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To Compare the Effect of Muscle Energy Technique versus Myofascial Release with Transcutaneous Electrical Nerve Stimulation in Upper Crossed Syndrome to Reduce Pain and Improve Rom in Desktop Professionals

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Abstract: ***To compare the effect of muscle energy technique versus myofascial release with transcutaneous electrical nerve stimulation in upper crossed syndrome to reduce pain and improve rom in desktop professionals. Background: Upper crossed syndrome is characterized by muscle imbalance involving tightness of upper trapezius, levator scapulae, sternocleidomastoid, sub-occipitalis, pectoralis major and pectoralis minor with weakness of deep neck flexors, rhomboids, serratus anterior, middle trapezius and lower trapezius muscle is common among desktop professionals. Objectives: To compare the effect of muscle energy technique versus myofascial release with transcutaneous electrical nerve stimulation in upper crossed syndrome to reduce pain and improve ROM in desktop professionals. Methods: 60 patients with upper cross syndrome between age group 28 to 40 years according to inclusion and exclusion criteria and were divided into 2 groups. Each group were allocated 30 patients respectively. Group A samples were given Muscle Energy Technique and Transcutaneous Electrical Nerve Stimulation Group B samples were given Myofascial Release and Transcutaneous Electrical Nerve Stimulation three days per week for four consecutive weeks. The study assessed pain intensity using the Pain Pressure Threshold, Neck Disability Index to measure functional status and a Universal goniometer was used to measure cervical range of motion. Paired and independent t-tests were used to assess pre- and post-intervention data, with a significance level of p<0.05. Results: Results of within group analysis of NDI, CROM and PPT showed statistically significant improvement between day one and at the end of fourth week (p<0.05) in both the groups, but Group A being superior to group B. Conclusion: This study concludes that both Muscle Energy Technique and Myofascial Release with Transcutaneous Electrical Nerve Stimulation in upper cross syndrome are effective in reducing neck pain, disability, improving pressure pain threshold and cervical ROM. Here Muscle energy technique showed higher mean difference than Myofascial Release. Muscle energy technique with transcutaneous electrical nerve stimulation is statistically more significant in reducing neck pain and disability, increasing pressure pain threshold and cervical rom (p<0.05).***

Keywords: Upper Crossed Syndrome, Muscle Energy Technique, Myofascial Release, Transcutaneous Electrical Nerve Stimulation, Neck Disability Index, Pressure Pain Threshold, Cervical Range of Motion

1. Introduction

Upper crossed syndrome is a common postural dysfunction characterized by muscular imbalance at the level of head, neck, shoulder and the upper back muscles. It is typically associated with tightness of suboccipitalis, sternocleidomastoid, upper trapezius, levator scapulae, pectoralis major and minor. Weakness of the deep neck flexors, rhomboids, serratus anterior, middle trapezius and lower trapezius muscle.[1] The opposing neck muscles and upper thoracic group muscle imbalance result in joint dysfunction at atlanto-occipital, cervicothoracic and glenohumeral joint in addition to postural abnormalities and upper limb misalignment.[2] There are various musculoskeletal symptoms and features that are present in case of upper cross syndrome, they are headache, neck pain and upper back pain and decreased quality of life[3] Further the condition progress to the forward head posture, cervical lordosis, thoracic hyper kyphosis and rounded shoulders.[4]

It has been reported to affect 80% of the population, with a prevalence of 67% among IT professionals. [5] The risk factor for upper cross syndrome is continuing to adopt an incorrect posture for an extended period of time or repetitive tasks. Some daily tasks that result in poor posture are frequently connected to one's nature of work.[6]

Management of UCS primarily focuses on correcting muscular imbalance, reducing pain, improving mobility and restoring functional posture. There are Various physiotherapy treatment which are available for treating the upper crossed syndrome patients such as exercise therapy, therapeutic ultrasound TENS, Myofascial release, Muscle energy technique, Exercise therapy (such as stretching, strengthening exercises), thermotherapy and cryotherapy. [7,8]

Muscle Energy Technique is a manual therapy technique which treat soft structure of the tissue, mobilize the joints, stretch the tight muscles and the fascia, reduce local pain and enhance blood circulation.[9]] MFR denotes a manual application of low amplitude, long duration stretches to the fascia and muscles.[10]] The purpose of the MFR techniques are to alleviate pain, restore the optimal length of a muscle,

improve function, and relieve tissue tenderness of the myofascial system.[11]

Transcutaneous electrical nerve stimulation (TENS) is a non-invasive analgesic modality that activates large A beta fibers to gate nociceptive transmission and promote endorphin release.[12]

Although both Myofascial release Muscle Energy technique are commonly used in clinical practice, limited evidence exists comparing their effectiveness in individuals with UCS. Therefore, this study aimed to compare the effects of MET and MFR, each combined with TENS, on pain, disability, and cervical range of motion in desktop professionals with UCS.

2. Methodology

Material and Method

For this study, 60 participants diagnosed with Upper Cross Syndrome, aged 28–40 years, who met the inclusion and exclusion criteria were recruited and randomly allocated into two groups of 30 participants each. Group A received Muscle Energy Technique (MET) along with Transcutaneous Electrical Nerve Stimulation (TENS), while Group B received Myofascial Release (MFR) along with Transcutaneous Electrical Nerve Stimulation (TENS). Both groups underwent treatment three sessions per week for four consecutive weeks.

Source of Data
- Kempegowda institute of physiotherapy Outpatient department
- KIMS Hospital inpatient and outpatient Physiotherapy Departments.
- KIMS Hospital and Research Centre orthopedic inpatient and outpatient department.

Methods of Collection of Data
- **Study design:** Comparative study
- **Sample size:** 60 samples (30 in each group)
- **Sampling method:** Simple random sampling method
- **Study duration:** 12 months
- **Study subjects:**

Group A(n=30): Muscle Energy Technique with Transcutaneous electrical nerve stimulation for upper crossed syndrome

Group B(n=30): Myofascial Release Technique with Transcutaneous electrical nerve stimulation for upper crossed syndrome.

Inclusion Criteria:
- The subjects diagnosed with upper crossed syndrome.
- The patient age group ranges between 28-40 years included in this study.
- Restricted cervical range of motion
- Both males and females.
- Patient who are able to comprehend, command and willing to participate in the study

Exclusion Criteria:
- Patient who have diagnosed pathology like inflammatory disorders, malignancy, infection.
- Patient with any neurological condition affecting cervical spine such as cervical radiculopathy.
- Patient with history of cervical spine surgery or trauma
- Patient with osteoporosis
- Patient with disc buldge, or cervical spondylosis
- Thoracic outlet syndrome

Intervention Protocol:

Group A: Participants in Group A received Muscle Energy Technique (MET) targeting the upper trapezius, levator scapulae, sternocleidomastoid, pectoralis major, and pectoralis minor muscles. The patient performed a sub-maximal isometric contraction (20% effort) against the therapist's resistance for 10 seconds followed by gentle stretching into the new range (post-isometric relaxation techniques method). Each muscle received 3 repetition.[13] TENS was delivered at 80 Hz, 150 µs pulse duration, 15 minutes per session, at intensity per patient tolerance.[14] Treatment was given for 3 days per week for 4 consecutive weeks.

Group B: Participants in Group B received Direct Myofascial Release (MFR) applied to the upper trapezius, levator scapulae, sternocleidomastoid, pectoralis major, and pectoralis minor muscles. Sustained myofascial tension was applied for 90 seconds and repeated twice for each muscle.[15] Followed by Transcutaneous Electrical Nerve Stimulation (TENS) using the same treatment parameters as group A[14]. The intervention was administered three times per week for four consecutive weeks.

Home Exercise Program (both groups): Chin tucks targeting the deep neck flexors, scapular mobility exercises for rhomboids and trapezius, cervical isometrics (10 repetitions with 5-second holds). Self-stretches of upper trapezius, levator scapulae, and pectoralis major (3 repetitions with 15-second holds)

Outcome Measures:

Neck Disability Index (NDI)
The Neck Disability Index (NDI) is a 10-item questionnaire used to assess neck pain-related disability. Each item is scored from 0 (no disability) to 5 (complete disability), with a total score ranging from 0 to 100. Higher scores indicate greater disability. The NDI has good reliability (ICC: 0.50–0.98).[16]

Universal Goniometer (UG)
A universal goniometer was used to measure active cervical range of motion, including flexion, extension, lateral flexion, and rotation. It is a reliable instrument for assessing cervical ROM (ICC: 0.80–0.98). [17]

Pressure Pain Threshold
Pressure pain threshold was measured using a digital pressure algometer over the upper trapezius, levator scapulae, and sternocleidomastoid muscles. Three measurements were obtained at 30-second intervals, and the mean value was used

for analysis. The algometer was applied perpendicular to the skin, and participants indicated the onset of pain by raising their hand. The pressure algometer has demonstrated high reliability (ICC = 0.91)[18]

Statistical Analysis:
SPSS version 26 was used to analyse the data. For within group analysis, the paired t-test was utilized, and for between group comparison, the independent t-test. For categorical variables, the chi – square test was used. The significance threshold was set at $p<0.05$.

3. Results

Table 1: Mean Age

		Group A (MET)	Group B (MFR)	T Value (Mann Whitney U test)	P Value
Age	Right	33.5	32.1	**1.53**	**0.13**
	Left	3.86	3.19		

The mean age of Group A (MET+TENS) was 33.5 ± 3.86 years and that of Group B (MFR+TENS) was 32.1 ± 3.19 years. The Mann–Whitney U test yielded a T value of 1.53 ($p = 0.13$), indicating no statistically significant difference in age between groups ($p>0.05$). Both groups were comparable.

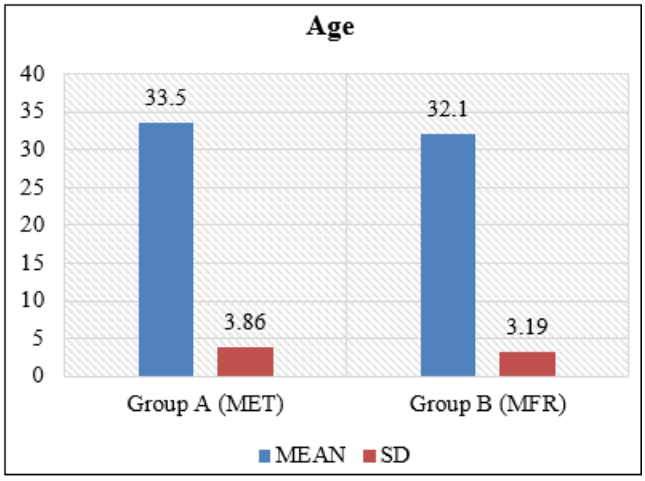


Table 2: Gender

		Group A (MET)	Group B (MFR)	X2 Value (Chi Square Test)	P Value
Gender	Male	16 (53.4%)	15 (50%)	**0.32**	**0.57**
	Female	14 (46.6%)	15 (50%)		

Group A comprised 16 males (53.4%) and 14 females (46.6%); Group B comprised 15 males (50%) and 15 females (50%). Chi-square analysis yielded $\chi^2 = 0.32$ ($p = 0.57$), confirming no significant gender difference between groups.

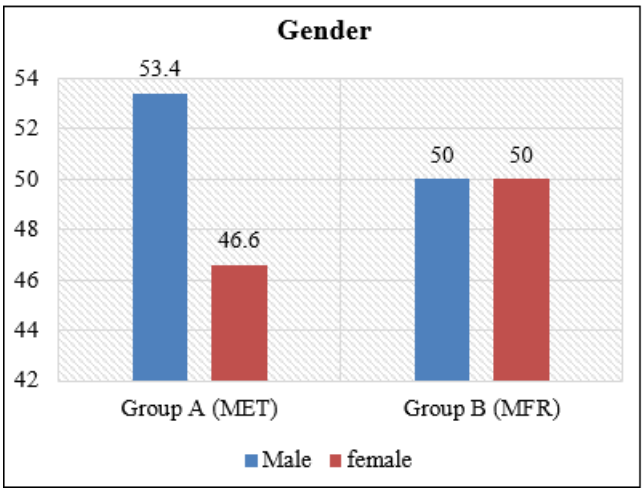


Table 3: Side

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
Gender	Right	14 (46.6%)	16 (53.4%)	**1.28**	**0.25**
	Left	16 (53.4%)	14 (46.6%)		

Group A had 14 right-side (46.6%) and 16 left-side (53.4%) involvements; Group B had 16 right-side (53.4%) and 14 left-side (46.6%) involvements. Chi-square test yielded $\chi^2 = 1.28$ ($p = 0.25$), confirming no significant between-group difference in side distribution.

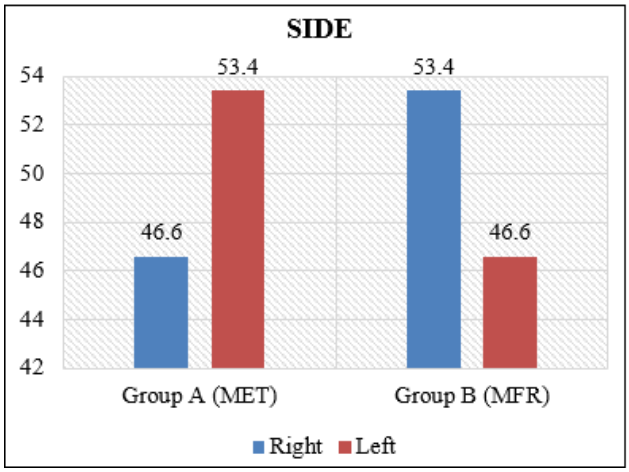
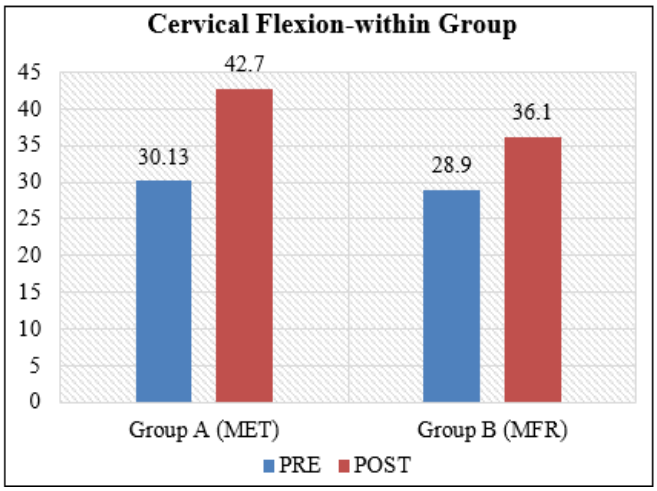


Table 4: Between and within group comparison of 'Cervical Flexion'

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
Flexion	Pre	30.13±4.53	28.9±4.74	1.03	0.30
	Post	42.7±4.88	36.1±4.54	5.49	0.0001*
Difference		12.57±4.65	7.2±4.62		
T Value		10.43	6.04		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		41.7%	24.9%		

Table 4 presents the results of cervical flexion measurements before and after intervention in both Group A (MET) and Group B (MFR). Both groups showed statistically significant within-group improvement in cervical flexion ($p=0.0001$). Group A mean flexion increased from 30.13±4.53° to 42.7±4.88° (Δ 12.57±4.65°; 41.7% gain); Group B improved

from 28.9±4.74° to 36.1±4.54° (Δ 7.2±4.62°; 24.9% gain). Between-group comparison at post-test was significantly in favour of Group A (t=5.49, p=0.0001).



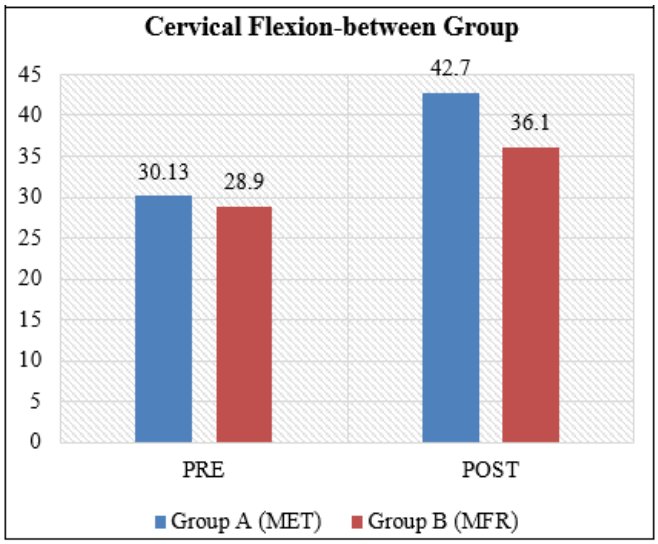
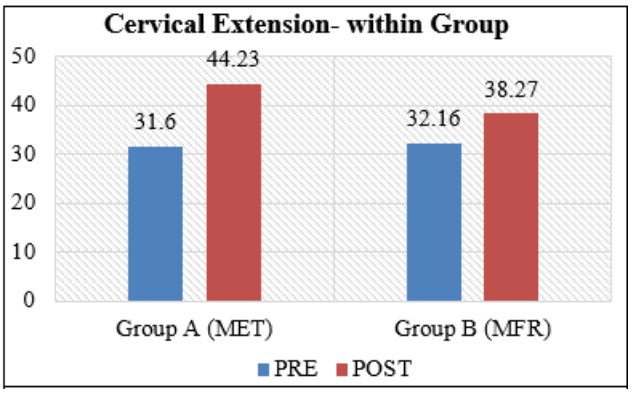


Table 5: Between and within group comparison of 'Cervical Extension'

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
Extension	Pre	31.6±4.49	32.16±4.47	0.48	0.62
	Post	44.23±3.71	38.27±4.61	5.53	0.0001*
Difference		12.63±4.12	6.11±4.50		
T Value		11.87	5.21		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		39.9%	18.9%		

Table 5 illustrates the changes in cervical extension before and after intervention in both Group A (MET) and Group B (MFR). Significant within-group improvement was observed in both groups (p=0.0001). Group A improved from 31.6±4.49° to 44.23±3.71° (39.9%); Group B improved from 32.16±4.47° to 38.27±4.61° (18.9%). Group A was significantly superior on between-group comparison (t=5.53, p=0.0001).



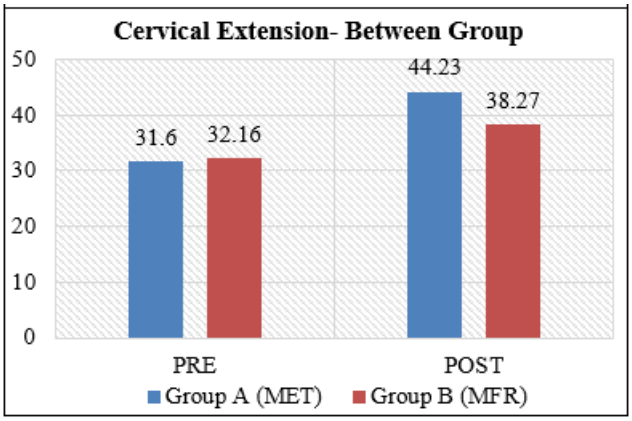
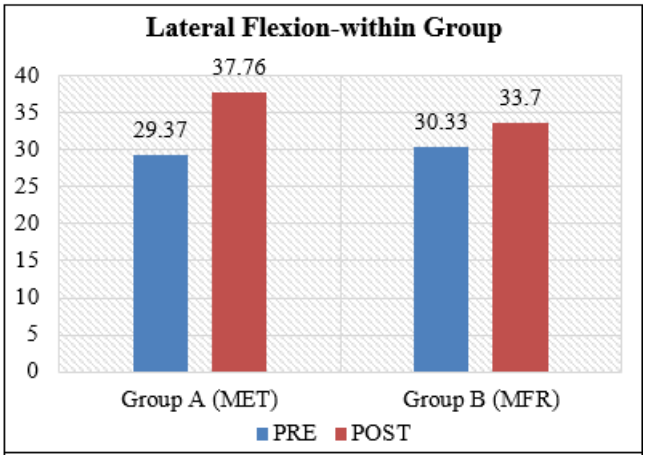


Table 6: Between and within group comparison of 'Lateral flexion'

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
Lateral flexion	Pre	29.37±4.76	30.33±4.85	0.77	0.44
	Post	37.76±5.12	33.7±5.06	3.08	0.0001*
Difference		8.39±4.88	3.37±4.98		
T Value		6.57	2.63		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		28.5%	11.12%		

Table 6 presents the comparison of lateral flexion range before and after intervention in Group A (MET) and Group B (MFR). Both groups improved significantly within groups (p=0.0001). Group A lateral flexion increased from 29.37±4.76° to 37.76±5.12° (28.5%); Group B improved from 30.33±4.85° to 33.7±5.06° (11.12%). Between-group analysis favoured Group A (t=3.08, p=0.003).



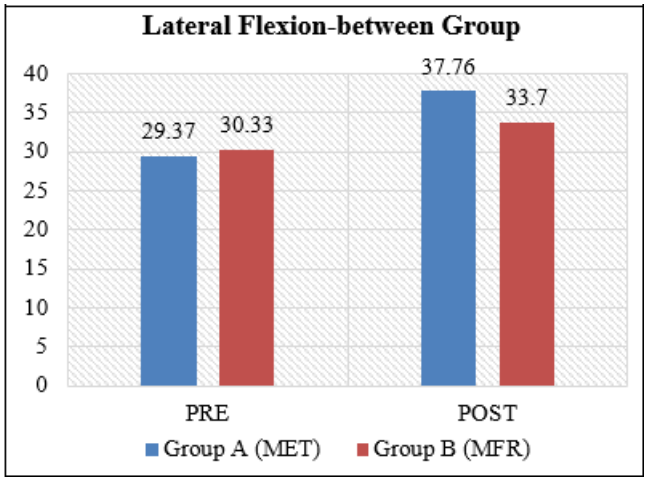
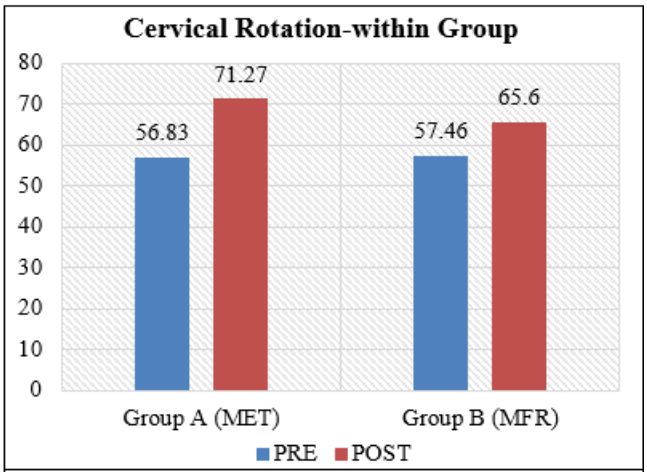


Table 7: Between and within group comparison of 'Cervical Rotation

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
Cervical Rotation	Pre	56.83±7.51	57.46±6.63	0.34	0.73
	Post	71.27±6.91	65.6±6.03	3.39	0.0001*
Difference		14.45±7.12	8.14±6.34		
T Value		7.76	4.67		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		25.4%	14.16%		

Significant within-group improvements were observed in both groups (p=0.0001). Group A rotation improved from 56.83±7.51° to 71.27±6.91° (25.4%); Group B from 57.46±6.63° to 65.6±6.03° (14.16%). Group A was significantly superior on between-group comparison (t=3.39, p=0.0001).



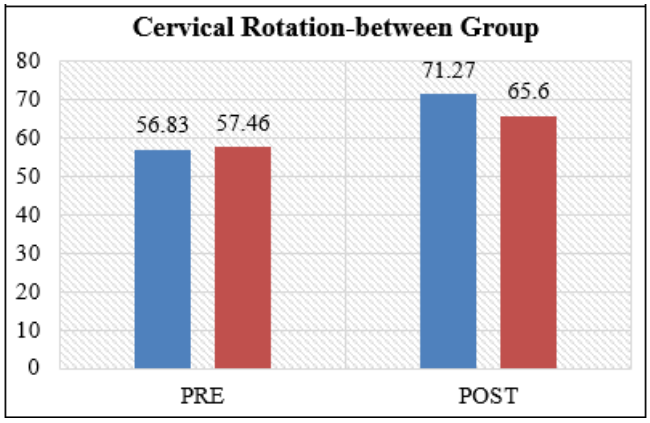
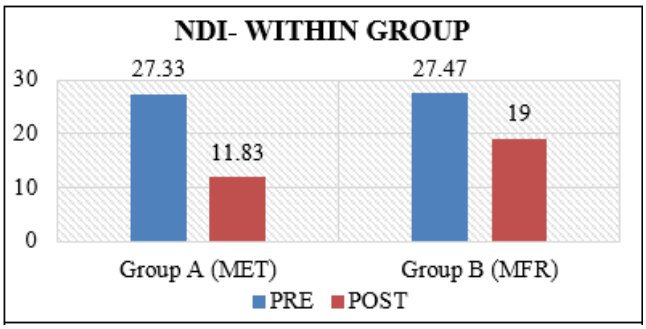


Table 8: Between and within group comparison of 'NDI'

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
NDI	Pre	27.33±1.84	27.47±1.76	0.30	0.76
	Post	11.83±1.53	19±2.39	14.23	0.0001*
Difference		16±1.68	8.47±2.22		
Z Value		38.76	16.01		
P Value (Paired T test)		0.0001*	0.0001*		
Percentage difference		58.5%	30.8%		

Both groups demonstrated significant reductions in NDI scores (p=0.0001). Group A mean NDI score decreased from 27.33±1.84 to 11.83±1.53 (58.5% reduction; Δ 16±1.68); Group B decreased from 27.47±1.76 to 19±2.39 (30.8% reduction; Δ 8.47±2.22). The between-group comparison was highly significant in favour of Group A (t=14.23, p=0.0001).



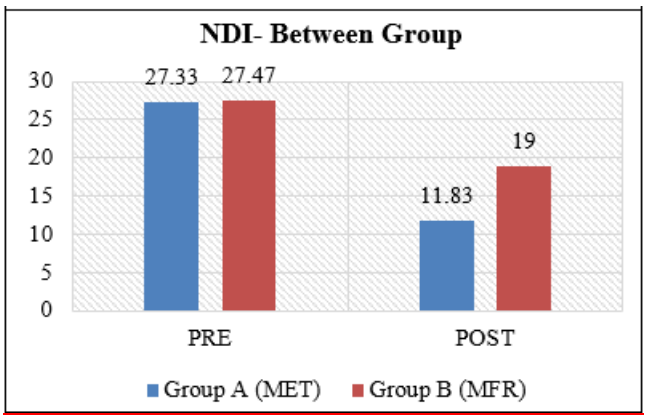
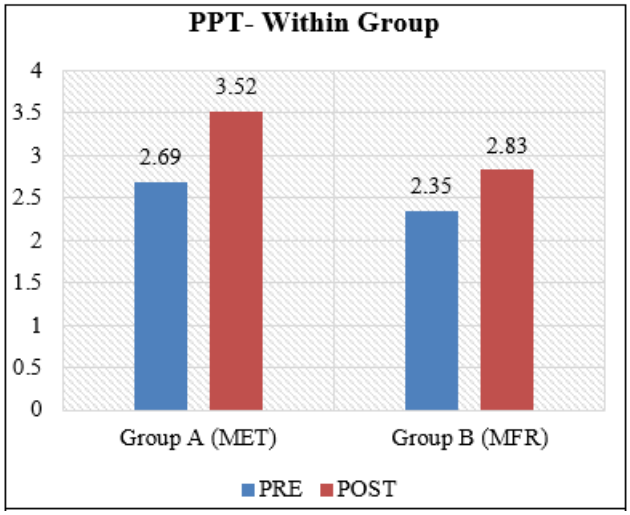
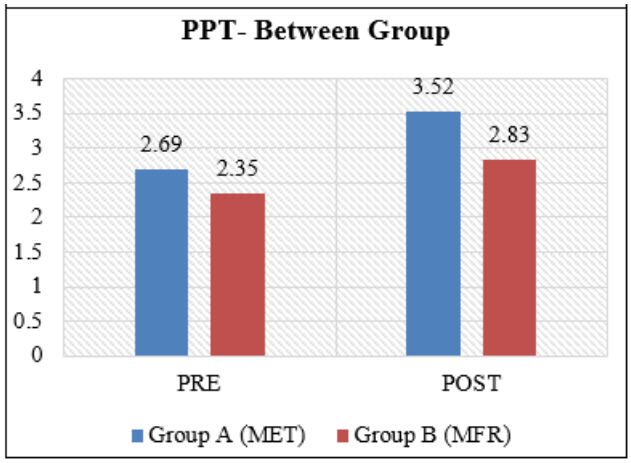


Table 9: Between and within group comparison of 'PPT'

		Group A (MET)	Group B (MFR)	T Value (T Test)	P Value
PPT	Pre	2.69±0.69	2.35±0.68	1.92	0.06
	Post	3.52±0.72	2.83±0.67	3.81	0.003*
Difference		0.83±0.71	0.48±0.67		
T Value		4.59	2.75		
P Value (Paired T test)		0.0001*	0.007*		
Percentage difference		30.8%	20.4%		

Within-group improvements in PPT were significant in both groups (Group A: p=0.0001; Group B: p=0.007). Group A PPT rose from 2.69±0.69 to 3.52±0.72 kg/cm² (30.8%); Group B from 2.35±0.68 to 2.83±0.67 kg/cm² (20.4%). Between-group comparison showed Group A achieved significantly greater PPT improvement (t=3.81, p=0.003).





4. Discussion

This randomized comparative study evaluated the effectiveness of Muscle Energy Technique (MET) combined with Transcutaneous Electrical Stimulation (TENS) versus Myofascial Release (MFR) combined with Transcutaneous Electrical Stimulation (TENS) in 60 desktop professionals with Upper Crossed Syndrome over four weeks. Both interventions produced statistically significant improvements in all outcome measures cervical range of motion (flexion, extension, lateral flexion, rotation), pressure pain threshold (PPT), and Neck Disability Index (NDI). However, Group A MET with TENS demonstrated significantly superior outcomes across all parameters ($p<0.05$).

MET exerts its beneficial effects via two principal neurophysiological mechanisms: post-isometric relaxation (PIR), whereby sustained isometric contraction stimulates Golgi tendon organs, triggering inhibitory reflexes that facilitate muscle elongation; and reciprocal inhibition, whereby activation of the agonist reduces antagonist tone via inhibition of alpha motor neurons.[9]These mechanisms, combined with mechanoreceptor and proprioceptor modulation in cervical joints, likely explain the superior ROM gains observed in Group A.

MFR achieves its effects through sustained mechanical deformation of fascial layers, inducing histological changes including increased tissue extensibility and improved lymphatic and vascular perfusion.[10] Although effective, the slower biomechanical response of fascial remodelling may explain the comparatively smaller gains in the 4-week study period.

TENS, as an adjunct modality in both groups, provided consistent analgesia through gate-control mechanisms and endorphin release, creating a favourable environment for manual therapy.[12] Its effects on PPT were augmented more substantially when combined with MET, consistent with MET's direct neurophysiological targeting of muscle spindle and Golgi tendon organ activity.

These findings align with Shahzad et al. (2022), who reported MET with routine physiotherapy produced superior outcomes in UCS[19]. And with Sbardella et al. (2021), who systematically reviewed 21 studies confirming MET's superiority in reducing pain and enhancing PPT in non-specific neck pain.[20] Similarly, Phogat et al. (2024) demonstrated improvements in both MET combined with MFR and MET along with stretching groups in UCS, with MET consistently contributing to pain and ROM benefits.[21]

The demographic equivalence between groups (mean age, gender distribution, and side involvement; $p>0.05$ for all) confirms that observed differences in outcomes were attributable to the interventions and not to baseline confounders

5. Conclusion

Both Muscle Energy Technique (MET) with Transcutaneous Electrical Nerve Stimulation (TENS) and Myofascial Release (MFR) with Transcutaneous Electrical Nerve Stimulation (TENS) were effective in improving cervical range of motion, increasing pressure pain threshold, and reducing functional disability in individuals with Upper Cross Syndrome after four weeks of intervention. However, MET combined with TENS demonstrated significantly greater improvements than MFR combined with TENS. These findings suggest that MET with TENS may be considered a more effective conservative treatment approach for managing Upper Cross Syndrome in desktop professionals

6. Limitations

- This study was carried out on small sample size.

- Absence of long term monitoring
- The age group of the patient limits the study.

7. Recommendations

Further research with larger sample size, longer follow-ups and weekly assessment of outcome measures is recommended to better monitor the progression and effectiveness of the interventions.

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