

# Comparison of Manual versus Instrument Assisted Soft Tissue Mobilisation of Levator Scapulae in Chronic Neck Pain

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## ABSTRACT

**Introduction:** Evidence reveals association of chronic neck pain and dysfunction of muscles of cervical spine. Levator scapulae is one among those muscles. Both manual soft tissue mobilization (STM) and instrument assisted soft tissue mobilization (IASTM) have been used in the treatment of dysfunction of muscles but there is dearth of studies comparing both techniques. This study compares both the techniques in improving range of motion (ROM), pain and function in chronic neck pain.

**Materials and Methods:** 74 participants with chronic neck pain between age group of 18-45 years were divided in two groups- A and B by random allocation. Group A received manual soft tissue mobilisation (STM) and group B received instrument assisted soft tissue mobilisation (IASTM) over Levator scapulae. Cervical ROM, pain intensity and functional disability were evaluated pre-treatment and 48 hours post-treatment.

**Results:** Considering 95% CI for all outcome measures in both groups, manual STM group showed significant improvement in side-flexion ROM ( $p < 0.0001$ ), pain ( $p < 0.0001$ ) and function ( $p < 0.0001$ ). IASTM group showed significant improvement in side-flexion ROM ( $p < 0.0001$ ), pain ( $p < 0.0001$ ) and function ( $p < 0.0001$ ). On comparing mean differences between-group no statistically significant difference was found between both groups for side-flexion ROM ( $p = 0.6900$ ), flexion ROM ( $p > 0.9999$ ), pain ( $p = 0.3213$ ) and function ( $p = 0.3957$ )

**Conclusion:** Both Manual STM and IASTM are effective in improving ROM, pain and function in chronic neck pain. There is no statistically

significant difference in effectiveness of both techniques. Therefore any of the techniques may be used according to treating therapist's skills and availability of required instruments.

**Key words:** Manual Soft Tissue Mobilisation, Instrument Assisted Soft Tissue mobilisation, Chronic Neck Pain, Neck Disability, Levator scapulae

## INTRODUCTION

Chronic neck pain is defined as the pain in the cervical region existing for more than 3 months. There is evidence of an association between chronic neck pain and dysfunction of the muscles of the cervical spine. [1] Levator scapulae becomes tense and painful leading to reduced range of motion (ROM), especially cervical flexion and side flexion to the contralateral side. [2] Various modalities and exercise therapy are used in the treatment of chronic neck pain and none of these treatments were found to be superior to other. [2] Soft tissue mobilisation, self-myofascial release with foam roller and instrument assisted soft-tissue mobilization (IASTM) have been used. [3-5] Soft tissue mobilisation (STM) is a hands-on technique that involves applying gentle sustained pressure into the adhered tissue in the direction of resistance. [5] M2T-Blade is a latest invention in IASTM. It is ergonomically designed stainless steel (0.316 surgical grade) tool.

Though literature provides studies evaluating effects of manual STM and IASTM techniques, there is dearth of studies comparing both techniques. Hence, present study aims to explore comparative effects of manual STM and IASTM on pain, ROM and function in chronic neck pain.

## MATERIALS AND METHODS

The materials included -

- Plinth
- Chairs
- Numerical Pain Rating Scale
- Neck Disability Index
- Universal goniometer
- Cotton
- Lubricant (to apply over skin surface)
- Sticking tape
- M2T-Blade: The blade consists of 8 treatment planes. In the present study, treatment plane number 2 was used.

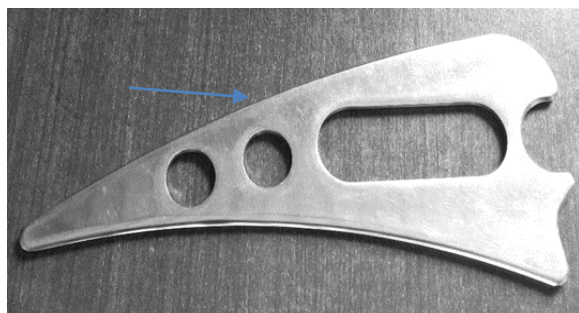


Figure 1: M2T Blade

**Design:** This was an experimental two groups pre-post study. Participants were recruited as per eligibility criteria after obtaining informed consent. They were divided in one of the two groups A and B by random allocation using chit method. Outcome measures were recorded pre-treatment and 48 hours post-treatment.

**Participants:** All participants were recruited at physiotherapy OPD of a tertiary care hospital. Inclusion criteria were: Males and females between age group of 18-45 years, pain over upper medial angle of scapula, tenderness over levator scapulae and chronic neck pain (more than 3 months). Exclusion criteria were: any recent surgery, spinal pathology, ankylosing

spondylitis, any open wound around neck, history of cervical fracture, torticollis, any other condition that contraindicates M2T blade such as skin sensitivity.

**Intervention:** The participants of group A received manual STM and of group B received IASTM. In manual STM group participant was made to lay prone, head neutral and relaxed. Restrictions were assessed by palpation along the length of levator scapulae. Manual STM was given by ulnar border and heel of hands. Sustained pressure was applied in the direction of restriction over the area of levator scapulae along its length till the motion barrier is reached.

In IASTM group participant was made to sit on chair with head slightly tilted ipsilateral to the affected side. Restrictions were assessed using M2T-Blade in either directions along the length of levator scapulae by applying strokes on skin lubricated using small amount of lubricant. Once the restriction was reverberated back, strokes in the direction of restriction with blade at an angle of 45 degrees to the skin surface were given.

In both the techniques intensity of technique was modified according to the participant's response. If the participant reported any increase in symptoms other than a sensation of local tenderness, pressure, pull, or stretch in that area then the amount of pressure was decreased.

## Outcome measures:

### Primary outcome

Primary outcome measures were active cervical flexion and contralateral side-flexion ROM measured using Universal Goniometer in degrees. [9]

### Secondary outcome

Secondary outcomes were pain intensity on activity and at rest, and functional disability. Pain intensity was measured using an 11 point Numerical Pain Rating Scale (NRS). Participants were asked to indicate the intensity of pain reporting a number that best represents it, ranging from

0 (no pain) to 10 (worst pain imaginable).  
[10]

Functional disability was measured using Neck Disability Index (NDI) score. It contains 10 items - 7 related to activities of daily living, 2 related to pain, and 1 related to concentration. Participants were asked to score each item from 0 to 5 and the total score was expressed as a percentage (total possible score, 100%), with higher scores corresponding to greater disability. [10]

### Statistical Methods:

Pilot study was conducted to determine appropriate sample size using difference of means. A total of 10 participants were recruited as per inclusion and exclusion criteria, and allocated randomly in two groups A and B comprising of 5 participants in each group. With estimated confidence interval of 95%, at level of significance 0.05 and power 90%, a total of 74 participants were included in the study. Each group consisted of 37 participants.

Data analysis was carried out for all outcome measures that were calculated pre-treatment and 48 hours post treatment for both the groups. Data analysis was performed to find the statistical significance of the effectiveness of manual STM and IASTM on ROM, pain and NDI scores within the groups and the difference in the effectiveness of both the techniques.

### RESULTS

Baseline (pre-treatment) and post-treatment outcome variables and statistical data are presented in table 1 and 2 for manual STM group, table 3 and 4 for IASTM group and comparison of both groups are presented in table 5. Data was tested for normality using Kolmogorov Smirnov test for all outcome variables in both the groups.

Since data did not pass normality in manual STM group Wilcoxon matched pair signed rank test was used for comparison of all variables within group.

**Table 1: Descriptive statistics manual STM group**

Variable	Side flexion		Flexion		NRS-rest		NRS-activity		NDI	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	23.1	25.4	39.7	40.5	3.1	1.8	5.7	3.7	24.0	16.4
SD	5.8	5.5	7.1	6.4	1.4	1.3	1.5	1.5	9.0	8.2

SD = Standard Deviation, NRS = Numerical Pain Rating Scale, NDI = Neck Disability Index

**Table 2: Inferential statistics manual STM group**

Variable	Side flexion	Flexion	NRS-rest	NRS-activity	NDI
MD	2.2	0.81	-1.35	-2.02	7.5
SD	3.3	2.5	1.1	1.3	6.2
95% CI	1.1 to 3.4	-0.02 to 1.6	-1.73 to -0.96	-2.46 to -1.58	5.4 to 9.6
P value	<0.0001	0.1094	<0.0001	<0.0001	<0.0001
Statistically significant	Yes	No	Yes	Yes	Yes

MD = Mean Difference, SD = Standard Deviation, CI = Confidence Interval, NRS = Numerical Pain Rating Scale, NDI = Neck Disability Index

The data passed normality for NDI scores of IASTM group and therefore Paired t test was used for within group comparison. Since the data did not pass normality for ROM & NRS, Wilcoxon matched pair signed rank test was used for comparison of variables within IASTM group.

**Table 3: Descriptive statistics IASTM group**

Variable	Side flexion		Flexion		NRS-rest		NRS-activity		NDI	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	22.4	24.1	39.1	40	3.1	1.9	6.0	4.3	27.0	19.2
SD	5.5	5.1	6.6	6.2	1.6	1.1	1.7	1.6	9.4	10.1

SD = Standard Deviation, NRS = Numerical Pain Rating Scale, NDI = Neck Disability Index

**Table 4: Inferential statistics IASTM group**

Variable	Side flexion	Flexion	NRS-rest	NRS-activity	NDI
MD	1.7	0.81	-1.13	-1.68	-7.86
SD	2.2	2.2	1.0	0.94	5.3
95% CI	0.95 to 2.4	0.07 to 1.5	-1.47 to -0.80	-1.91 to -1.36	-9.63 to -6.08
P value	<0.0001	0.0625	<0.0001	<0.0001	<0.0001
Statistically significant	Yes	No	Yes	Yes	Yes

MD = Mean Difference, SD = Standard Deviation, CI = Confidence Interval, NRS = Numerical Pain Rating Scale, NDI = Neck Disability Index

The data did not pass normality while comparing variables between manual STM and IASTM group. Hence Mann Whitney test was used.

**Table 5: Inferential statistics between manual STM group and IASTM group**

Variable	Side flexion	Flexion	NRS-rest	NRS-activity	NDI
MD	0.59	0	0.21	0.35	-0.31
SD	4.1	3.5	1.2	1.4	8.4
95% CI	-0.81 to 1.9	-1.17 to 1.1	-0.20 to 0.64	-0.14 to 0.84	-3.13 to 2.5
P value	0.6900	>0.9999	0.5506	0.3213	0.3957
Statistically significant	No	No	No	No	No

MD = Mean Difference, SD = Standard Deviation, CI = Confidence Interval, NRS = Numerical Pain Rating Scale, NDI = Neck Disability Index

## DISCUSSION

In present study, manual STM showed statistically significant difference in increasing active cervical contralateral side flexion ROM. These findings are in line with a study which reported increased ROM post manual STM. [11] The increase in ROM may be due to removal of soft tissue adhesions and consequent reduction of tissue tension and stiffness. However, there was no statistically significant difference found in increasing active cervical flexion ROM. This may be attributed to adhesions in cervical extensor muscles other than levator scapulae which were not addressed in present study but may contribute to neck pain and limited cervical flexion ROM. [2]

We found significant reduction in pain intensity on NRS at rest and on activity in manual STM group. These findings are in line with previous studies which reported reduction in neck pain. [5,11] Reduction in pain may be due to removal of waste products as circulation increases and activation of cutaneous receptors that block the nociceptive stimulus thus alleviating pain. [5] Also, decrease in cortisol levels and increased dopamine and serotonin levels have been reported to cause pain reduction post STM. [11]

Manual STM showed statistically significant difference in decreasing NDI

scores. Previous study has reported that treatments which reduce neck pain may improve function of neck. [5] Decrease in NDI scores may be attributed to decrease in pain. However these findings are in contradiction to a previous study which reported that manual STM did not significantly change NDI scores. [11]

Consistent with findings of previous studies we also found increase in ROM post IASTM. [4,6] IASTM causes triggering of controlled microtrauma in affected tissue, increases activity and number of fibroblasts, along with fibronectin, through localized inflammation. Thus, it facilitates synthesis and realignment of collagen. Hence, there occurs reduction in tissue adhesions which contribute to ROM restriction. IASTM changes viscosity of tissues as a result removes pressure from pain sensitive structures and causes returning to proper alignment. [6] Reduction in tissue adhesions and pain may result in improved ROM. However improvement in cervical flexion ROM was not significant.

IASTM showed statistically significant reduction in pain at rest and on activity. Several other researchers reported decrease in neck pain post IASTM. [6-8] Possible mechanism for pain reduction by IASTM may be triggering of microtrauma and thus increased blood flow which

quickly removes pain substrates that develop around affected tissue. [8]

Similar to findings of a previous study, this study too found improved function post IASTM. [12] As the treatments which reduce pain may improve function of the neck, decrease in NDI scores may be attributed to decrease in pain. [2] IASTM causes improvement in muscle activity level due to pain reduction. This may result in better performance during daily activities and ultimately reduction of one's disability level. [13,14]

Thus, both techniques were effective individually in increasing ROM, relieving pain and improving function however when we compared effectiveness of both techniques, there was no statistical significant difference in improving any of the outcome variable. Similar results were reported in a previous research. [15]

Manual STM and IASTM have their own advantages and disadvantages. Manual STM does not need availability of any specific instrument for treatment application; however, can cause increased joint stress in hands. A survey revealed 91% absenteeism was attributed to pain in therapist's hands due to manual STM. [16] IASTM requires availability of instrument and training in its use. IASTM tool is an ergonomically designed tool which glides over adhered tissues and reverberates feeling in our hands, thus finding exact areas of restriction and help treat them. It reduces imposed stress on hands of therapist. [13]

During experiment, researcher experienced that participants' tolerance to treatment was better with manual STM than IASTM.

## CONCLUSION

This study concludes that manual STM and IASTM are individually effective in improving ROM, pain and function in chronic neck pain.

Given the evidence that there is no difference found in effectiveness of both techniques, either of the intervention

techniques of manual STM and IASTM may be used to treat tense and painful muscle in chronic neck pain according to treating therapist's skills and availability of required instruments. Limitation of this study was lack of long term follow up. Also, it may not be generalised to different population of patients.

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