

Comparative Effectiveness of Routine Physical Therapy with and without Instrument Assisted Soft Tissue Mobilization for Improving Pain and Disability in Patients with Neck Pain Due to Upper Crossed Syndrome

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ABSTRACT

Background: Musculoskeletal disorders of the neck arise due to poor posture, which imposes overpressure on the muscles of the head, neck, and shoulder. Intervention strategies are needed to facilitate the muscles for improving functional index. **Objective:** To compare effectiveness of IASTM with routine physical therapy for improving pain and disability in patients of neck pain due to upper crossed syndrome. **Study Design:** Single-Blind Randomized Clinical Trial. **Settings:** The Agile Physical Therapy Rehabilitation Complex Bahawalpur and National Orthopedic Hospital Bahawalpur Pakistan. **Duration:** 6 months, from 28 August 2019 to 29 February 2020. **Methods:** Sixty subjects were randomized using the coin toss method. Thirty subjects in each group. Group A received routine physical Therapy (RPT) and Group B received Instrument Assisted Soft Tissue Mobilization (IASTM) + RPT, with 3 sessions/week for 4 weeks. The study's outcomes were the Numeric Pain Rating Scale and Neck Disability Index. Measurements were taken at baseline, at the end of 2nd and 4th week. The Data was analyzed by using SPSS Version 22. Repeated Measurement ANOVA was used for within-group and Independent T-test for between group analyses. **Results:** The mean age in both groups was 31 year. The mean Pain rating at baseline in Group A was 5.56 ± 0.85 and after 4th week was 2.06 ± 0.94. And in Group B was 5.72 ± 0.65 and after 04 weeks was 1.57 ± 0.56. The NDI means at baseline in Group A was 18.70 ± 2.98 and at 4th week was 15.20 ± 2.59 but in Group B was 19.16 ± 2.30 and after 4 weeks was 10.50 ± 1.85. The Significance difference observed for NPRS at P-value = 0.001 and NDI at P = 0.00 between groups comparison after 08 weeks of intervention. **Conclusion:** Both techniques were effective in the management of Neck pain and Neck functional Index but group B (IASTM) had superior effects as compared to Group A (Routine physical therapy). There was Significance difference observed for Numeric Pain Rating and Neck Disability Index between groups. IRCT registration number: IRCT20190912044754N1

Keywords: Instrument assisted soft tissue mobilization, Neck pain, Neck disability index, Stretching exercise, Upper crossed syndrome, Numeric pain rating scale.

INTRODUCTION

In Upper Crossed Syndrome, (UCS) the impaired posture of head and shoulder regions is often found due to poor ergonomics during desktop or table work, which imposes overpressure on the muscles of head, neck, shoulder and spinal muscles.¹ UCS is also known as cervical crossed syndrome, which was first explained by Vladimir Janda in 1979 as a pattern of this alternating weakness tightness and that involves the shoulder and

neck.² The technology has made us dependent other use of devices and the professional workers exposed to both physical and psychosocial workplace risk factors were more likely to report symptoms of upper extremity musculoskeletal disorders than workers highly exposed to one or the other workplace.³ Work-related musculoskeletal disorders and complaints account for a large number of working days lost and considerable worker's compensation and disability payments.⁴ About

57% of office employees have neck and shoulder pain complaints.⁵ Poor posture and tight musculature in UCS can cause the joints to become misaligned inducing symptoms.⁶ UCS symptoms such as pain, limited range of motion, disability of neck, management includes chiropractic care, physical therapy and exercise. Regarding upper cross syndrome; cervicogenic headache,⁷ tension headache and migraine are also associated symptoms of forward head Posture.⁸ These musculoskeletal disorders signs and symptoms start appearing and the body develops a specific pattern that can be managed in different ways including lifestyle modification at early stages. To correct, interventional strategy are needed to correct, realign or reverse the developing pattern.⁹ Manual Therapy including Mobilization and Manipulation are very effective techniques in reduction of pain and decreasing disability.¹⁰ The basic aim is to correct and realign deformity with decreased stress on respective joints using exercise or stretching patterns facilitation on inhibited muscles. IASTM is aimed to treat inhibited muscles adhesions and restrictions. It has deep penetration, and perception of the vibration during strokes helps to detect the adhesions.¹¹ It provides a mechanical advantage of force and helps to break the scar and fascial restrictions, mechanoreceptor and mechano-nociceptors stimulation. The IASTM was thought to be more effective and patient outcomes analysis and a systematic approach to better match myofascial therapy interventions for patient presentation¹² IASTM mechanism based on breaking the cross-linkages that is energy efficient for practitioners and having its own indications and can replace the surgical requirement in some cases.¹³ Recently, an approach gaining popularity over the past years is the combination of Instrument Assisted Soft Tissue Mobilization Technique (IASTM -T) with stretching protocol.^{14*} The lack of evidence available on neck pain due to upper crossed syndrome using IASTM, this study focused on the use of Instrument - Assisted Soft Tissue Mobilization. The study assumed the hypothesis that, which treatment is more effective with significant differences between groups A and B. The aim was to compare effectiveness of IASTM with routine physical therapy for improving pain and disability in patients of neck pain due to upper crossed syndrome. This technique will minimize the hand, shoulder as well as neck-related musculoskeletal disorders concerning individuals. It guides a specific site of tissue lesion, restriction and helps in targeting the point rather than manual ways which covers a larger area of contact.

METHODS

This randomized clinical trial was conducted at The Agile Physical Therapy Rehabilitation Complex Bahawalpur and National Orthopedic Hospital, Bahawalpur Pakistan.

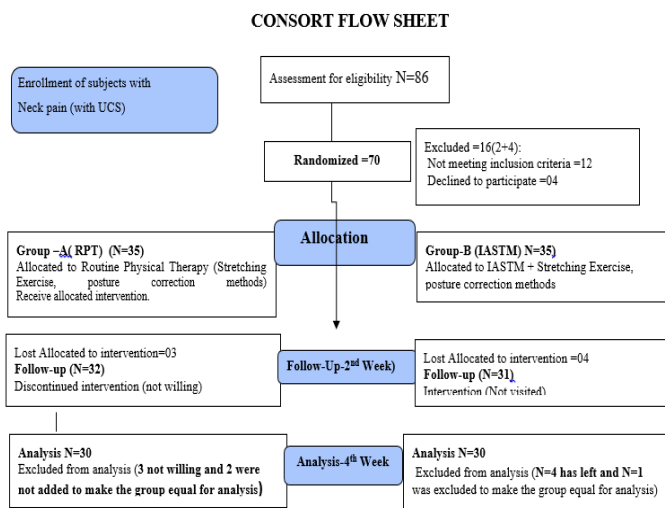
Duration of the study was 6 months, from 28 August 2019 to 29 February 2020.

The sample size $n=60$, calculated by the following formula $N = (Z_{1-\beta} + Z_{1-\alpha/2})^2 (\delta_1^2 + \delta_2^2) / (\mu_1 - \mu_2)^2 / 2$, where desired Power of the study = $\beta = 95\%$, desired Level of Significance = $\alpha = 5\%$, expected Mean Difference in Visual analogue score = $\mu_1 - \mu_2 = 25.50 - 44.60 = 19.10$, Standard Deviation of treatment Group = $\delta_1 = 7.30$, Standard Deviation of Conventionally treated group = $\delta_2 = 14.60$ Sample size in each group, $n = 12.0$.^{15,16} Non-probability purposive sampling technique was used in this study.

Only male gender, having age of 18-40 years and Diagnosed patients with the upper crossed syndrome who have chronic neck pain for more than 3 months and having neck pain scoring more than 3 on the Numeric Pain Scale were included in this study. The subjects with any previous surgery, any type of Infection, Hypersensitive skin, Diabetes Mellitus type II, Having Traumatic Injury, Psychological disorder, Manual therapy contraindication like osteoporosis, infection, disc-herniation, acute Inflammation, burn scars, closed /non-complicated fractures and pen wound including all in which IASTM is contraindicated were excluded from the study.^{17,19}

After taking approval from Institutional Review Board of 'The University of Lahore' (REF # IRB-UOL-FAHS/60/2019). The sample size was taken $N=30$ in each group after screening of 86 patients with symptoms of upper crossed syndrome. All the subjects participating in the study were confirmed for the presence of upper crossed syndrome, by standing along the wall, while on their back towards wall. In this way forward head posture was assessed. Posture included anterior rolled shoulders, winged scapula, and anterior head carriage associated with muscle imbalances including 1. Hypertonic-Pectoralis, Levator scapulae, upper trapezius muscles, and sub-occipital musculature 2. Inhibited - Lower trapezius, Latissimus dorsi, Rhomboids, and sub-scapularis muscles. 3. Weakness -Deep neck flexors as a unit (to evaluate individual muscles is difficult).¹⁵

All ethical values including privacy and confidentiality were maintained as mentioned in Helsinki Declaration and was conducted according to CONSORT Guidelines. (Consort Flow sheet attached) For Baseline data, subjects were asked to rate their pain from 0-10 on the Numeric pain rating scale. NDI has 10 sections with 5 scores in each section. The score was calculated from 50 and converted into percentage. NDI has reliability, correlation coefficient of $r = 0.94-0.99$ and for pain was $r = 0.81-0.89$.¹⁸ The baseline data was recorded by a blind assessor. The subjects were randomized using coin toss method and 30 subjects were allocated to each group A and B. Non-probability purposive sampling technique was used.



In Group A after warm up sessions, routine Exercise including stretching and posture correction were performed for involved Muscles of Neck (Sub-Occipitals), Latissimus Dorsi, Rhomboids, Pectoralis, levator Scapulae and Trapezius. In group B, Instrument Gua Sha Tools (GST4, GST5) were used for soft tissue mobilization. We have used facilitation methods for breaking the adhesions. Emollient Gel/Lubrication gel (Hawk Grips product) was also be used for the lubrication to make the skin easy for the tool to move.^{18, 19} The instrument has two sides, one is treatment side and other is holding side. IASTM has different types of strokes including scanning, sweeping, j-Stroke, fileting, fanning and swiveling types of strokes for soft tissue mobilization.

For pectoralis major, subjects were asked to lie supine with their thorax front side exposed. In abduction, restriction or adhesions was located using scanning and gel was applied. The average force of 10 Newton during mobilization was used following Graston protocol but there is no still no authentic evidence statin But still, there is a need to specify the angle of treatment, force delivered, and frequency of stroke^{20,21} After scanning and sweeping over the pectoralis muscle starting from the sternal to humeral head fanning with the humeral head, further fileting strokes and lifting was applied in direction perpendicular holding the device parallel to pectoralis major for 1-2 minutes. (Figure 1).

Figure 1: Pectoralis Major Scanning (Right Side)



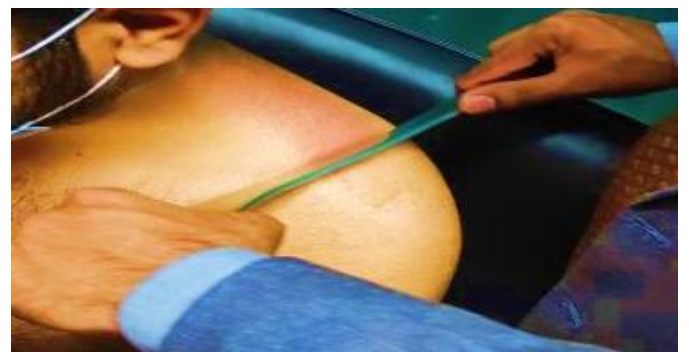
The Levator Scapulae was mobilized in sitting with curved edge (hook of tool i.e. Bevel) of the tool at 45 degree J –stroke down to up and up to down, for 20 -30 seconds. Then brushing with asking the patient to rotate on the other side while holding for 5 seconds and applying pressure while neck is rotated on other side (Figure 2).

Figure 2: Levator Scapulae –Brushing



Brushing while asking the patient to rotate on the other side while holding for 5 seconds and applying pressure while neck is rotated on other side. For upper trapezius muscles Instrument (Tool No. 04) was applied over the muscle with slight pressure in sitting, while locating the restrictions (scanning) followed by sweeping in direction of the muscle belly. Then neck was moved to opposite side to stretch the trapezius muscle. (Figure 3)

Figure 3: Upper Trapezius –Scanning



For upper trapezius muscles Instrument (Tool No. 04) was applied over the muscle with slight pressure in sitting, while locating the restrictions followed by sweeping in direction of the muscle belly. The latissimus dorsi, rhomboids were facilitated with swiveling maneuver followed by sweeping (was applied with instrument held and 30 degrees with bevel up). Then the same exercise was performed by subjects as given in Routine Physical Therapy (RPT) (Group A). The data was collected again after 2 weeks (06 sessions) and then after 4 weeks (12 sessions) and results were compared for variables of interest.

The SPSS (Statistical Package for Social Sciences) Version 22.0 was used for data analysis. The numerical data like

Body Mass Index were given in standard categories, while Age, NDI and NPRS are presented in the form of Mean \pm SD. After fulfilling parametric assumptions, approximate normal distribution of data (skewness and Kurtosis), repeated Measurement ANOVA (Analysis of Variances), Bonferroni was used for mean difference (\pm SD) in Numeric Pain Rating and Neck Disability Index within groups. Independent sample t-Test was used for the comparison between groups i.e. A (RPT) and B (IASTM). Criteria of significance i.e., p-value <0.05 was taken as significant (95% CI= Confidence Interval).

Table 1: Demographic Profile of Participants

Category		RPT (Routine Physical Therapy) Group A	IASTM (Instrument Assisted Soft Tissue Mobilization) Group B
Marital Status	Married	10	12
	Un-Married	20	18
Body Mass Index	Under Weight	10	12
	Normal Weight	16	15
	Over Weight	04	03
Occupation	Bankers	09	14
	IT workers	6	10
	Students	10	4
	Others	5	2
Socioeconomic Status	Upper class	3	5
	Middle Class	17	22
	Lower Class	10	03
Age	Mean	31.50 \pm 6.38	31.20 \pm 5.92

Group B (IASTM) pain mean was 5.72 ± 0.65 at baseline and decreased to 1.57 ± 0.56 after 4 weeks of intervention. Neck Disability Index Mean at base line in Group B was 19.16 ± 2.30 after 04 weeks decreased with of 10.50 ± 1.85 .

RESULTS

There were N=30 male participants in experimental group (IASTM) and N=30 in Routine physical. There were 10 married in group A and 12 in group-B. Body Mass Index of the most participants were normal (n=31) category. The bankers and students were mostly included and socioeconomic status was middle class of more than half of the participants. The mean age in group B was 32.60 ± 5.55 group A was 31.50 ± 6.38 . (Table 1)

Both of the groups showed improvement but there was more improvement in the experimental group (B) compared to RPT (A). (Table 2)

Table 2: Within Group A and B - Descriptive statistics for pain and neck disability index

Outcome	Assessment	Group	N	Mean	STD. Deviation	P-Value
Numeric Pain Rating	At Baseline	Routine Physical Therapy (A)	30	5.56	.85	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	5.72	.65	
	After 02 Weeks	Routine Therapy (A)	30	3.83	.74	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	2.91	.55	
	After 04 Weeks	Routine Physical Therapy (A)	30	2.06	.94	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	1.57	.56	
Neck Disability Index	At Baseline	Routine Physical Therapy (A)	30	18.70	2.98	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	19.16	2.30	
	After 02 Weeks	Routine Physical Therapy (A)	30	16.90	2.56	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	15.90	2.28	
	After 04 Weeks	Routine Physical Therapy (A)	30	15.20	2.59	.00
		Instrument Assisted Soft Tissue Mobilization (B)	30	10.50	1.85	

RPT=Routine Physical Therapy, IASTM=Instrument Assisted Soft Tissue Mobilization

Group B (IASTM) pain mean was 5.72 ± 0.65 at baseline and decreased to 1.57 ± 0.56 after 4 weeks of intervention. Neck Disability Index Mean at base line in Group B was 19.16 ± 2.30 after 04 weeks decreased with of 10.51 ± 1.85 . Both of the groups showed improvement but there was more improvement in the experimental group (B) compared to RPT (A)

Independent T-test showed that pain mean difference was $4.13 \pm .86$ in IASTM group while it was 3.50 ± 1.00 in group -A. Similarly, the Neck disability differences with mean 8.66 ± 1.74 in IASTM group while $3.50 \pm .97$ was found in the group A. Numeric Pain rating and Neck

Disability Index showed significant improvement between RPT and Experimental group (IASTM) shown by P value of .01 for NPRS while .00 for Neck Disability Index. (Table 3)

Table 3: Between the Group A and B: Mean difference of pain and neck disability index:

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	Df.	Sig. (2-tailed)	Mean Dif.	Std. Error Dif.	95% Confidence Interval of the Difference	
									Lower	Upper
NPRS Difference	Equal variances assumed	1.09	.30	2.61	58.00	.00	.63	.24	.14	1.11
	Equal variances not assumed			2.61	56.59	.00	.63	.24	.14	1.11
NDI Difference	Equal variances assumed	8.70	.00	14.13	58.00	.00	5.16	.36	4.43	5.89
	Equal variances not assumed			14.13	45.41	.00	5.16	.36	4.43	5.9

NPRS =Numeric Pain Rating Score, NDI= Neck Disability Index, Level of significant at <0.05

Numeric Pain rating and Neck Disability Index showed significant improvement between RPT and Experimental group (IASTM) shown by P value of .01 for NPRS while .00 for Neck Disability Index

DISCUSSION

This study was conducted on 60 subjects, with concealed allocation of 30 subjects, randomized by coin toss method in each group on the basis of inclusion and exclusion criteria. The result stated that Instrument Assisted Soft tissue mobilization technique with addition exercise was dominant for improving pain and Neck Disability Index. It has statistically significant difference compared to routine physical Therapy group alone. IASTM significantly improved the outcomes including NPRS (P=.00) and Neck functioning Index (P=.01). In UCS management manual postural Correction as experimental compared to self-stretching in control group. The manual postural correction was found effective compared to control group regarding pain and Disability. The p value was <0.05. The study concluded that combined manual therapy was equally effective for improving pain.²² In current study neck pain and Disability scores were decreased in IASTM (Group-B) with P <.05 which is quite similar to the results of the study on chronic neck pain. The studies with Gua Sha Tools for Chronic Musculoskeletal neck pain on 48 subjects randomized in two equal groups and followed up the intervention for 7 days. There was significant reduction of pain, Improvement in Neck Disability and ROM in Gua Sha Group which directly affected the Quality of Life. The significant difference was observed as P<0.00.²³ In contrast to our study, where statistically significant difference were found in IASTM compared to RPT. In another study, Manual therapy compared to IASTM, IASTM used for sensing the restrictions on levator scapulae and tool was moved over the belly of the muscle. The findings showed contra lateral side active flexion improvement but statistically significant differences were found for NPRS and NDI.²⁴ In current study neck pain within group was 5.56 ± 0.85 at baseline, while at follow up was 2.06 ± 0.94 while in experimental group it was 5.70 ± 0.65 and 1.57 ± 0.58 respectively. The results regarding neck pain showed that pain in

experimental group was improved more compared to RPT group which shows that IASTM was more effective compared to Routine physical therapy alone. The P value was 0.01. The literature supports that when increased in mobility of neck there will be decrease in pain in neck as well.²⁵ Neck Disability index in this study at base line in IASTM (Experimental group) -Group was 19.16 ± 2.30 and after 04 weeks was 10.50 ± 1.85 . Both of the groups showed improvement but there was more improvement in the experimental group treated with IASTM shown P=0.00 as P<0.005 .In one of the national study with Mulligan as trial compared to Maitland as control, the NDI at baseline was 17.32 ± 7.88 and follow up of weeks was 3.92 ± 3.34 , while P= 0.18, which shows that Mulligan Mobilization Natural Apophyseal Glides were dominant on Maitland in Managing Neck pain.²⁶ The efficacy of IASTM, stated that it is effective for soft tissue mobilization, the mechanism is by increasing flow of blood, myofascial release, and interruption of pain pathway and also increase in flexibility.²⁷

CONCLUSION

The results showed that instrument-assisted soft tissue mobilization in combination with stretching exercises are more effective in the management of Pain and Improving Neck functioning. There were significant differences in improvement in the IASTM group for the Pain and Neck disability index (P < 0.05) that support our alternative hypothesis.

LIMITATIONS

This study was limited to only male participants, there was no homogeneity of techniques and the application of force during the application is not specified.

SUGGESTIONS / RECOMMENDATIONS

The conduction of the study in different demographic and both genders will make the results more generalized.

As this study lacks homogeneity of techniques, so further studies can be conducted with a comparison of different IASTM devices.

CONFLICT OF INTEREST / DISCLOSURE

This is part of Master's thesis.

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