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COMPARISON OF INSTRUMENT-ASSISTED SOFT TISSUE MOBILIZATION TECHNIQUE AND MYOFASCIAL GUN IN UPPER CROSS SYNDROME

Original Research

Hafsa Siddiqui[1], Muhammad Affan Iqbal[1], Azka Batool[2]*, Nemra Shah[3], Saman Javaria[1], Saadullah Khalid[4], Aqsa Mustafa[1]
[1]Riphah International University, Pakistan.
[2]Department of Physical Therapy, Riphah College of Rehabilitation & Allied Health Sciences, Islamabad, Pakistan.
[3]Helping Hand for Relief and Development, Quetta, Affiliated with Disability Program, Pakistan.
[4]Pakistan Railway General Hospital, Rawalpindi, Pakistan.
Corresponding Author: Azka Batool, Department of Physical Therapy, Riphah College of Rehabilitation & Allied Health Sciences, Islamabad, Pakistan. azkabatool09@gmail.com
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ABSTRACT

Background: Upper Cross Syndrome (UCS) is acquired due to use of cell phones, laptops etc. Upper Trapezius is one of the primary muscles that is tightened in UCS. Myofascial release is a known method to treat UCS to relieve pain and improve cervical ranges and posture. This analyzes the effects of myofascial release of the Upper Trapezius muscle through IASTM and Myofascial Gun on pain, cervical ROMs, posture, and disability in UCS. The effects of IASTM on UCS are evident. However, Myofascial Guns are a new advancement whose effects are yet to be studied in UCS.

Objective: To determine the effects of IASTM and Myofascial Gun on pain, cervical ROM's, Posture, and functional status in UCS.

Methods: An RCT was conducted on 30 patients with UCS. Participants were divided into two groups with 15 in each. Group A was treated with IASTM and Group B with Myofascial Gun on the upper trapezius muscle. Both groups received 3 sessions per week for 4 weeks. Assessments were taken at baseline and after 4 weeks of intervention.

Results: IASTM and Myofascial Gun both were equally effective in improving NPRS, Cervical flexion, extension, right and left rotation, right and left lateral flexion, NDI scores and tragus to wall distance after 4 weeks of intervention in UCS.

Conclusion: It is concluded that IASTM and Myofascial Gun both are equally effective in improving pain, cervical ROMs, posture and functional status in Upper Cross Syndrome.

Keywords: Upper Cross syndrome, IASTM, Myofascial Gun, Upper Trapezius, Graston's tool, Forward Head Posture.

INTRODUCTION

Upper Cross Syndrome, one of the prevalent postural anomaly was(1), first explained by Vladimir Janda(2). It is characterized by muscular imbalance in shoulder and cervical region(1, 3). The amalgam of protracted shoulders and Forward Head Posture is UCS (4). There is an increase in thoracic curvature and straightening of cervical curve. Upper trapezius, Pectoralis Major, Levator Scapulae (5) and Sternocleidomastoid are tightened (6). The lower and middle trapezius become weakened (5). Moreover, over-activity of the Pectoralis minor and inhibition of deep neck flexors and rhomboids have also been found (4, 7). This leads to round shoulders. It is mostly observed in individuals acquiring abnormal compromised postures as part of daily life habits or work-related(5). According to Janda treating UCS requires the balance in muscles to be restored(8). A study on students found that the most prevalent muscle tightness in UCS was in trapezius and neck muscle extensors which were 65%. This is the main culprit in causing pain and abnormal posture(9). When a tissue undergoes trauma it leads to the genesis of cells and scar. Scar, with compromised flexibility and more tendency to adhere, leads to hypoxia and nutrient deficiency which in turn compromises collagen rebuilding. This makes the tissue more susceptible to trauma (10).

The fascia surrounding muscles can also be shortened resulting in muscle inflexibility affecting its ROM. Myofascial release helps overcome fascial restrictions. When a shortened muscle is given myofascial release, the impulses generated through stimulus cause it to further become tightened. This causes reciprocal inhibition and the muscle relaxes (11). Deep myofascial release helps decrease muscular stiffness by treating the trigger points in the muscle (12) Myofascial techniques and massage increase the mobility of the cervical spine in individuals with upper-cross syndrome (13). Instrument Assisted Soft Tissue Mobilization is a new advancement in the field of Physiotherapy based on the concept given be Cyriax (14). It is used to treat trigger points. IASTM is easier to use and can be applied with more pressure (14, 15). The movement of fascia enhances oxygen in the tissue. There is more circulation and more fibroblastic proliferation. When fascia is targeted in this way it can lead to breaking adhesions (16).

Myofascial Guns are gaining popularity in the field of Physiotherapy. These handheld guns have different heads that can be attached depending upon the area where they are applied and move at very high frequency that hit the tissue. Frequencies can be set from 5 to as much as 3000 hertz. The Myofascial Guns are better in a way that they act on the same mechanism and principle as of manual massage technique of Tapotement, but with many different frequency settings and depth of the blow. The practitioner does not fatigue, and he or she can apply the device on bigger surface area in comparatively less time (17). Vibrating foam rollers have been seen to improve ranges in the lower limb's joints when used for decreasing muscle tightness. These guns give deeper vibrations that are said to be more effective. Furthermore, it helps in significant pain reduction (11). The evidence on Myofascial Gun or Thera Gun in the field of Physical therapy is sparse as it is a new technology. Researches on effects of Thera Gun have shown significant improvement in pain and ROM in cervical, back and planter flexors(18, 19).

METHODS

A randomized clinical trial (registered with clinicaltrials.gov, NCT05474443) was conducted at the Pakistan Railway General Hospital, Rawalpindi, Pakistan, for a duration of 6 months. It was approved from the Institutional Review Board and Ethics Committee of PRGH. Written informed consent was taken from the participants before data collection. A total of 42 subjects with UCS were assessed for eligibility. However, 30 subjects fulfilled the inclusion criteria. The participants were randomly divided into two treatment groups i.e., IASTM (n=15) and Myofascial Gun (n=15) through coin toss method. The inclusion criteria included participants aged between 20-50 years and Forward Head Posture more than 9.5 cm on Tragus to Wall Test. However, participants with congenital anomalies of the shoulder, malalignment and previous fractures of the clavicle, malalignment, and Tuberculosis of Spine and Pigeon and barrel chest were excluded from the study.

All the participants received 12 sessions (three sessions per week), for a duration of four weeks. Both groups received Hot Pack at the beginning of session for 10 minutes(20). Then after application of tool, stretches were given to all subjects. At the end, cold pack was applied for 10 minutes (15, 21). Group A received treatment through IASTM on Trapezius muscle. Vaseline was applied for lubrication over the required area (15). Graston's tool, after sanitizing with alcohol swab was held at 45-degree angle with patient sitting erect and

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was moved from muscle origin to insertion. The intervention was applied for 120 seconds(15). Group B received treatment through Myofascial Gun which was applied over the Trapezius muscle for 5 minutes. In the first two sessions frequency was set to 1-2 then increased to next two sessions 3-4 and so on. (34) Level 1 gives 2100 rpm level 2 2400 rpm, level 3 2700 rpm, level 4 3000 rpm level 5, 3300 rpm and level 6 3600 rpm. For first two sessions level 1 was applied. Then next two sessions were given on level 2 and so on.

The Levator scapulae muscle was stretched in a sitting position with patients arm under the chair of the same side and head in 45 degrees opposite side rotation (22). The Upper Trapezius muscle was stretched in sitting position with opposite side lateral flexion with Therapist stabilizing the shoulder (15). To stretch Pectoralis major the subject was asked to sit and the therapist stood behind the patient. The subject was asked to perform horizontal abduction bilaterally and the stretching force was given by the Therapist(23). The outcome measures of Pain, Cervical ROMs, Forward head Posture and Functional status were assessed through Numeric Pain Rating Scale (24), Tragus to Wall Distance Test (25, 26), Inclinometer (27) and Neck Disability Index (28) respectively at baseline and after 4 weeks of intervention. IBM SPSS 26 version was used for the whole statistical analysis. For gender and age frequency and mean ± SD was calculated. For computing the homogeneity of the data tests for normality were applied. The decision to apply parametric and non-parametric tests were done through the Shapiro-Wilk test values.

The p-value for NPRS was <0.05 for both groups so non-parametric tests were applied for that. The rest of the sample was found to have >0.05 so parametric tests were applied for within and between group analysis. In Myofascial Gun group Shapiro Wilk value was found to be <0.05 for Left Lateral flexion so non-parametric tests were applied for within and between group analysis. For analysis of Cervical extension, flexion, right lateral flexion, right and left rotation, Tragus to wall distance test, Neck Disability Index total score and percentages for pre and post between group comparison assessments, Independent T test was applied. For NPRS pre- and post-analysis for between groups, the comparison Mann-Whitney U test was applied. Cervical extension, flexion, right and left rotation, right lateral flexion, Tragus to wall distance test, Neck Disability Index total score, and percentages pre- and post-within group analysis were performed with Paired T-test. For within-group assessment of pre- and post-treatment analysis of NPRS Wilcoxon Signed rank test was used. For left Lateral flexion in the IASTM group within a group and between group analysis Wilcoxin rank sum and Mann Whitney u tests were applied respectively.

RESULTS

The study included 30 participants, predominantly females (93.3%), with only 2 males (6.7%). The participants were divided into two groups: 15 subjects in the IASTM group and 15 in the Myofascial Gun group. The mean age of participants in the IASTM group was 37.33 ± 10.33 years, while the Myofascial Gun group had a mean age of 40.86 ± 8.92 years. Participants included 5 healthcare workers and 25 housewives, with the Myofascial Gun group consisting of 13 housewives and 2 healthcare workers, and the IASTM group comprising 12 housewives and 3 healthcare workers. Cervical range of motion (ROM) in flexion, extension, lateral flexion (right and left), and rotation (right and left), along with forward head posture measured via the Tragus-to-Wall Distance Test, significantly improved in both groups after four weeks of intervention ($p<0.05$). Pain intensity assessed through the Numeric Pain Rating Scale (NPRS) and functional status evaluated using the Neck Disability Index (NDI) also demonstrated statistically significant improvements in both groups ($p<0.05$).

In the IASTM group, cervical flexion increased from 47.00 ± 10.32° to 66.07 ± 11.02° ($p<0.001$), and extension improved from 43.07 ± 8.91° to 56.20 ± 10.73° ($p<0.001$). Similarly, left lateral flexion increased from 33.00 ± 5.00° to 42.47 ± 2.47° ($p<0.001$), and right lateral flexion improved from 51.27 ± 17.60° to 69.00 ± 16.14° ($p<0.001$). Both right and left rotations showed notable improvements, with right rotation increasing from 56.27 ± 11.32° to 70.27 ± 10.94° ($p<0.001$) and left rotation from 51.27 ± 17.60° to 69.00 ± 16.14° ($p<0.001$). Forward head posture, as indicated by the Tragus-to-Wall Distance Test, decreased significantly from 15.57 ± 2.18 cm to 13.79 ± 2.06 cm ($p<0.001$). The NDI scores for functional status also showed significant improvement, decreasing from 70.41 ± 10.69 to 19.53 ± 8.00 ($p<0.001$). In the Myofascial Gun group, cervical flexion increased from 51.13 ± 11.45° to 63.73 ± 9.56° ($p=0.01$), and extension improved from 48.27 ± 9.14° to 61.87 ± 10.30° ($p=0.03$). Left lateral flexion increased significantly from 35.00 ± 7.76° to 46.33 ± 8.41° ($p<0.001$), while right lateral flexion remained unchanged at 34.80 ± 9.22°. Right rotation improved from 48.40 ± 12.49° to 68.47 ± 11.94° ($p<0.001$), and left rotation increased from 49.27 ± 11.09° to 71.27 ± 11.61° ($p<0.001$). Forward head posture significantly improved as the Tragus-to-Wall Distance decreased from 15.25 ± 1.34 cm to 13.39 ± 1.23 cm ($p<0.001$). Functional status, as measured by the NDI, also showed a significant reduction in scores from 67.54 ± 9.43 to 19.73 ± 6.53 ($p<0.001$).

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Between-group comparisons revealed no significant differences in cervical flexion, extension, right and left lateral flexion, right and left rotations, forward head posture, pain intensity, and functional status ($p>0.05$). However, within-group analysis highlighted the significant improvements achieved in both groups. Analysis of NPRS showed that pain intensity significantly decreased in both groups. The median NPRS score in the IASTM group reduced from 6 (IQR=1) to 2 (IQR=2) ($p=0.001$), while the Myofascial Gun group demonstrated a reduction from 7 (IQR=1) to 2 (IQR=2) ($p=0.001$). Functional improvements in specific NDI items such as pain intensity, personal care, lifting, reading, concentration, and recreation were also observed in both groups, with p-values <0.001 for most variables. Despite significant within-group improvements, no statistically significant differences were observed between the IASTM and Myofascial Gun groups for any of the measured variables. Both interventions were effective, demonstrating their utility in managing upper cross syndrome.

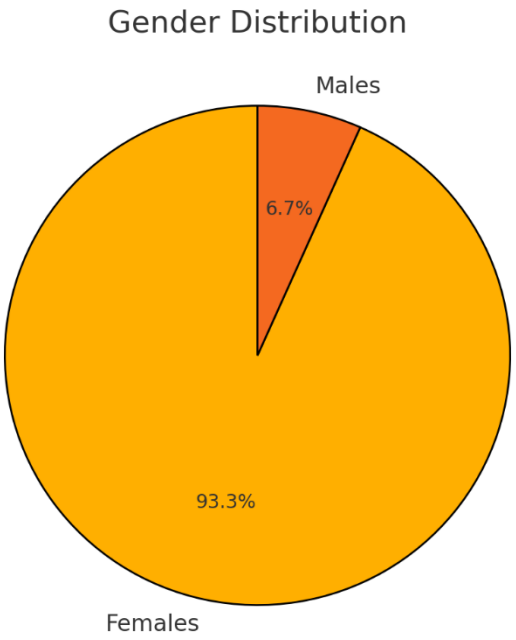

Figure 2 Gender Distribution

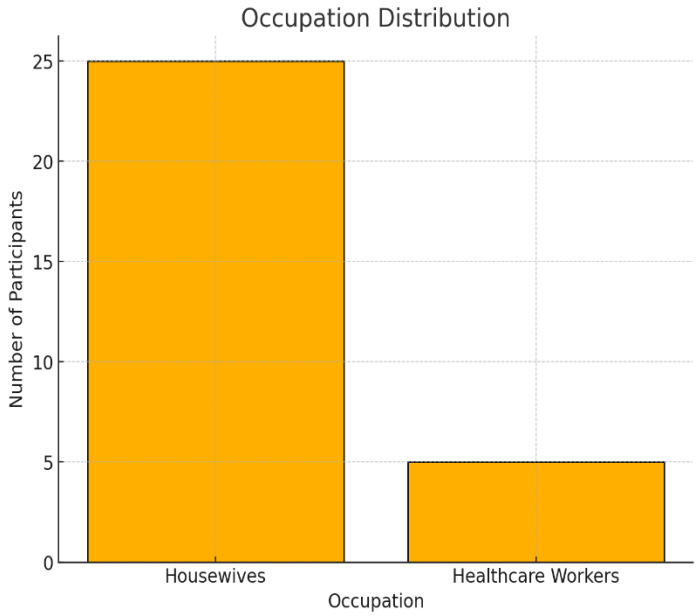

Figure 1 Occupation Distribution

The Gender Distribution chart highlights that the majority of participants were females (93.3%, n=28), with only a small proportion being males (6.7%, n=2). The Occupation Distribution chart shows that most participants were housewives (83.3%, n=25), while the remaining were healthcare workers (16.7%, n=5), reflecting the demographic characteristics of the study population.

Table 1: Mean and SD of Age of subjects

Age	
Group	Mean ± SD
IASTM	37.33 ± 10.33
Myofascial Gun	40.86 ± 8.92
Total	39.10 ± 9.65

Pre- and post-data analysis showed that the cervical ROMS of flexion, extension, right and left Lateral flexion and Right and Left Rotation, Tragus to Wall Distance Test scores, The Neck Disability Index, and NPRS were significantly improved ($p<0.05$) in both groups (Table 2&3)

Table 2: Paired t Test for IASTM and Myofascial Group

Groups	**Mean ± SD**	**Cervical Flexion**	**Cervical Extension**	**Left Lateral Flexion**	**Right Lateral Flexion**	**Left Rotation**	**Right Rotation**	**Tragus-to-wall distance**	**NDI**
IASTM Group	Pre-intervention	47.00 ± 10.32	43.07 ± 8.91	-	33.00 ± 5.00	51.27 ± 17.60	56.27 ± 11.32	15.57 ± 2.18	70.41 ± 10.69
	Post-intervention	66.07 ± 11.02	56.20 ± 10.73	-	42.47 ± 2.47	69.00 ± 16.14	70.27 ± 10.94	13.79 ± 2.06	19.53 ± 8.00
	P- Value	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001
Myofascial Gun Group	Pre-intervention	51.13 ± 11.45	48.27 ± 9.14	35.00 ± 7.76	34.80 ± 9.22	49.27 ± 11.09	48.40 ± 12.49	15.25 ± 1.34	67.54 ± 9.43
	Post-intervention	63.73 ± 9.56	61.87 ± 10.30	46.33 ± 8.41	34.80 ± 9.22	71.27 ± 11.61	68.47 ± 11.94	13.39 ± 1.23	67.54 ± 9.43
	P- Value	0.01	0.03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

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Table 3: Wilcoxon Test for IASTM and Myofascial Gun Groups for non-normal variables

GROUPS	Variable	Assessment	Median (IQR)	P value
IASTM	NPRS	Pre-intervention	6(1)	0.001
		Pre-intervention	2(2)	
MYOFASCIAL GUN	NPRS	Pre-Intervention	7(1)	0.001
		Post-intervention	2(2)	
	Left Lateral Flexion	Pre-intervention	32(8)	0.001
		Post-intervention	42(4)	

Between-the-groups comparison revealed that there was no significant difference in Cervical flexion, extension right and left Lateral Flexion and Right and Left Rotations, The tragus to Wall distance test, NPRS and NDI in IASTM and Myofascial Gun groups (p>0.05). (Table 5&6)

Table 4: Independent t Test at pre and post-intervention

Groups	Mean ± SD	Cervical Flexion	Cervical Extension	Right Lateral Flexion	Left Rotation	Right Rotation	Tragus-to-wall distance	NDI
BASELINE	IASTM	66.07±11.02	56.20±10.73	42.47±2.47	69.00±16.14	70.27±10.94	13.79±2.06	19.52±8.00
	Myofascial Gun	63.73±9.57	61.87±10.30	47.00±6.87	71.27±11.61	68.47±11.94	13.39±1.23	19.73±6.53
	P- Value	0.541	0.151	0.069	0.662	0.670	0.531	0.938
POST-INTERVENTION	IASTM	47.00±10.32	43.07±8.91	33.00 ± 5	51.27±17.60	56.27±11.32	15.57±2.18	70.41±10.69
	Myofascial Gun	51.13±11.45	48.27±9.14	34.8 ±9.22	49.27±11.09	48.40±12.49	15.25±1.34	67.54±9.43
	P- Value	0.308	0.126	0.512	0.713	0.082	0.632	0.442

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Table 5: Mann Whitney U test for non-normal variables

Variable	Assessment	Median (IQR)	Mean Rank (Sum of Ranks) IASTM	Mean Rank (Sum of Ranks) Gun	U value	P value
NPRS	Pre	6(1)	16.27(244)	14.73(221)	101.0	0.604
	Post	2(1)	17.06(255)	14.00(210)	90.00	0.337
Left Lateral Flexion	Pre	34(8.5)	12.43(186.50)	18.57(278)	66.50	0.055
	Post	42.5(4.25)	12.43(186.50)	18.33(275)	70.00	0.075

Table 6: NDI items for IASTM Group

No.	Variables	Assessment	Median (IQR)	P value
Section 1	Pain Intensity	Pre	4(2)	0.000
		Post	1(1)	
Section 2	Personal care	Pre	3(1)	0.001
		Post	1(1)	
Section 3	Lifting	Pre	4(1)	0.000
		Post	2(1)	
Section 4	Reading	Pre	3(1)	0.000
		post	0(1)	
Section 5	Headaches	pre	4(1)	0.001
		Post	1(1)	
Section 6	Concentration	pre	3(1)	0.001
		Post	0(0)	
Section 7	Work	Pre	4(0)	0.000
		Post	2(1)	
Section 8	Driving	Pre	3.5(1.75)	0.18
		Post	1(1.75)	
Section 9	Sleeping	Pre	4(1)	0.001
		Post	1(2)	
Section 10	Recreation	Pre	3(2)	0.001
		post	0(1)	

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Table 7: NDI items for Myofascial Gun Group

No.	Variables	Assessment	Median (IQR)	P value
Section 1	Pain Intensity	Pre	4(1)	<0.001
		Post	1(1)	
Section 2	Personal care	Pre	3(1)	<0.001
		Post	1(1)	
Section 3	Lifting	Pre	4(1)	<0.001
		Post	2(1)	
Section 4	Reading	Pre	3(1)	<0.001
		post	0(1)	
Section 5	Headaches	pre	3(1)	0.001
		Post	1(2)	
Section 6	Concentration	pre	2(3)	0.001
		Post	0(1)	
Section 7	Work	Pre	4(1)	0.001
		Post	2(1)	
Section 8	Driving	Pre	-	-
		Post	-	
Section 9	Sleeping	Pre	4(1)	<0.001
		Post	1(1)	
Section 10	Recreation	Pre	3(1)	0.001
		Post	1(2)	

DISCUSSION

This study compared the effects of IASTM and Myofascial Gun on UCS in terms of pain, cervical ROM, posture and Functional status. Both tools are used to release muscles and in this study the effect of upper Trapezius muscle release was compared and analyzed in both groups. The effect of IASTM on UCS has been studied previously but this study was distinctive in comparing the Myofascial Gun on UCS. In 2021 a study compared IASTM and routine physical therapy in UCS. Pain was improved after 4 weeks in IASTM group as p value was 0.001. In the same study cervical ranges of flexion, extension, right and left bending were also improved in IASTM group as p value was < 0.05 (29). Tahir Mahmood et al compared IASTM with routine physical therapy in UCS. The pain in IASTM group was significantly reduced. with p value 0.001. NDI in their study was also significantly improved in IASTM group. The score was decreased from 19.16 ± 2.30 to 10.50 ± 1.85 after 12 sessions in their study with p value <0.05 (30). This is in accordance to the current study. A study by Al Hafez et al compared IASTM with Stripping massage on Upper Trapezius trigger points. The pain and NDI scores were significantly improved in IASTM group as p value was 0.001 for both outcome measures respectively after 4 weeks (15). This is in accordance to the current study.

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Another study compared IASTM, static stretching and PNF on hamstring muscle flexibility. They found that Hamstring flexibility was increased in IASTM group significantly as p value was <0.05 (31). Similarly, a study by Sandrey et al compared effects of foam rolling and IASTM on knee extension. Both were equally effective in improving knee extension ranges after 3 weeks of intervention(32). In the current study cervical ranges were improved significantly in IASTM group as p value for all ranges were <0.05. Myalonas et al showed that intervention with IASTM on neck and thoracic area with neuromuscular physical therapy session was effective in improving FHP in individuals with Mechanical neck pain as the p value for CVA after treatment session was found to be 0.04. The p value for cervical ROMS was 0.002, for VAS 0.008 and NDI 0.0005 after 8 sessions (33). Miranda HS et al compared MRT with M2T in females with Buffalo hump and FHP. After 5 days of session results, CVA was improved significantly with p value 0.0001 (34). This is in accordance to the present study. A study was done by Konrad A et al to analyze the effects of massage gun on Planter flexor muscles and its range of motion after the session. The ROM was improved from 29.30 ± 6.53 to 34.70 ± 7.38 (19). Guzman et al assessed hamstring length ROM after only one 5 min session with Myofascial Gun. The hip flexion and knee extension ROM were improved with p=0.003 and p=0.04 respectively after the session(35). One study compared the effects of Myofascial Gun and static stretching done on triceps surae muscles on ankle dorsiflexion ROM. The treatment consisted of a single session of five minutes and the ranges were measured. The Myofascial Gun group showed improvement from 14.6±3.78 to 19.4±6.79 after the session (36). This is in accordance with the current study as cervical ranges were significantly improved in Myofascial Gun group

Seju et al compared effects of Myofascial Gun and surged faradic current on cases of Trapezitis in terms of VAS and neck flexion ranges. The VAS scores improved significantly after two weeks. The p values were <0.001 for the study (37). Patel et al studied the effects of Myofascial Gun on back flexibility. The gun was applied on both sides of hamstrings for 1 week for 5 minutes. The NPRS and sit and reach test both were significantly improved (18). This is also in accordance with the present study.

CONCLUSION

The study concluded that both the Instrument-Assisted Soft Tissue Mobilization (IASTM) technique and the Myofascial Gun intervention were equally effective in managing upper cross syndrome. Both approaches led to significant improvements in reducing pain, enhancing cervical range of motion, correcting posture, and improving functional status. These findings suggest that either technique can be utilized as an effective therapeutic option for individuals with upper cross syndrome, providing flexibility in treatment selection based on patient preference and clinical feasibility.

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