of trapezius and suboccipital muscle NPAD but not in CVA angle after 4 week intervention.

Conclusion: Muscle Energy Technique along with conventional treatment is more effective for improving pressure pain threshold for trapezius and suboccipital muscle, improving the neck function by decreasing score of NPAD than Positional Release technique along with conventional treatment in patient with forward head posture along with neck pain. Whereas, both Muscle Energy Technique and Positional Release technique showed significant difference in CVA, PPT of trapezius and suboccipital muscle and NPAD respectively.

Introduction

Forward head posture (FHP) is a posture in which there is malalignment of head-on-trunk causing excessive anterior positioning of the head in relation to a vertical reference line.² Due to malalignment in forward head posture there is pain in neck and shoulder region.¹ The prevalence of forward head posture and its effects on daily activity is 73% in an age group of 18–30 years in India.³ From evidences it is indicated that the presence of neck pain and forward head posture will lead to delayed or inhibited activation of the deep neck flexors in the cervical spine, which in turn is accompanied by shortening of the opposing suboccipital muscles.⁴

A previous study demonstrated that increased forward head posture was associated with a decreased Cranio-vertebral angle (CVA). For evaluating forward head posture most common method is measuring the craniocervical angle and examines head status relative to the seventh cervical vertebrae (C7)²⁸. To assess craniocervical angle, Web Plot Digitizer (WPD) has been used recently which extracts quantitative data from various types of plots and images.¹³ Pressure-pain thresholds (PPTs) occur at the minimum transition point when applied pressure (i.e., force) is sensed as pain. Pressure-pain thresholds provide a quantified force reading of

one's "tenderness" and, thus, are very useful in a variety of clinical situations. Pressure Algometer is used for measuring pressure-pain threshold which measures pain sensitivity and tenderness.⁵ The reliability of pressure pain thresholds according to raters or measurement frequencies is relatively high.⁶ In forward head posture pressure-pain threshold is checked for suboccipital muscle and upper trapezius muscle.⁷

Recent studies have reported that the forward head posture can cause neck pain, but there is also relationship between forward head posture and pain with functional disability.⁸ An available method for checking pain and functional disability is neck pain and disability scale in subjects with forward head posture.⁹ NPAD-G has excellent internal consistency and test-retest reliability hence it has been used this scale to assess neck pain.¹⁰

Suboccipital release is a technique applied to the craniocervical region aimed at suboccipital muscle inhibition reducing stress on the deep upper cervical tissues.² It has been found that suboccipital release technique significantly improved craniocervical angle patients. As in forward head posture upper trapezius is also shortened so integrated neuromuscular inhibition

technique (INIT) of Ischemic³ compression has shown effect of reducing pain in upper trapezius.¹¹

Sub-occipital muscle inhibition and sub-occipital muscle energy technique have been effectively used as a treatment protocol in forward head posture but there is no study done comparing sub-occipital muscle inhibition and upper trapezius inhibition with suboccipital muscle and upper trapezius muscle energy technique though both the muscles play an important role in forward head posture. Hence the need arises to conduct a study to compare effect of positional release technique and muscle energy technique in subjects with forward head posture.²⁸

Aim of the study- To compare the effect of positional release technique and Muscle Energy Technique on Cranio- vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture.

Hypothesis- null hypothesis states that , there is no significant difference between positional release technique and muscle energy technique on neck functions in subjects with forward head shoulder.

Methodology

Study design used was pre-post experimental Study.

Study population consisted of Patients of forward head posture with 20-35 years of age group.

Sampling technique included Purposive sampling .For sample size calculation in this study, the effect size was calculated from the result of the pilot study. The sample size was estimated in G Power 3.1.9.2 version with effect size 1.31 and $\alpha = 0.05$ at 95% power. Sample size calculated was 34, with a drop out chances of 5% the total sample size was 36, 18 samples in Group 1 and 18 samples in Group 2.

Study duration was of 1 Year.

Study setting was SPB Physiotherapy College OPD and other clinical OPDs of Surat.

Selection criteria: Inclusion criteria Patients willing to participate in the study were included if they met the following criteria: • Cranio-vertebral angle (CVA) between 44-48°¹⁸ • Both male and female • 20-35 years age Group • Neck pain for more than 3 months,¹² • Pressure algometer, a case where the threshold was 3 kg, or the difference in threshold between both sides was 2 kg⁶ • Subjects who can read and understand Gujarati.

Exclusion criteria • No current musculoskeletal, neurological, or cardiorespiratory disorders.¹⁰ • History of cervical injury or cervical surgery, • Idiopathic scoliosis • Bone cancer¹⁸ • Severe cervical Arthrosis • Cervical disc herniation • Upper limb neurologic symptoms • Straightening of the cervical lordosis • Temporomandibular surgery within past 6 months • Trauma in past 6 months • Systemic disease⁷ • Receiving soft tissue therapy within past 6 months • Consumption of analgesics or anti-inflammatory drugs within 48 hours before data collection¹⁹

Outcome measures: 1. Cranio-vertebral angle (CVA) evaluated using Web Plot Digitizer (WPD)²⁹ 2. Pain Pressure Threshold (PPT) evaluated using the Algometer¹⁷ 3. Neck function evaluated using the Neck Pain And Disability Scale (NPAD) Gujarati version.²⁰

Evaluation of CVA Each subject was required to stand relaxed on a mark over the floor at a distance of 1.5 m from the webcam during the assessment. The subject was asked to fix their gaze on a mark on the wall directly in front of them. The examiner identifies the cutaneous bony points and place colored adhesive tapes to mark the C7 Spinous process and external auditory meatus. The C7 spinous was identified by palpating the lower cervical spine, while flexing or extending the cervical spine and another on. A picture of the sagittal view of the right upper body will be taken using the web camera. The captured

image was uploaded on the web plot digitizer (WPD) software, and the angles of forward head posture will be measured by using “angles measure” function as previously reported.²⁹ The craniovertebral angle formed by a horizontal line

drawn through the spinous process of the seventh cervical (C7) vertebra and a line joining the spinous process of C7 vertebra with the tragus of the ear will be recorded.⁴¹



FIG.1. Depicts evaluation of CVA angle measurement by WPD, FIG. 2 & 3. Depicts evaluation of PPT for trapezius muscle and suboccipital muscles.

Evaluation of PPT -Pressure pain threshold was measured using a Pressure Algometer where the force will be applied perpendicularly to the skin at a rate of approximately 3 N/s with a ferrule of 0.5cm². Measurements will be taken at the midpoint of the upper trapezius in sitting position. Subjects was instructed to report ‘pain’ as soon as the feeling of pressure is changed to pain. The investigator then immediately remove the pressure algometer, which recorded the maximum pressure applied. There was 30-s interval between measurements. Three measurements will be taken for each point and the mean of the three measurements will be used for data analysis. The midpoint of the trapezius was defined as the midpoint of a line between the anterior angle of the acromion and C7.¹⁷

For Sub-occipital muscle the subject was in prone relaxed position, to allow the researcher to palpate a tender point in the area between the occiput and the C2 spinous process. A midline point between the occiput and C2 will be chosen as the location for PPT measurement, as both are prominent landmarks therefore enabling the procedure to be repeatable.¹⁴ Prior to measurement, participants

were instructed to say when the pressure applied to the tender point produced pain.¹⁶ For both muscles 3 tests will conducted with a 30 seconds rest between tests.²²

Evaluation of neck functions The tool which is used for evaluating neck function was Neck Pain and Disability Scale (NPAD). It consists of 20 items that measure the intensity of pain, its interference with vocational, recreational, social, and functional aspects of living, and the presence and the extent of the associated emotional factors. Patients respond to each item by marking along a 10-cm scale. Item scores range from 0 to 5, in quarter-point increments. The total score was the sum of the item score with zero indicating no dysfunction and 100 indicating maximal dysfunction.²³ Thus it has been seen in recent studies that neck pain and disability¹⁴ scale has good content validity and are therefore equally relevant for use in this patient group and there is broader scope of the NPAD, particularly in relation to emotional and social functions.¹⁰

Procedure- The patient was screened on the basis of inclusion and exclusion criteria and their

demographic data will be taken by an assessment performa. Prior to the commencement of the study, detailed procedure of the study will be explained to the patients and a signed informed consent form was taken from them. Then the subjects were allocated to any of the two groups by random allocation using lottery method. On the first day of the first week, baseline measurements of Cranio-vertebral angle and Pressure Pain Threshold and neck functions were taken. Total treatment duration was of 4 weeks with 3 sessions per week. Post assessment was taken at the end of 4 week.

Group-1 : Conventional treatment + Positional Release Technique



FIG.4 Demonstrating SMI technique given to patient of group-1



FIG.5 Integrated Neuromuscular Inhibition Technique on upper trapezius

Group-2 :Conventional treatment+ muscle energy technique

MET- The subjects allocated to the MET treatment group received MET stretch to the Suboccipital and upper trapezius muscles on both the left and right sides. The practitioner contact the base of the occiput using one hand, while the other hand will stabilize the shoulder. The head and neck was positioned in flexion and slight lateral bending to the opposite side until the subject will report a stretching sensation in the sub-occipital region. The participants were instructed to gently push their head back against the practitioner's resistance for 3-5 s, followed by a period of approximately 5 s of relaxation. The practitioner repeated this procedure, so that three applications of 'contraction-relaxation' are performed on the muscles of each side.¹⁴

Group-2 : Conventional treatment + Muscle Energy Technique.

Same Conventional treatment (CT) was given to both the groups. Conventional treatment included: All the subjects were given four weeks physiotherapy treatment which included cervical isometrics, Transcutaneous electrical nerve stimulation (TENS). TENS was given for 15 min, at the intensity of 10-30 mA with a frequency of 80 Hz. Cervical isometric exercises in the sitting position by applying resistance at the forehead(cervical flexion, extension, rotation, and side bending) maintained for 10 sec having 15-sec breaks between holds with 10-15 repetitions .²⁴

The subject lies supine, arm on the side to be treated lying alongside the trunk, head/neck side bent away from the side being treated to just short of the restriction barrier, while the practitioner stabilizes the shoulder with one hand and cups the ear/mastoid area of the same side of the head with the other.²⁶ The subject was asked to simultaneously shrug the involved shoulder toward her ear, as well as bringing the ear closer to the shoulder, against resistance. The isometric contraction was be held for 7-10 seconds. Following the contraction, the therapist applies contralateral side bending and ipsilateral rotation to initiate a local tissue stretch, in the tissues in which the trigger point was located. The stretch was held for 30 seconds and the procedure was repeated for three to five times. The degree of effort should be mild and no pain should be

present. Once the muscle is being stretched, the subject relaxes and the stretch is held for 10–30

sec.²⁵ Thus for a single session, duration of treatment was be of 20 minutes.



FIG.6. Demonstrating MET for Trapezius muscle & suboccipital muscle for patient in group-2

Statistical analysis and Result

The Statistical software named statistical package of social sciences (SPSS) version 20 (SPSS 20.0) was used for the analysis of the data and Microsoft word 2013 and Excel 2013 was used to generate graphs and tables. Descriptive statistical analysis was carried out at 95% confidence interval. Outcome measurements analyzed were presented as mean ± SD. Significance was assessed at 5 % level of significance with p 0.05. Total sample size analyzed was 36, since there were 2 drop outs, data was analyzed for 34

patients. For checking the homogeneity of the data, the Levene’s test for equality of variance was done. The data were ensured for their normal distribution using Shapiro-Wilk Test. From that all variables followed the normal. So, the parametric tests were performed. Paired ‘t’ test as a parametric test have been used to analyze the variables pre-intervention to postintervention with calculation of change. Independent ‘t’ test as a parametric test has been used to compare the means of variables between two groups with calculation of difference between the means.

	Shapiro-Wilk		
	Statistic	df	Sig. (p value)
PRECVA	.906	34	.007
POSTCVA	.973	34	.540
AGE	.953	34	.147
PREPPTTR	.943	34	.078
POSTPPTTR	.967	34	.386
PREPPTSUBO	.905	34	.006
POSTPPTSUBO	.953	34	.156
PRENPAD	.941	34	.067
POSTNPAD	.942	34	.069

	LEVENE'S TEST FOR EQUALITY OF VARIANCES	
	F	Sig.(pvalue)
CVA	0.810	0.375
PPT TR	0.995	0.326
PPT SUB	3.487	0.071

Table 1 shows normality distribution and table 2 shows homogeneity of data

Table 2. shows paired t test values for outcome measures within group 1

Paired sample outcome for group-1	Paired differences		t value	Sig.(2-tailed) (p value)
	Mean	Std. Deviation		
PRECVA-POSTCVA	-1.25824	1.87059	-2.773	.014
PREPPTTR-POSTPPTTR	-.3353	.1169	-11.821	.000
PREPPTSUBO-POSTPPTSUBO	-.3647	.0931	-16.143	.000
PRENPAD-POSTNPAD	8.294	1.572	21.757	.000

Table 3. shows paired t test values for outcome measures within group 2

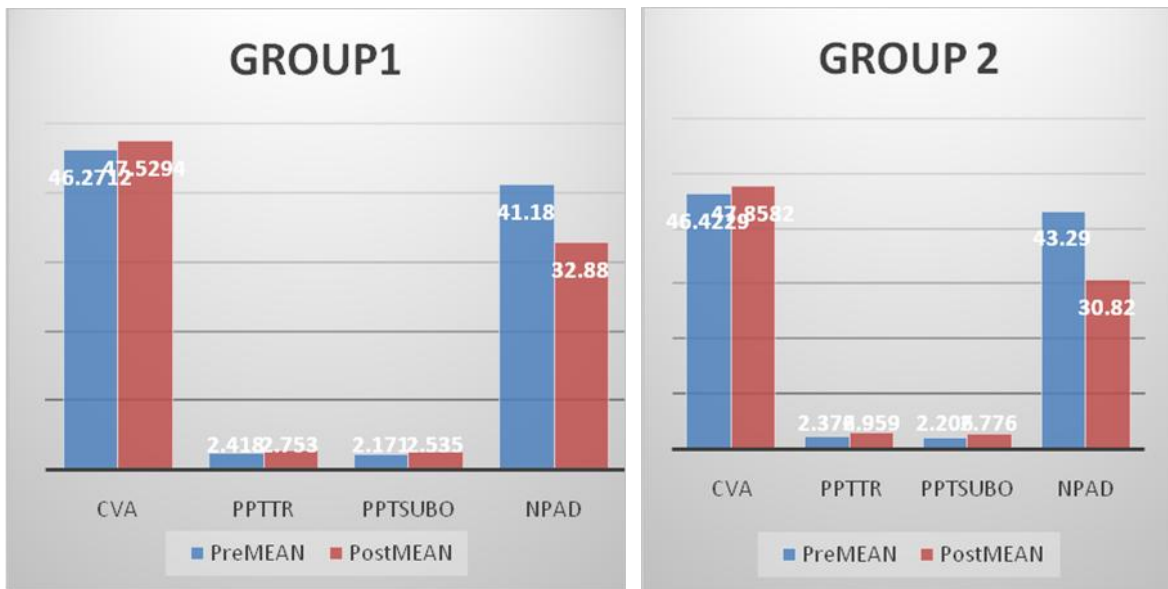
Paired sample outcome for Group-2	Paired Differences		t value	Sig.(2-tailed) (p value)
	Mean	Std. Deviation		
PRECVA-POSTCVA	-1.43529	2.17535	-2.720	.015
PREPPTTR-POSTPPTTR	-.5824	.1704	-14.089	.000
PREPPTSUBOC-POSTPPTSUBO	-.5706	.1572	-14.967	.000
PRENPAD-POSTNPAD	12.471	2.401	21.415	.000

Table 4 : Table for mean difference of outcome measures for both groups

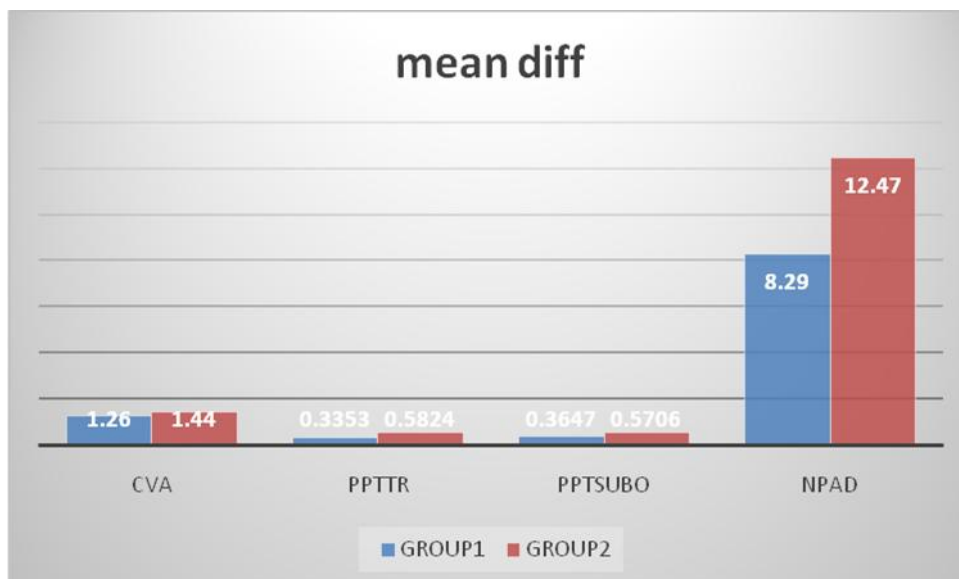
	GROUP	Meandiff	Std. Deviation
MEANDIFCVA	1	1.26	1.871
	2	1.44	2.175
MEANDIFPPTTR	1	.3353	.11695
	2	.5824	.17042
MEANDIFPPTSUB	1	.3647	.09315
	2	.5706	.15718
MEANDIFNPAD	1	8.29	1.572
	2	12.47	2.401

Table 5: Illustrates table for independent sample t-test for mean difference of outcome measure of both groups

	t-TEST FOR EQUALITY OF MEANS				
	t	df	Sig.(2-tailed) p value	Mean difference	Std. Error difference
MEANDIFFOFCVA	-.254	32	.801	-.177	.696
MEANDIFFPPTOFTR	-4.928	32	.000	-.24706	.05013
MEANDIFFPPTOFSUB	-4.646	32	.000	-.20588	.04431
MEANDIFFOFNPAD	-6.001	32	.000	-4.176	.696



Graph 1 & 2 , illustrates pre post mean values for all outcome measures in both groups 1 & 2



Graph 3 represents mean diff values for all outcome measures between group 1 & 2

Discussion

The primary goal of this study was to determine the effect of Muscle Energy Technique and positional release technique on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture having neck pain respectively and to compare the effect of positional release technique and Muscle Energy Technique on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture. Positional Release Technique along with conventional therapy on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture having neck pain showed significant result in all the subjects of group-1. The physiological mechanism behind the Effect of Positional Release Technique is based on local circulation, inflammatory reaction and neurophysiologic regulation of activity which is influenced by sympathetic nervous system. PRT removes restricted barriers of movement by decreasing muscle spasm, trigger point, pain and swelling and increasing circulation which even improves functionality.¹³

In a study done by Eun-Dong Jeonga et al., which saw short-term effects of the suboccipital muscle inhibition technique and cranio-cervical flexion exercise on hamstring flexibility, cranio-vertebral angle, and range of motion of the cervical spine in subjects with neck pain. In conclusion, these results suggested that both the SMI technique and CCFE improve the SLR test, CVA, and CROM, and are equally effective in immediate enhancement of the hamstring flexibility, CVA, and CROM in subjects with neck pain. Hence these results are similar to present study in which there is increase in CVA angle after giving SMI which showed same effect after 4 weeks which was seen by increase in mean of pre-intervention and post-intervention mean values.⁴

Muscle Energy Technique along with conventional therapy on Cranio-vertebral angle, Pressure pain threshold and neck functions in patients with forward head posture having neck

pain showed significant result in all the subjects of group-2. There was a study done by Edrish Saifee Contractor et al., to see the Immediate Effect of Suboccipital Muscle Energy Technique on Craniovertebral Angle and CranioHorizontal Angle on Subjects with Forward Head Posture Addition of Muscle Energy Technique (MET) to Deep Neck Flexor Exercise (DNFE) in interventions designed for subjects with Forward Head Posture, it was seen that MET along with deep neck flexor exercise can provide superior benefits compared to Deep Neck Flexor Exercise (DNFE) alone. Similar thing is seen in present result that along with conventional therapy MET technique gave better results to improve mean value of CVA angle after 4 weeks.²⁷

The physiological mechanism behind Muscle Energy Technique is that it effects over the stretch receptors called as Golgi tendons and spindles which react to overstretch of muscle and inhibit further muscle contraction. When GTO is triggered, afferent nerve impulses enter spinal cord dorsal root and reaches inhibitory motor neuron which stops impulses discharge from efferent motor neuron. This prevents muscle contraction causing lengthening and relaxation of agonist. They also react to movements of body and this may have relaxing effect over the muscle. When muscle gets shorten, the discharge through spindle decreases and it relaxes the muscle. So, MET may be effective due to production of viscoelastic change and passive extensibility of muscle. In patient with neck pain, MET decreases hyperactivation and tightness in shortened deep cervical extensors which is evident in subjects with FHP and hence the pain is decreased and function is improved.¹³

There was a study done by Maitrayee S Waje et al., to compare Effects of suboccipital muscle energy technique (MET) versus suboccipital release technique (SOR) on craniovertebral angle, cervical range of motion and chronic neck pain in medical students with upper cross syndrome at the end of 6 weeks. The study concluded that Suboccipital Release Technique (Group B) was more effective than Suboccipital (MET) in

reducing chronic neck pain, whereas, both Group A and Group B were equally effective in improving craniovertebral angle and cervical spine range of motion in medical students with Upper Cross Syndrome at the end of 6 weeks. But results of present study go in line with CVA angle as it is improved in both groups but it is improved more in MET group. But this result contradicts present study which states that neck pain is decreased in both groups but more in group which was given MET rather than PRT.¹⁵

Conclusion

According to this study both MET and PRT for trapezius and suboccipital muscle along with conventional therapy has shown significant differences in mean of Pain Pressure Threshold of trapezius and suboccipital muscle along with increase in CVA angle and decrease in neck pain and functionality by decreasing score of NPAD after 4 weeks of intervention individually in both groups. On comparing the effect of PRT and MET group it has shown statistical significant difference in all outcome except in CVA angle i.e., the difference was not significant. On comparing both the groups it was concluded that results were better in MET group than PRT group except for CVA angle. Hence, we concluded that the Muscle Energy Technique along with conventional treatment is more effective for improving pressure pain threshold for trapezius and suboccipital muscle and decreasing NPAD score which causes decreased pain and increased functionality along with conventional treatment in patient with forward head posture having neck pain.

Limitations: Following limitations should be considered when designing future trials. This study included participants of 20-35 years old only. Also, the evaluation of the impact of therapeutic applications had short-term character and was limited to four weeks. There was no follow up once the treatment was completed hence long-term effects were not evaluated. In present study measures of biomechanical or kinematic parameters, such as relative joint

moments, cervical ROM, muscle activation, and proprioception of the cervical spine were not evaluated.

Suggestions: A study evaluating the effect of various techniques except for MET and PRT can be used for the reduction of neck pain and decreasing forward head posture which would assess the therapeutic effect of applied techniques in all the aspects of the functional capacity of the patients and must have long-term evaluation and re-evaluation planning. In future studies even age criteria can be increased to see effect of these techniques in patient with neck pain. Whereas, this study can be generalized on population with all occupations so same study can be done by focusing on occupations in which neck pain due to forward head posture is usually seen. Therefore, future studies that provide direct qualitative parameters measuring the biomechanical parameters and electromyography recordings from the cervical muscles are also necessary.

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