International Journal of Advanced Research and Development
www.multidisciplinaryjournal.net
ISSN: 2455-4030
Received: 08-01-2023, Accepted: 25-01-2023, Published: 10-02-2023
Volume 8, Issue 1, 2023, Page No. 37-43

The effect of muscle energy technique on muscle strength, length and disability in patients with upper crossed syndrome- An experimental study

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Abstract
Background and Purpose: Upper crossed syndrome arises from the imbalance between the muscle functions. During the working hours, particular posture may be adapted by body muscle forces may transferred improperly on the body, and may alter the mechanics of joint. The purpose of study is to study the effect of muscle energy technique on muscle strength, length and disability in patients with upper crossed syndrome (UCS).
Methodology: 28 participants were selected on the basis of forward head posture and pectoralis minor tightness. All the participants were randomly allocated into two groups. The self-stretching or control group and MET or experimental group. PML, NDI, and Deep cervical flexor strength were assessed on pre- intervention and post-intervention after 4weeks.
Result: Wilcoxon signed rank test and Mann Whitney U Test was used for analysis the data. Between group comparison showed more significant improvement in PML and NDI, p value <0.05 in MET group compared to control group.
Conclusion: Result of this study concluded that, 4 weeks of MET program had greater effect compared to control group for improving muscle length and functional disability while both the techniques are equally effective to improve neck flexor strength and forward head posture in patients with UCS.

Keywords: MET, muscle strength, disability, muscle length, upper crossed syndrome

Introduction

Upper crossed syndrome, characterized by the shortness of the upper trapezius, levator scapulae, pectoralis major and minor crosses with the weakness of deep cervical flexors, middle and lower trapezius [1]. forward head posture is corresponding with the shortness of upper trapezius muscle and neck extensor muscles [2]. the protracted shoulder may interpret with the anterior translation of the Acromion process of the scapula in relation to C7th spinous process. May caused tightness of pectoralis minor muscle and scapular upward rotation [3]. JANDA stated that the sustained hunched back posture predisposed to UCS. Activities that promote, incorrect posture includes computer, laptop and mobile phone use, driving, watching TV, reading, and biking [4].

The overactivation of one side of muscles compensated by an under activation of the adjacent side of muscles, creating an 'x' pattern [5]. Excessive physical strain on the muscular structure may cause micro-injury to the connective tissues. [6] UCS is a functional musculoskeletal problem. Developing from a disproportion between the tonic-flexor group system and the phasic- extensor group system. The tonic flexor system involved anti-gravity muscles or also known as postural muscles. help us to maintain equilibrium against gravity, tended towards shortened or tightness. The muscles that involved tonic flexor system are sternocleidomastoid, pectorals, the upper fiber of trapezius, levator scapulae flexor of the upper extremity, the iliopsoas [7].

If the muscular imbalance occurs in between postural and phasic muscles. This pattern of imbalance creates impairment in joints, markedly at the scapulothoracic joint, Shoulder Joint, and T4-T5 region, lower cervical region [8]. Normally, the Neural and muscular mechanism depends on the synapses of motor neuron and muscle fiber. Transmit the impulses to skeletal muscle, tonic and phasic muscles works together and maintain an optimal length-tension relationship between the flexor and extensor systems. This mechanism required for maintaining upright posture and coordination of cervical movement [9]. Mechanically, this length-tension relationship connects the link between tonic and phasic muscles, and sustained equilibrium. Abnormal correlation in length and tension may create an imbalance in muscle forces which leads to an abnormal arthrokinematics, and unconcerned movement [10] If the muscular imbalance occurs in this musculature.

Various techniques are available for the management of the upper crossed syndrome. Studies have been conducted on UCS in that active release technique, stretching technique, sitting chair stretch doorway stretch, Bruegger's, wall angels, The Kibler's exercise, cervical stabilization exercises, and push-pull exercise [11]. Spinal manipulation in the lower cervical region, cervical range of motion exercises involved cervical spine extension exercises, Neck retraction exercises, proprioceptive exercises by using gym ball provide good control and Neuromuscular balance [12] A study was done on the effect of scapular stabilization exercise on neck posture a result concluded that scapular stabilization exercise showed increase upper trapezius and scapular retractors activity, as well as improvement in craniovertebral angle [13].

Muscle-energy technique is a manual therapy which firstly used by chiropractors in which the active muscle contraction necessary. Patients contracts a targeted muscle actively and resistance against that targeted muscle produced by the therapist or clinician. Force applied in such a way that the resistance forced matched with the targeted force applied by the patient. Post-isometric relaxation MET, in which only 20 % strength used for a counterforce, followed by relaxation, and a passive stretch. This technique described by Lewit commonly used to improve strength and increase

the flexibility of muscle and mobilize restricted structures. [14] In this study, we used post-isometric relaxation (PIR) the concept originated in the year 1999 by Karel Lewit. A brief period of isometric-contraction reduced tone in hyperactive muscle. There is a lack of literature on the effect of muscle energy technique on muscle strength, length and disability in patients with the upper crossed syndrome.

Aim

The aim of this study was is to study the effect of muscle energy technique on muscle strength, length and disability in patients with UCS.

Objectives

The objectives were

1. To find out the effect of muscle energy technique on muscle strength, length and disability in patients with UCS.
2. To find out the effect of conventional physiotherapy i.e self-stretching exercises on muscle strength, length and disability in patients with UCS.
3. To compare the effect of muscle energy technique with conventional physiotherapy i.e., self-stretching exercises on muscle strength, length and disability in patients with UCS.

Hypothesis

Null hypothesis H0

There is no significant difference between the effect of muscle energy technique and conventional physiotherapy on muscle strength, length and disability in patients with UCS.

Alternate hypothesis H1

There is significant difference between the effect of muscle energy technique and conventional physiotherapy on muscle strength, length and disability in patients with UCS.

Methodology

- **Study design:** An experimental study
- **Study Duration:** six months
- **Study Population:** Patients with UCS
- **Sampling method:** Convenient sampling
- **Sample size:** 28. From pilot study mean and SD was calculated which were 42.16 and SD 4.22 and 37.18 and SD 3.16 for experimental group and control group respectively. The confidence level at 95% the α value was set at 5%. The power was set at 80% Hence calculated sample size was 12 in each group, on considering dropouts, 10% attrition sample size would be 14 in each group. G power software used for the sample size calculation.

Selection Criteria

- **Inclusion criteria**

1. Age 17-25 years
2. Presence of postural deficiencies such as forward head posture.
3. Exaggeration of cervical lordosis and thoracic kyphosis.
4. Elevated and protracted shoulders.
5. Craniovertebral angle 49°-59°
6. Pectoralis Minor tightness. PML index <7.44

- **Exclusion criteria**

1. Cervical spine conditions, such as disk prolapse
2. History of severe trauma, instability, torticollis, Frequent migraine, peripheral nerve involvement.
3. Fibromyalgia.
4. Shoulder diseases (tendonitis, bursitis, and capsulitis).
5. Inflammatory rheumatic diseases

- **Outcome measures**

1. Deep cervical flexor strength, By pressure biofeedback [15]
2. Pectoralis Minor length measured by inch tape [16]
3. Craniovertebral angle by ON protractor app [17]
4. Neck disability index Participants were assessed [18]

Procedure

- Participants were explained the details about the treatment protocol, as well as harm and benefits of intervention. Participants were selected according to selection criteria. Participants willing to participate were included in the study and informed consent was taken from them.
- They were randomly allocated in control group and experimental. Experimental group received MET while the control group received self- stretching exercise. Participants were blinded about group allocation. Computer generated random table was used for allocation. Sequentially-numbered, opaque, sealed envelopes was used for concealment

- **Group A:** Control Group (n=12)
- **Group B:** Experimental Group (n=12)
- All the outcome measures were assessed at Baseline-Pre-intervention and after 4 weeks for post-intervention assessment.

a. Deep cervical flexor strength

For measurement of Deep neck flexor strength pressure biofeedback used. participant in a supine position with hip and knees flexed to 90 degrees to avoid lumbar lordosis, no pillow under the head. Pressure biofeedback kept under the cervical region pressure increased by 20mmhg and asked participants to press the neck and 3 readings were taken an average of three noted [15].

b. Pectoralis minor length (PML)

Pectoralis minor length was measured by Inch tape. Pectoralis minor originates from the 3,4 and 5th ribs inserted in the inferomedial aspect of a Coracoid process Participants were asked to stand with their arms at their sides and look straight in this resting position. To avoid conscious postural correction, the subjects were asked to stand in the same position several times prior to data collection. Measuring tape placed on the fourth rib and the inferomedial aspect of the Coracoid process. The distance was calculated 3readings were taken and an average of three noted. The PML index was calculated by The mean of all the three reading was divided by the participant's height and multiplied to 100.PML index of less than 7.44 could be considered a short muscle. ICC value 0. 82-0. 86 [16].

c. Craniovertebral angle (CVA)

For measurement of Craniovertebral angle smartphone application ON protractor used. The participant was sitting on a chair with back straight and look forward on a particular point, hand kept by the side of the body, hip and

knees placed in 90 degrees of flexion and foot rest on the floor. Marker placed on C7to the tragus and horizontal line extending from C7 to Marker. And the angle was measured [17].

d. Neck disability index (NDI)

Neck disability index is 10 item questionnaires, used to score functional disability affected due to neck pain. This was a self-reported questionnaire by the participants. A reliability ICC value of NDI 0.69-0.70. Total ten, Questions were included which based on the daily activities of individuals, such as personal care, lifting, reading, work, driving, sleeping, recreational activities, pain intensity, concentration, and headache. Each question was graded on 0 - 5, and an overall score out of 100 was arithmetic by adding each item score together and multiplying it by two [18].

- **Intervention**

Muscle Energy technique

a. Upper trapezius

The participant was in supine lying, the therapist was standing at the head end of the participant. No pillow under the participants neck, the therapist placed one hand on opposite shoulder while other hand placed on the side to be tested on ear or mastoid process, under the occiput with this hand the neck was laterally flexed and rotated towards contralateral side by taking weight on forearm, and resistance applied to the opposite shoulder asked a participants to elevate the shoulder with 20% resistance was given to the shoulder. therapist sustained for 7-10 second and perform,3-5 repetition, 3sets [19].

b. Levator Scapulae

The participant was in supine with the arm of the side to be tested straight out along the side of the trunk with the hand in supination, The therapist, in walk standing at the head of the table, passes his contralateral arm under the occiput. The therapist's other hand supported the neck on lateral aspect just behind the ear, to resist rotation the therapist's forearm lifts the neck into full flexion The head is turned fully into side-flexion and rotation away from the side would be treated. The participants asked to take the head back towards the table, and slightly to the side from which it was turned, against the therapist's resistance, slight (20% of available strength). the isometric contraction for 7-10 second,3-5 times, 3sets/session [19].

c. Pectoralis Major

The participant was in prone lying therapist stand in walk standing at the side to be tested facing towards the participant. Participants shoulder abducted to 90° and the Elbow flexed to 90°, palm facing towards the floor, with the upper arms rest on the plinth. Therapist, place one hand on participants palm and another hand on the scapula. The therapist applied force in the direction of extension and lateral rotation of shoulder, 20% strength. And participant asked to take his/her arm toward the floor it remains parallel to the floor. 7-10 second isometric contraction,3-5 repetition,3 sets/session [19].

d. Pectoralis Minor

The participant was in the supine lying position. the therapist was standing at the side of being tested, participants hand took in flexion. The therapist kept his/her one hand over the contralateral side of ASIS and another hand kept on the elbow joint, asked the participants to take his/her hand towards the opposite hip and resistance is given,20% strength contraction held for 7-10seconds, 3-5 repetition,3 sets/session [19].

Self -stretching

a. Upper trapezius

The participant was in Sitting position, The ipsilateral hand behind the back to stabilize the scapulae Instructed the patient to rotate his neck towards the tight side, then side bends away from the tight side and adds neck flexion. Hold for 30 seconds, performed 3 times/session [20].

b. Levator Scapulae

The participant was in a sitting position, with the head side, bent and rotated away from the tight side. To stabilize the scapula, the tight side hand holds the chair. The other hand is placed on the head to gently pull the head forward and diagonal opposite to the tight muscle. hold for 30seconds performed 3 times/session [20]

c. Pectoralis major

The participant was in a Standing, facing a corner, position the arm in "T" pattern, Shoulder abducted to 90°, elbow flexed to 90°, hold the corner of a wall with the palm and participants leaned, the entire body forward from the ankle. "v" pattern Shoulder abducted to 120°, elbow straight, and palm supported on the wall. The participants, leaned the entire body forward from the ankles (knees slightly flexed) The degree of stretch was adjusted by the amount of forwarding movement. Perform30-second hold, 3 times/session [20].

d. Pectoralis Minor

Participant stand at the door side keep his/her shoulders abducted to 90° elbow 90 degrees with palm supported to the door and moved the body forward [20].

Strengthening exercises

a. Middle trapezius

Position- participants were in Prone lying on the plinth, shoulder 90º Abducted, elbow 90º flexed and wrist in a neutral position, the participants were instructed to take the arm up, holds for 5 seconds,10 repetitions 3 sets/ session [21].

b. Lower trapezius

Position-Participant was in prone lying shoulder120-degree abduction. Elbow extended the participants were instructed to take the arm up.

Holds for 10 seconds, 10 repetitions, 3sets/session [21].

c. Neck flexor

The position of the participants was in a supine position. Swiss ball kept under the participants head, Both the hands of the participants placed on their abdomen, Asked the participants to pressed their neck on the Swiss ball held for 10 seconds,10 repetitions,3sets/session [21].

Postural correction exercise

Participants were in sitting position arm at the side of a body asked the participant to take his shoulder back holds for a 10 second 3 repetition 5 sets. Chin tuck, participants were sitting position instructed the participants to tuck the chin in hold for a 10 second, 3repetition, 5 sets [21].

Statistical analysis

Data for statistical analysis was entered using MS-Excel 2010, Statistical Analysis was performed using SPSS version 15. Kolmogorov-Smirnov test was used to check normality of the data. Outcomes did not pass the normality test. Hence, non-parametric test, i.e., Mann Whitney test was used for between group comparison and Wilcoxon signed rank test was used for within group comparison. Significance value was set at $p \leq 0.05$.

Results

Demograhic data and baseline outcome measures when compared between the groups, non-significant ($p>0.05$) difference was found (Table-1)

For Group A comparison of pre and post NDI using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post Deep Cervical Flexor Strength using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post Pectoralis Minor Length Right using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post-Pectoralis Minor Length left using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post-Pectoralis Minor Length left using a Wilcoxon signed-rank test, there was a significant difference (p=0.0005) (Table-2).

For Group B comparison between-and post NDI using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post Deep Cervical Flexor Strength using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005). Comparison between pre and post Pectoralis Minor Length left using a Wilcoxon signed-rank test, there was a significant difference (p=0.0002). Comparison between pre and post Pectoralis Minor Length left using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0002). Comparison between pre and post Pectoralis Minor Length left using Wilcoxon Signed Rank Test, there was a significant difference (p=0.0005) (Table-3)

When compared between the groups, for NDI Group A and Group B, Mann- Whitney U test was used there was a significant difference (p=0.03). On the comparison between the groups for the Deep cervical flexor strength, Group A and Group B, Mann- Whitney U test was used there was a non-significant difference (p=0.13). On the comparison between the groups for an outcome measure of pectoralis minor length right side. Group A and Group B, Mann-Whitney U test was used there was a significant difference (p=0.0001). On the comparison between the groups, for an outcome measure of pectoralis minor length left. Group A and Group B, Mann- Whitney U test was used there was a significant difference (p=0.03). Comparison between the groups, for an outcome measure CVA. Group A and Group B, Mann- Whitney U test was used there was a non-significant difference (p=0.64). (Table-4)

Table 1: demographic data and baseline analysis for an outcome Measures

Variables	Mean ± sd (group a)	Mean ± sd (group b)	P-value
Age	20.66 ± 1.96	21.41 ± 2.02	0.36
Weight	56.5 ± 4.16	56.41 ± 6.78	0.09
Height	162.25 ± 5.24	163 ± 6.53	0.07
Bmi	21.41 ± 1.30	21.07 ± 2.06	0.70
Ndi	49.0516 ± 16.40	53.04 ± 15.43	0.54
Deep cervical flexor strength	25.75 ± 3.20	22.72 ± 3.17	0.1
Pect. Minor length right	6.72 ± 0.39	6.68 ± 0.48	0.82
Pect. Minor length left	6.71 ± 0.44	6.6 ± 0.38	0.52
Craniovertebral angle	53.65 ± 2.97	53.76 ± 3.23	0.9

Table 2: Within Group Comparison of pre and post intervention outcome measures of group A

Variables	Pre- intervention Mean ± sd	Post- intervention Mean ± sd	P-value
Ndi	49.05 ± 16.40	19.19 ± 2.59	0.0005
Deep cervical flexor strength	25.63 ± 3.45	34.81 ± 2.00	0.0005
Pect. Minor length right	6.72 ± 0.39	8.53 ± 0.33	0.0005
Pect. Minor length left	6.71 ± 0.44	8.55 ± 0.38	0.0005
Craniovertebral angle	53.65 ± 2.96	32.97 ± 1.23	0.005

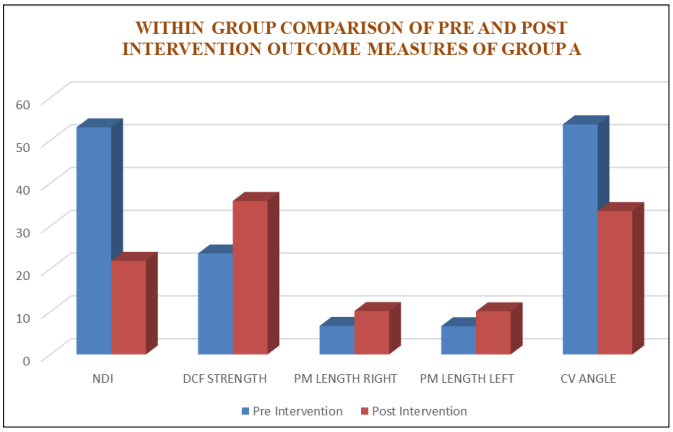

Fig 1: Within Group Comparison of pre and post intervention outcome measures of group A.

Table 3: Within Group Comparison of pre and post intervention outcome measures of group B.

variables	pre- intervention means ± sd	post- intervention means ± sd	p-value
Ndi	53.04 ± 15.43	21.86 ± 4.29	0.0005
deep cervical flexor strength	23.59 ± 3.70	35.86 ± 1.82	0.0005
Pect. minor length right	6.68 ± 0.48	10.15 ± 0.47	0.0002
Pect. minor length left	6.6 ± 0.38	10.08 ± 0.47	0.0002
Craniovertebral angle	53.76 ± 3.23	33.50 ± 2.11	0.0005

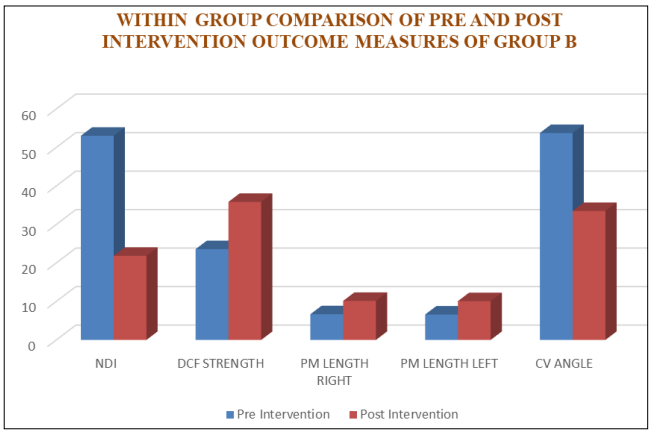

Fig 2: Within Group Comparison of pre and post intervention outcome measures of group B.

Table 4: between the group's comparison of post outcome measures of Group A and Group B

Variables	Mean ± sd (Group a)	Mean ± sd (Group b)	P-value
Ndi	19.19 ± 2.59	21.86 ± 4.29	0.03
Deep cervical flexor strength	34.81 ± 2.00	35.86 ± 1.82	0.13
Pect. Minor length right	8.53 ± 0.33	10.15 ± 0.47	0.0001
Pect. Minor length left	8.55 ± 0.38	10.08 ± 0.47	0.0001
Craniovertebral angle	32.97 ± 1.23	33.50 ± 2.11	0.64

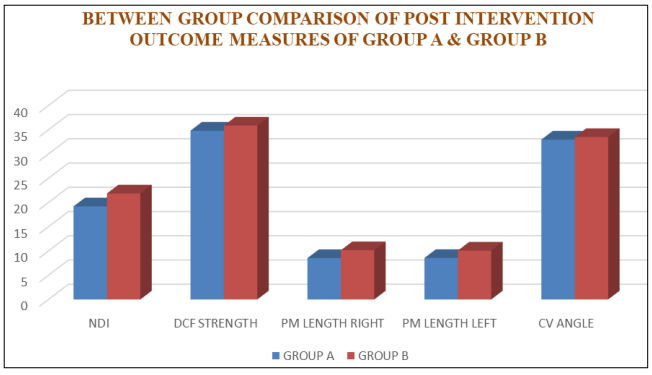

Fig 3: between the group's comparison of post outcome measures of group a and group b

Discussion

This study was undertaken to find out the effects of muscle energy technique on muscle strength, length and disability in patients with upper crossed syndrome. Result of this research revealed that there was a significant improvement in Neck disability index and Pectoralis Minor Length, in a group B. Whereas, both the techniques were equally effective in improving Deep cervical Flexer strength and craniovertebral angle.

The result of this study supported by the previous study done by Sajjid Ali et.al. Post-isometric MET to group A and Static-stretching to group B. protocol given for 3 times per week and they concluded that reduced pain, improved functions, and increased cervical Rom.in MET group as compared to the stretching group [22].

The findings of our study also approbated by the study of Simranjeet Kaur et al, 40 participants, 28 females and 12 males with the tightness of levator scapulae and upper trapezius were included in the study. The outcome measure was cervical Rom, NDI, VAS assessed on day 1 and 7th day. Group A treated with muscle energy technique for 5 repetitions,20% strength to upper trapezius and levator scapulae. Group B treated with passive stretching to upper trapezius and levator scapulae.20-second hold,5 repetitions. the result of this study concluded that MET was more superior than passive-stretching [23] Leon Chaitow explained Mechanism of MET which states that Myofascial extensibility increased due to change in the muscle property, change in connective tissue property and changes to stretch tolerance. Length of the muscle increased by reflex muscle relaxation.

Changes in connective tissue property Viscoelasticity is the property of connective tissue, contained fluid gel components when the tissue stretched for a period of time some energy may losses in the form hysteresis, while the elongation of tissues occurred by creep. Sustained contraction caused micro-tearing of collagen fibers as well as may affect water content, glycosaminoglycan. which brings to immediate changes in stiffness of the muscle [24] Stretch receptor tolerance Isometric contraction stimulates joint mechanoreceptor and proprioceptor produces inhibition of pain perception [24].

In this study, the result showed MET had better improvement in pectoralis Minor length as compared to the stretching group. the finding of our study favored by the study of Kevin G. Launder *et.al*. In their study, they have given the 6-week program of MET, to the pectoralis minor muscle and found significantly increased in resting pectoralis minor length. [25] Gary Fryer et al, MET can improve the length of shortened muscles. The muscle contraction sustained for a period it stimulates the firing of Golgi tendon organ and caused to relax and lengthen muscle fibers, also it activates the stretch receptor, and suppressed pain receptor These may be caused central pain blocked [26].

Within a group comparison done for Self- stretching as well as MET group, it showed significant differences in all the outcome measures. The neck disability index showed significant improvement. In both groups. Isometric contraction inhibits the pain receptors which present on the muscle fiber and spinal cord. A sustained contraction activates the afferent motor neuron which inhibits pain blocked substance opiate and reduced pain, reduction of pain was the reason for improving functional ability in the participants [26].

Neck exercises are one of the important components of our research protocol, these exercises help to control neuromuscular coordination. Proprioception help to the degraded stretch response. Multiple practice sessions, Resettled the intrafusal fibers and broke a cycle of muscle tension [27]. In our study, the result showed both the techniques are equally effective in the improvement of deep

cervical flexor strength and craniovertebral angle. In the resistive training, multiple factors influencing strength, i.e., Neural factor, muscular factor, and morphological factors. The neurological factors involved greater benefaction during the initial phase of the training program, the morphological factor may lead to hypertrophic changes i.e., increase in muscle cross-sectional area and muscle volume, help to improve scapular posture and symmetry [28].

The strengthening of scapular muscles improves the stability at the scapulothoracic joint, thus dynamically positioning the glenoid, and prevent anterior tilting of a scapula [29]. Improvement of deep cervical flexor strength**,** Improvement of deep cervical flexor strength, found in both the group's, deep cervical flexors, the longus colli muscle, key muscle for maintaining cervical spine alignment, strengthening of longus colli help to maintained cervical control and maintained endurance [29].

Bhuvan et al. conducted a study in the dentist on chronic neck pain. They used pressure biofeedback for the deep cervical flexor strength measurement. adjustable camera for posture, NDI, and VAS. They intervened 4weeks training program for Deep cervical flexor experimental group. And conventional isometric training in a control group. The results of this study concluded that the experimental group showed increased deep cervical flexor strength [30].

The result of our study showed significant improvement in the craniovertebral angle. This supported to the study done by Boyoung *at el*. 15participantswere randomly allocated into the stabilization group(n=8) and control group(n=7) scapular stabilization exercise given for a 30 minutes 3days per week for a period of 4weeks. scapular stabilization exercises involved hold a posture in a supine lying relaxed body with deep breathing, supine lying knees bend to hold it without neck movement, Raised arm up to 90 degrees, retract shoulder and chin tuck. Hold each position for 10 second 3 repetitions. As a result, they concluded that improvement in craniovertebral angle and neck function in the scapular stabilization exercise group [31]. Kim *et al*. said that Correction exercises for regions around the neck and scapula patient with a forward head improved the recovery of positional distortion and muscle stiffness. And changes the patterns of muscle imbalances [32].

Chansirinukor *et al*. reported that the scapular kinematics impairment resulted in alteration in scapular position, exaggeration of cervical lordosis and thoracic kyphosis

change in the scapular alignment increased forward head posture. This altered the mechanism of the scapula. and reduced strength of the muscles [33]. Con Hrysomallis, described the concept of strengthening and stretching scapulae. In this review, they concluded that stretching of anterior chest muscles and strengthening of scapular retractors muscle showed a significant effect on improving muscle strength, endurance and correct the position of the scapula [34].

Stretching manipulation help to increase the extensibility of tissues and it aligned collagen fibers in a muscle [35]. Arja Hakkins *et al*. conducted a study on a 1-year program of strengthening with stretching and only stretching. After1-year followup stretching showed a more significant result (P< 0.005) The result of this study supported by another study done by Richa Mahajan *et al*. check the effect of pain and functional disability in subacute cervical pain, they concluded that MET was more superior than static stretching to relieving pain and improved cervical ROM [36].

Our study also supported the study of El Laithy *et al*, the effect of post-isometric relaxation MET, on neck pain, disability, and cervical ROM. PIR showed significant improvement in disability and increased cervical ROM in mechanical neck pain ($p<0.05$) [37].

Conclusion

Muscle energy technique and self- stretching technique along with strengthening exercises, postural correction exercises both are effective in reducing functional disability, forward head posture, improved strength of the muscles and correct protracted shoulder. MET was better as compared to the self- stretching for improving function as well as to correct protracted shoulder.

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