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IMMEDIATE EFFECT OF MUSCLE ENERGY TECHNIQUE VERSUS PASSIVE STRECHING ON PAIN & RANGE OF MOTION ON SUBJECT WITH UPPER CROSS SYNDROME: A RANDOMISED CLICINAL TRIAL

[1]Ritu Chavhan, [2]Dr. Vaishanavi Chaudhari (PT), [3]Dr. Jayawant Nagulkar (PT)

[1]Intern, [2]Assistant professor, [3]Principal
Department of Physiotherapy
[1] Dr Ulhas Patil College of Physiotherapy, Jalgaon, India

Abstract: This Upper Crossed Syndrome (UCS) is a common postural dysfunction characterized by muscular imbalance involving tight cervical and shoulder girdle muscles and weakness of deep neck flexors and scapular stabilizers, often resulting from prolonged faulty postures and leading to neck pain and restricted cervical range of motion. Muscle Energy Technique (MET) and Passive Stretching are commonly used physiotherapy interventions to address muscle tightness and improve mobility. The aim of this study was to compare the immediate effects of Muscle Energy Technique and Passive Stretching on pain and cervical range of motion in individuals with Upper Crossed Syndrome. An experimental study was conducted on participants diagnosed with UCS, who were divided into two groups: one group received Muscle Energy Technique and the other received Passive Stretching. Pain intensity was assessed using the Numerical Pain Rating Scale (NPRS), and cervical range of motion was measured using a goniometer. Interventions were applied to commonly tight muscles associated with UCS, including the sterocleiodomastoid muscle, pectoralis major, and pectoralis minor. Pre- and post-intervention measurements were recorded and analyzed. The results demonstrated a significant reduction in pain and improvement in cervical range of motion in both groups. The study concludes that both Muscle Energy Technique and Passive Stretching are effective physiotherapy interventions for managing Upper Crossed Syndrome.

Keywords: Upper Crossed Syndrome, Muscle Energy Technique, passive stretching,Neck Pain, Cervical Range of Motion, Postural Dysfunction.

INTRODUCTION

The neck is the part of the body between the head and the shoulder, connecting the head with the body. When people sit incorrectly for extended periods, especially during activities like studying, writing or using a computer the neck and the base of the head and shoulders are at a higher risk of strain and pain. neck pain is commonly caused by poor posture when working, anxiety, exhaustion, heavy lifting and physically demanding employment [1].

Upper cross syndrome (UCS) is imbalance creates a pattern of muscle weakness and tightness that crosses between the front (ventral) and back (dorsal) side of the body [2]. This pattern of the imbalance seen in UCS leads to the joint dysfunction in key area of the body. The affected joints often include:

- Atlanto-occipital joint (where the skull meets the spine),
- C4-C5 segment (mid-cervical spine),
- Cervicothoracic joint (where the cervical spine meets the thoracic spine),
- Glenohumeral joint (shoulder joint), and
- T4-T5 segment (upper thoracic spine). These regions are prone to stress [3]

In the elderly the prevalence of neck pain is around 38% while in younger population it ranges from 6% to 22%. over a lifetime the prevalence of neck pain varies widely ranging from 14.2% to 71% [4]. Data suggest that in the shoulder -girdle and cervico -thoracic area, 6% to 48% of the upper cross syndrome
(UCS) population experience pain [1]. Prevalence of the neck pain, particularly cervical neck pain which is more common in middle -age women than in men [5].

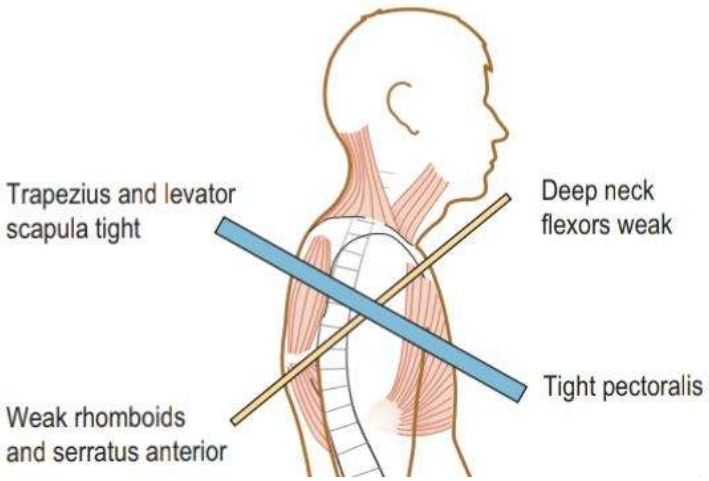

Figure: upper cross syndrome

Tight and weaken of muscle leading to dysfunction in the neck and upper body in UCS Tight or shortened muscle includes:

- Suboccipitalis
- Sternocleidomastoid (SCM)
- Levator Scapulae
- Pectoralis Major and Minor
- Scalenes
- Upper Trapezius (UT)

Weakened or stretched muscles include:

- Deep Neck Flexors (DNFs)
- Serratus Anterior (SA)
- Rhomboids
- Middle Trapezius (MT) and Lower Trapezius (LT) [2,6].

People with upper cross syndrome may show signs like forward head posture, a rounded upper back, shoulder that are raised and held up for extended periods, winged scapulae, cervical kyphosis and limited mobility in the thoracic spine [2,3,7]. Physical examinations for upper crossed syndrome (UCS) are crucial for proper diagnosis and treatment. These examinations involve various assessments to evaluate different aspects of the body. Here's a breakdown of some key assessments:

1. Gait Analysis: This assessment focuses on how a person walks or moves to identify any abnormalities or imbalances in their gait pattern. It helps in understanding how the body moves during walking.
2. Postural Analysis: Postural analysis looks at the alignment and positioning of the body while standing, sitting, or moving. It helps in identifying postural deviations that may contribute to UCS.

By conducting these examinations, healthcare professionals can gather valuable information to diagnose UCS accurately and develop an appropriate treatment plan [8]. Among these intervention Muscle Energy Techniques (MET) are indeed a valuable method used in treating musculoskeletal issues. These techniques involve the active participation of the subject to target specific muscles and joints for manipulation or mobilization. MET is commonly used in osteopathic medicine to address dysfunctions in the musculoskeletal system .an early historical article about MET (Muscle Energy Technique) written by Mitchell Sr. in 1948 published in the American Academy of Osteopathy's yearbook. a 2003 study by Johnson and Kurtz identified Muscle Energy Technique (MET) as one of the three most commonly used techniques by American osteopaths [10]

The patient's posture is characterized by a noticeable forward positioning of the head, a reduction in the normal inward curvature of the cervical spine, and bilateral shoulder protraction, resulting in a rounded shoulder appearance, indicative of potential muscular imbalances and postural dysfunction. [11]

· The foundation of met lies in the concept of autogenic and reciprocal inhibition. Physiotherapy frequently employ muscle energy technique and stretching in the treatment protocols. An advanced stretching technique that differ from static stretching. In MET the subject actively participates in the stretching process, making it an active technique [12]. MET is a rehabilitative approach aimed at relaxing, stretching and strengthening muscles to alleviate non- specific neck pain, promoting joint mobility and discomfort reduction [8]. Contraction of the soft tissue initiates a self – correcting mechanism, addressing musculoskeletal impairment [13]. This therapy holds benefits for both physiatrist and physiotherapist [8].

Stretching encompasses various therapeutic techniques aimed at enhancing soft tissue flexibility and range of motion (ROM) by lengthening adaptively shortened, hypomobile structure. there are various types of stretching methods such as static, cyclic, ballistic, manual, mechanical, self, active, proprioceptive neuromuscular facilitation and passive stretching etc [14]. Passive stretching is a traditional and effective method used by physical therapists to relieve muscle tightness [13]. Passive stretching is the most popular

stretching method used in clinics. this technique is Acknowledge as a reliable and low -risk approach to increasing range of motion [13].

NEED OF THE STUDY.

The Upper cross syndrome is prevalent condition affecting the upper body. The trapezius muscle's prominence in research obscures the importance of adjacent muscles. Specifically, the sternocleidomastoid and pectoralis muscles require intensified study to clarify their involvement in upper body mechanics. There is lack of research on the treatment provided to sternocleidomastoid and pectoralis muscle. Previous studies have invested various exercise and treatment approaches to address postural dysfunctions and pain management in upper cross syndrome patient. the field of physical therapy lacks consensus on the most effective intervention for addressing muscle shortness, a common contributor to neck mobility limitations. This study fills the gap by conducting the randomized clinical trial which investigates the immediate effect of MET and passive stretching of sternocleidomastoid and pectoralis muscle length and tension in individuals with neck pain, comparing the efficacy of these two interventions.

RESEARCH METHODOLOGY

3.1Population and Sample

The population for the present study consisted of individuals diagnosed with Upper Crossed Syndrome. A total of 30 participants aged between 17 and 25 years were selected from this population using a sampling method. Participants fulfilling the inclusion criteria were recruited and randomly allocated into two groups, with 15 participants in each group. Group A received Muscle Energy Technique, while Group B received Passive Stretching. The selected sample represented individuals with neck pain and postural dysfunction associated with Upper Crossed Syndrome.

3.2 Data and Sources of Data

The data for the present study were collected from individuals diagnosed with Upper Crossed Syndrome who fulfilled the inclusion criteria. Primary data were obtained through clinical assessment of pain using the Numerical Pain Rating Scale (NPRS) and measurement of cervical range of motion using a universal goniometer. Pre- and post-intervention data were recorded for both groups and analyzed using MS Excel and minitab 17 so as to validate the results found. Descriptive and inferential statistical tests were applied to determine the significance of differences within but non significance between the groups, and the level of significance was set at $p < 0.05$.

3.3 Theoretical framework

Upper Crossed Syndrome occurs due to muscular imbalance caused by prolonged faulty posture, characterized by tight cervical and shoulder girdle muscles and weak deep neck flexors and scapular stabilizers. This imbalance leads to neck pain and restricted cervical range of motion. Muscle Energy Technique works on the principles of post-isometric relaxation and reciprocal inhibition, while Passive Stretching acts by elongating shortened muscles. Both interventions aim to correct muscle imbalance, reduce pain, and improve cervical mobility. Pain and cervical range of motion are used as outcome measures to assess the effectiveness of the interventions.

RESULTS

Table 4.1: Gender Distribution

Group A comprised of 11 females and 4 males. Group B consist of 13 females and 2 males. thus there were total 24 of females and 6 of males in the study.

Group	Variable	Groups	Frequency	Percentage
A	**Gender**	Male	4	26.67
		Female	11	73.33

Group	Variable	Groups	Frequency	Percentage
B	**Gender**	Male	2	13.33
		Female	13	86.67

Table 4.2: Comparison of NPRS

NPRS	Test	Mean	S.D.	t value	P value
Group A	PRE	5.40	1.05	19.86	0.00
	POST	2.80	1.01		
Group B	PRE	5.13	0.99	16.00	0.00
	POST	4.06	0.96		

Pain Assessment:
Pain was measure by using numerical pain rating scale and the results were recorded

- Within group analysis: For within group analysis paired t test was used.
- In group 1: when the means at pre- intervention and post-intervention were compared, the p value was 0.00. This shows there is significant difference in the means
- In group 2: when the means at pre- intervention and post -intervention were compared, the p value was 0.00. this shows there is significant difference in the means.
- Between group analysis: Unpaired t test is used to compare the means of group1 and group 2 at post intervention.
- Post intervention: the score is 3.40+-1.06 in group 1 and 3.13+-0.91in group 2.the p value is 0.44. This shows no significant difference in the means.

Table 4.3: The comparisons of NPRS scores

NPRS	Test	Mean	S.D.	t value	P value
POST TEST	Group A	2.80	1.01	3.51	0.002
	Group B	4.06	0.96		

***p<0.05 i.e. significant difference in the average**

TABLE 4.4: Range of Motion of Group A

RANGE OF MOTION	Test	Mean	S.D.	t value	P value
CERVICAL FLEXION	PRE	34.00	1.77	10.83	0.000
	POST	38.46	1.18		
CERVICAL EXTENXION	PRE	59.33	4.78	10.69	0.000
	POST	63.73	4.1		
CERVICAL ROTATION RIGHT	PRE	45.13	7.85	1.15	0.270
	POST	47.4	1.96		
CERVICAL ROTATION LEFT	PRE	41.73	2.93	8.71	0.000
	POST	47.46	1.88		
LATERAL FLEXION RIGHT	PRE	16	2.03	9.03	0.000
	POST	20.26	1.53		
LATERAL FLEXION LEFT	PRE	16.06	2.05	11.37	0.000
	POST	20.06	1.66		

Range of motion: Range of motion of cervical joint was measured by using universal goniometer and the result were recorded.

- Within group analysis: For within group analysis paired t test was used.
- In group 1: when the means at pre- intervention and post-intervention were compared, the p value was 0.00 expect right cervical rotation has 0.270 p value. This shows there is significant difference in the means

TABLE 4.5: Range of Motion of Group B

In group 2: when the means at pre- intervention and post -intervention were compared, the p value was 0.00. this shows there is significant difference in the means.

RANGE OF MOTION	Test	Mean	S.D.	t value	P value
CERVICAL FLEXION	PRE	36.26	2.60	5.55	0.00
	POST	38.13	2.16		
CERVICAL EXTENXION	PRE	50.07	9.79	5.53	0.00
	POST	52.40	10.26		
CERVICAL ROTATION RIGHT	PRE	50.27	9.71	5.61	0.00
	POST	52.20	10.42		
CERVICAL ROTATION LEFT	PRE	50.20	10.47	6.24	0.00
	POST	52.53	10.24		
LATERAL FLEXION RIGHT	PRE	18.86	1.59	8.92	0.00
	POST	20.53	1.68		
LATERAL FLEXION LEFT	PRE	18.60	2.13	5.96	0.00

TABLE 4.6: Comparsion of Group A and Group B

Between group analysis Unpaired t test is used to compare the means of group1 and group 2 at post intervention.

RANGE OF MOTION	GROUP	Mean	S.D.	t value	P value
CERVICAL FLEXION	A	38.47	1.19	0.52	0.60
	B	38.13	2.17		
CERVICAL EXTENXION	A	63.70	4.10	3.97	0.001
	B	52.40	10.30		
CERVICAL ROTATION RIGHT	A	47.40	1.96	1.75	0.10
	B	52.20	10.40		
CERVICAL ROTATION LEFT	A	47.47	1.88	1.88	0.08
	B	52.50	10.20		
LATERAL FLEXION RIGHT	A	20.27	1.53	0.45	0.65
	B	20.53	1.68		
LATERAL FLEXION LEFT	A	20.07	1.67	0.11	0.91
	B	20.00	1.77		

The study compared the post-test cervical range of motion (ROM) scores between Group A and Group B using unpaired t-tests. For cervical flexion, Group A had a mean score of 37.47 (SD = 1.77), while Group B scored 38.13 (SD = 2.17), yielding a t-value of 0.92 and p = 0.36, indicating no significant difference. Similarly, cervical extension showed no significant difference (Group A: 55.5 ± 11.3, Group B: 52.4 ± 10.3, t = 0.78, p = 0.44). Cervical rotation to the right (Group A: 51.93 ± 9.71, Group B: 52.20 ± 10.4, t = 0.07, p = 0.94) and left (Group A: 51.13 ± 9.83, Group B: 52.5 ± 10.2, t = 0.38, p = 0.71) also revealed no significant differences. Lateral flexion to the right (Group A: 20.20 ± 1.66, Group B: 20.53 ± 1.68, t = 0.55, p = 0.44) and left (Group A: 18.80 ± 2.40, Group B: 20.00 ± 1.77, t = 1.56, p = 0.13) showed comparable results between the groups. Across all movements, the p-values exceeded 0.05, This shows no significant difference in the means

DISCUSSION

The present randomized clinical trial was conducted to investigate the effects of muscle energy technique and passive stretching on upper cross syndrome by using pain and range of motion. Statistical analysis supported the null hypothesis that's why in this study, muscle energy techniques and passive stretching were significantly effective but compared between the groups there is no difference with p>0.05.In present study, reduction in pain in the MET group was similar with other previous studies. Arif Ali Rana et al, conducted a study on "Effects of conventional physical therapy with and without muscle energy techniques for treatment of Upper Cross Syndrome" from September 3, 2016, to June 1, 2017 with the sample size of 60. Showed that both conventional therapy and Muscle Energy Technique (MET) demonstrated efficacy in treating upper cross syndrome. However, MET exhibited superior outcomes in alleviating neck pain and disability compared to conventional physical therapy, as evidenced by significant improvements in pain reduction, range of motion, and functional ability [12]. Result of the present study for MET group for improvement in cervical ROM and reduction in pain was similar with other previous studies. These findings align with previous research conducted by Jalal Y et al. in 2018 which showed that the study comprised 20 patients (both male and female, aged 25-50 years) with neck pain, cervical range of motion (ROM) limitation, and muscle spasm, who received treatment with Muscle Energy Technique (MET). Significant improvements were observed in cervical ROM and pain reduction, with statistically significant

differences in flexion, extension, rotation, and side bending ($p<0.05$). The mean age was 32.3 years (±6.53 SD). Patients treated with Muscle Energy Technique (MET) showed improved range of motion and reduced pain. Pre- and post-treatment differences were statistically significant ($p<0.05$). MET effectively improved cervical range of motion and reduced pain [19].

The present study found statically significant difference in cervical ROM and pain in MET group this could be occurring due to autogenic inhibition. research conducted by Mahrukh Siddiqui et al. in 2022 showed that Autogenic Inhibition-Muscle Energy Technique (AI-MET) has been shown to be more effective than Reciprocal Inhibition-MET (RI-MET) in alleviating pain, improving range of motion, and reducing functional disability in patients with sub-acute and chronic mechanical neck pain. As a result, incorporating AI-MET into conventional neck pain therapy can lead to better treatment outcomes for patients with mechanical neck pain [20].The study finding align with previous research. Dr. Vinod Kumar et al. found that Post-Isometric Relaxation (PIR) and sustained stretching are effective interventions for alleviating Upper Cross Syndrome (UCS) symptoms. Specifically, PIR demonstrates superior pain management capabilities, while sustained stretching is more effective in enhancing cervical Range of Motion (ROM). These findings suggest that clinicians should incorporate both PIR and sustained stretching into treatment protocols for UCS, tailoring approaches to individual patient needs [21]. this study supported the current study's results, as patient treated with stretching showed improvement in cervical range of motion and muscle energy technique showed improvement in pain on NPRS.

However, in the current study MET and stretching showed no significant improvement in pain and range of motion but individually were significantly effective. this was confirmed by Asima Irshad et al. (2022), showed that stretching and muscle energy techniques, combined with cervical mobilization, are effective in managing upper cross syndrome. Studies show that these methods can significantly reduce pain, improve cervical range of motion, and enhance functional ability. with results that is P Value is less than 0.05 reported that Both therapeutic approaches demonstrated comparable efficacy in reducing neck disability, improving cervical range of motion, and alleviating pain, with no significant between-group differences observed [22] .In contrast , Muhammad Kashif et al.(2024) reported that muscle energy techniques demonstrated significant effectiveness in reducing pain and enhancing functional status in patient with upper cross syndrome compared to stretching exercises, with a p value less than 0.05 [8] .This contradicts current study's results ,as muscle energy technique and streching no significant difference in this group.

Effect of muscle energy techniques on pain and range of motion:

- Muscle Energy Techniques (MET) facilitated the restoration of movement between muscles and surrounding structures through gliding motions, reducing intrinsic pressures on neural tissues and subsequently enhancing overall movement function [23]. The analgesic effect observed with Muscle Energy Techniques (MET) is attributed to pain inhibition mediated by both ascending and descending neurological pathways, resulting from the activation of muscle and joint mechanoreceptors during isometric contractions. Notably, this process triggers the release of endogenous pain-inhibiting substances, including endorphins, enkephalins, and endocannabinoids, contributing to the reduction in pain perception.[24].
- The physiological mechanisms underlying Muscle Energy Techniques (MET)-induced changes in muscle extensibility include reflex relaxation, viscoelastic or intrinsic muscle property modifications, and enhanced stretch tolerance. Isometric contractions employed in MET are hypothesized to augment muscular strength. These mechanisms collectively alter muscle physiology, thereby facilitating an increase in joint range of motion (ROM) [25].

Effect of passive stretching on pain and range of motion:

- The reduction in pain intensity observed with passive stretching may be attributed to the inhibition of the Golgi tendon organ (GTO), resulting in relaxation of the musculotendinous unit and subsequent attenuation of pain perception.[13]
- Passive stretching reduces joint stiffness and enhances tissue extensibility through passive viscoelastic changes, attributable to mechanisms such as reflex inhibition and alterations in viscoelastic properties [26]. improve flexibility often involves discomfort, as it aims to increase stretch tolerance by placing muscles and tendons under novel tensile stresses through relatively extreme body positions. [27]

CONCLUSION

This randomized clinical trial which was perform on 30 subjects consisting of males and females with a complain of neck pain having upper cross syndrome with interventions on sternocleidomastoid and pectoralis major and minor in the form of hot moist pack + muscle energy technique and hot moist pack + passive stretching showed that, both the treatment interventions can be useful in alleviating the neck pain in terms of pain (NPRS), increase in cervical range of motion.

LIMITATION

No follow up was taken to see the long-term effect of treatment. effect not observed that difference might remain beyond that time. Population covered was just college going student.

FUTURE SCOPE/ SUGGESTIONS

1) Follow up can be taken to see the long-term effect of intervention for upper cross syndrome.
2) Study can be further done by taking large sample size.
3) Explore other therapeutic intervention for upper cross syndrome.
4) We also recommend qualitative study of emotions to determine how they influence body posture, and study of adherence to physical exercise.
5) Any other assessment tools and scales which can be used for upper cross syndrome in the future studies.
6) This study was specified for single city there must be multicity studies so that we can apply this to large population of diverse culture and environmental condition.

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