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Effectiveness of instrument assisted soft tissue mobilization (IASTM) verses myofascial release (MFR) in subjects with non specific neck pain

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Abstract
Background and purpose: Neck pain is one of the commonest musculoskeletal problems affecting 70% of the population. It is characterized by periodic remissions and varying degree of functional recovery. Most of the affected individuals recover, but some go into Chronic Neck Pain and Disability.1 Neck pain has multifactorial aetiology. It is evident that IASTM helps in enhancing proliferation of extracellular matrix fibroblast, decrease the cellular matrix adhesions and improve the ion transport. This tool provides mechanical advantage. MFR is a soft tissue mobilizing technique which facilitates mechanical, neural and psychophysiological adaptive potentials through myofascial system. It eliminates the excessive pressure on pain sensitive structure and restores the proper alignment of the tissue. and very little focus is given to strengthening the deep Cervical Flexors. However there is abundant literature on the techniques but there is paucity of literature on the comparison of the effectiveness of the two techniques along with Deep Cervical Flexors Strengthening.
Method: This study was an Experimental study design. The samples were selected with the inclusion criteria of score more than 6 on NPRS and subjects were then randomized into 2 groups. 30 subjects were selected, in the age ranging from 18-50years and were assigned into two groups; Group A Instrument assisted soft tissue mobilization, Group B Myofascial release both along with Deep Cervical Flexors strengthening 15 subjects in each group for 3 weeks with 3 sessions per week. Pain was measured using Numerical pain rating scale as an inclusion criteria and disability and mobility was assessed using Neck Disability Index and Pressure Biofeedback Unit Both scales were taken pre intervention and post intervention at the end of three weeks.
Results: When means were analyzed using Paired 't' test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change, there was a statistically significant improvements in means of NPRS, NDI and PBU Scale in terms of pain, disability and mobility, Also, when Independent 't' test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between groups with calculation of percentage of difference between the means. Post intervention scores were compared between the groups there is no significant difference in the effectiveness of the techniques in both IASTM and MFR.
Conclusion: The present study concludes that both IASTM and MFR along with Deep Cervical Flexors Strengthening are effective in reducing pain, disability and mobility at the neck in subjects with Non Specific Neck Pain.

Keywords: Non-specific neck pain, myofascial release, MFR, instrument assisted soft tissue mobilization, IASTM

Introduction
Neck pain is one of the commonest musculoskeletal problem affecting 70% of the population. It is characterized by periodic remissions and varying degree of functional recovery [1]. Muscles basically are fibrous tissues in the human body that can contract- relax, produce movements, maintain position of the limbs and help in maintaining the posture of the body.1 But when an ergonomically incorrect posture is maintained for a prolonged time, a forward neck posture is caused, which increases the lordosis at the cervical spine resulting in misalignment at the scapulothoracic region [2, 3].
More than 80% of individuals experience neck pain and neck associated disorders during their lifetime, with 30–50% of the general adult population reporting neck pain annually. The prevalence varies widely between studies but is most commonly of greater values in the

middle aged, females predominantly than males. It is the fourth leading cause of disability worldwide and has a huge impact on individuals and their families, communities, and healthcare systems [4].

It was also reported that people with neck pain would display deficits in the postural endurance of DCF muscles along with impaired activation of the neck muscles. The performance of DCF muscle may influence the varied resting head posture, as this is considered to be an important stabilizer of the head-on-neck posture [5, 7].

Since these pains have a multifactorial etiology, it is commonly labelled as Non Specific Neck Pain (nsnp). The natural course of NSNP is unclear, it starts with nagging pain which is self limiting and in a few weeks of onset it ends up limiting ADLS. It has also been theorized that once muscle performance is impaired, the stability among the stabilizers on the posterior aspect of the neck and the DCFs might be disrupted, resulting in loss of right alignment and posture, that is then in a likelihood to contribute to cervical impairment. With increased lordosis at cervical spine, there is increased misalignment at scapulothoracic level [6, 8].

Myofascial pain syndrome is muscular pain caused by Myofascial trigger points and they are the primary cause of pain in 30-85% of cases.9 Myofascial trigger points are tender, nodular, hypersensitivity spots that arise in the muscle belly and are extremely painful to stretch, compression, palpation and give rise to referred pain, motor dysfunction, neurological symptoms and autonomic phenomenon.1 As there is an increase in the Actin Myosin contractile mechanism, there is an increase in the metabolites due to which the metabolic rate advances, resulting in the firing of Nociceptors leading to local or referred pain. This pathogenesis is suggested to be Acute, Chronic or Persistent [7, 9].

Various interventions have taken place to mitigate the pain and dysfunction caused due to Myofascial trigger points. Instrument Assisted Soft Tissue Mobilization (IASTM) is one of the therapeutic interventions for Myofascial trigger points. It is so mentioned that the mechanism of action of IASTM involves restarting the healing process by causing localized inflammation in the soft tissues. Poor vascularity in soft tissues due to injury acts as a factor that restricts the inflammatory response [9, 10, 11].

Myofascial release is a soft tissue mobilization technique, defined as “the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced via the myofascial system [12, 13]. Myofascial release (MFR) is a form of manual medicine which demands the application of a low load, long duration stretch to the myofascial complex, aiming in restoring optimal length, decrease pain, and improve function.

MFR generally involves slow, sustained pressure that is applied to restricted fascial layers. There are said to be two methods, direct and indirect. Direct technique MFR is thought to work directly on restricted fascia, using knuckles or elbow to slowly sink into the fascia, and the pressure applied is a few kilograms of force to contact the restricted fascia, apply tension, or stretch the fascia. Indirect MFR involves application of gentle stretch- the pressure applied is a few grams of force, and the hands tend to follow the direction of fascial restriction, hold the stretch, and allow the fascia to ‘unwind’ itself [14, 15, 16].

It was found a positive correlation between forward head posture (FHP) indicated by lesser isometric endurance of the DCF which related with lesser cranio-vertebral angles. Thus, to increase the endurance of these postural muscles, DCF training is important, thereby leading to improvement in FHP and aiding the decrease in neck pain [26, 27].

Methodology

A randomized controlled trial of 30 subjects using random sampling and allocation was done. Two groups were made, Group A and Group B, 15 subjects were assigned to each group, Group A- Instrument Assisted Soft Tissue Mobilization and Group B- Myofascial release. Deep cervical flexor strengthening was added to both the groups. As the study includes human subjects, ethical clearance was obtained from ethical committee of K.T.G. College of Physiotherapyand K.T.G. Hospital Banglore.

The subjects were treated thrice a week for three weeks. Informed consent. Subjects between the age 18-50 years, who cleared the inclusion criteria of scoring a minimum of 6 on Numeric Pain Rating Scale were enrolled. Neck Disability Index was used to understand the pre and post scores of the pain and disability caused due to neck pain.

IASTM, M2T blade was used on the Group A, in a conducive and a well lit room. 42 to release the muscles of the neck and upper back. (Splenius Capitis, Semispinilis Capitis, Leveator scapulae, Sternocleidomastoid, Scalene, Longisimisus Capitis and then the Trapezius.) [9, 13, 14].

The part to be treated was completely exposed, to avoid hindrance while treating 2. Emollient was used to minimize the friction between the tissue and blade. Adhesions were assessed with the blade in both upward and downward direction, whichever felt better were used for the treatment. 6 Moderate pressure was applied over the tissue with holding the blade at 45 degree, once redness occurred treatment area was changed. 4. When working on the neck, slack was removed and then strokes were given. 7. 30 strokes were given for the area consisting of maximum adhesions. The plane to be held in 450 position on the treatment area. 8. Ended the treatment with Cryotherapy, 10-15 min [10, 11, 12].

Fig 1: Instrument Assisted Soft Tissue Mobilization starting position and on going procedure

The Group B was treated with Myofascial release and as a general rule, myofascial release techniques are at first applied to superficial layers and then the deeper. The area that was to be treated was completely exposed to avoid hindrance while performing the strokes. The stroke were taken to the appropriate depth and it is important that the therapist continuously has contact with body’s response. These strokes were reapplied with adequate pressure maintained and the angle could also be modified during implementation and to ensure a continued stretch effect in the fascial structure. A lot

of pressure was not exerted especially when working on sensitive areas like neck. Using the ulnar border of the palm, gentle stroke were applied downwards from the base of the neck to the shoulders [20, 21, 22].

Fig 2: Myofascial Release starting position and procedure on going

Deep Cervical Flexor Strengthening [27, 28]: Sessions will be performed thrice a week. The subject was asked to lie in supine hook lying position. Pressure biofeedback unit's air bag was clipped together and folded in three, it was then be positioned behind the neck just below the occiput. The subjects were then advised to perform Craniocervical flexion and practiced head nodding action. 5 pressure levels were to be held for ten second between 22 mm Hg and 30 mmHg. A two second rest period were provided between each level. The minimum performance requirement is 26 mm Hg while ideal performance targets are 28 and 30 mm Hg. Subjects were be re-assessed for all baseline variables after three weeks of training.

Fig 3: Cervical Deep Flexor Strengthening exercise

Outcome measures

Neck disability index [23, 24]: Neck Disability Index (NDI) is a 10-item questionnaire to measures a patient's self reported neck pain related disability. It is based on Oswestry Low Back Pain Disability Questionnaire. Questions include activities of daily living, such as: personal care, lifting, reading, work, driving, sleeping, recreational activities, pain intensity, concentration and headache. Each question is measured on a scale from 0 to 5, and an overall score out of 100 is calculated by adding each item score together and multiplying it by two. A higher NDI score denotes the patient's perceived disability is greater due to neck pain.

Pressure biofeedback unit [25, 26]: This aimed to measure the ability of each subject to perform chin tuck, holding the contraction for 4 seconds within a 10-second period and monitored using a digital watch.

Results

The Statistical software namely SPSS 16.0 software. The level of significance was kept at 5%. Pearson Chi-Square test and has been used to analyse the significant of basic characteristic of gender, age and side distribution of the subjects studied. Paired T test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change. Independent T test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between groups with calculation of percentage of difference between the means.

Table 1: Presents the outcomes of age in years of the subjects with non-specific neck pain in both the groups

S.no	Variable	Group-A: IASTM		Group-B: MFR		Unpaired t-test
		Range	Mean ± SD	Range	Mean ± SD	
1	Age in years	20-47	33.30±8.87	21-48	33.67±9.78	T=0.278, p>0.05, NS

The table 1 presents the outcomes of age in years of the subjects with non-specific neck pain in both the groups. In group-A, the subjects were ranging within the age of 20-47 with mean and SD of 33.30±8.87. In group-B, the subjects were ranging within the age of 21-48 with mean and SD of 33.67±9.78. The unpaired t-test was carried to compare the means, which was found to be not significant at 5% level (ie. p>0.05). It revealed that the baseline characteristic of age was similar in both the groups.

Table 2: Distribution of subjects with non-specific neck pain according to gender in both groups

	Gender	Group	
		Group-A: IASTM	Group-B: MFR
1	Female	8(53.3%)	8(53.3%)
2	Male	7(46.7%)	7(46.7%)
		Chi-Square value=0 df=1, p>0.05,NS	

NS-Not significant. ie.,p>0.05.

Table 3: Range, mean and SD of outcome measures of subjects with non-specific neck pain in group-A

S. No	Outcome measures	Group-A: IASTM				Wilcoxon test/Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	NDI	14-28	20.67±3.31	3-6	4.20 ± 0.94	z=3.413*	p<0.001
2	NPRS	7-10	8.00±0.92	1-3	1.60±0.94	z=3.438*	p<0.001
3	Pressure biofeedback (seconds)	5-9	7.47±1.05	10-10	10±0	t=7.794*	P<0.001
4	Pressure biofeedback (mmHg)	26-28	27.20±1.01	26-30	28.67±1.63	t=4.608*	P<0.001

Note; * denotes –Significant (p<0.05), z- Wilcoxon test, t-paired t-test

Table 4: Range, mean and SD of outcome measures of subjects with non-specific neck pain in group-B

S. No	Outcome measures	Group-B:MFR				Wilcoxon test/Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	NDI	10-24	17.13±4.19	3-7	4.67 ± 1.44	z=3.404*	p<0.001
2	NPRS	6-9	7.67±0.81	1-4	2.00±1.13	z=3.426*	p<0.001
3	Pressure biofeedback (seconds)	6-9	7.87±1.06	10-10	10±0	t=7.728*	P<0.001
4	Pressure biofeedback (mmHg)	26-28	26.93±11.03	28-28	28 ±0	t=4.620*	P<0.001

Note; * denotes –Significant (p<0.05), z- Wilcoxon test, t-paired t-test

Table 5: Comparison of pre and post-test outcome measures of subjects with non-specific neck pain in between the groups.

S. No	Outcome measures	Pre test		Post test	
		Group-A	Group-B	Group-A	Group-B
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
1	NDI	20.67±3.31	17.13±4.19	4.20 ± 0.94	4.67 ± 1.44
2	NPRS	8.00±0.92	7.67±0.81	1.60±0.94	2.00±1.13
3	Pressure biofeedback (seconds)	7.47±1.05	7.87±1.06	10±0	10±0
4	Pressure biofeedback (mmHg)	27.20±1.01	26.93±11.03	28.67±1.63	28 ±0
Between group comparisons: Mann- Whitney U test/ Unpaired t-test		▪ NDI: z=1.414, p>0.05, NS ▪ NPRS: z=0.770 p>0.05, NS ▪ PBFB(sec): t=1.043, p>0.05, NS ▪ PBFB(mmHg): t=0.714 p>0.05, NS		▪ NDI: z=1.421, p>0.05, NS ▪ NPRS: z=0.854 p>0.05, NS ▪ PBFB(sec): t=1.228 p>0.05, NS PBFB (mmHg): t=1.581 p>0.05, NS	

S-denotes significant (p<0.05); NS – not significant (p>0.05).

Both the interventions in group-A and group-B were found to be individually effective in treating subjects with non-specific neck pain in reducing neck disability and pain and also increasing pressure biofeedback outcomes. But, while compared the post test outcomes in between the groups, there was no much difference in between the groups

Discussion

In present study was conducted with an objective of determining the best method for reducing pain, intensity, improving physical function and strength in the deep cervical flexors in subjects with Non Specific Neck Pain. In this comparative experimental study design, 30 subjects with Non Specific Neck Pain were randomly divided into 2 groups, where Group A (n=15) received IASTM along with Deep Cervical Flexor strengthening and Group B (n=15) received MFR along with Deep Cervical Flexor Strengthening by Pressure Biofeedback unit. The mean age for subjects with Non Specific Neck Pain ranges from the early 20s to the late 40s. The estimated age for Non Specific Neck Pain differs in different studies, the lifestyle, the way Activity of daily living are performed, the quality of living plays a very important role [2, 3, 5].

In one of the studies conducted on Neck Pain, the prevalence of neck pain was at peak in the age between18-50. In the current study, in Group A, the subjects were ranging within the age of 20-47 with mean and SD of 33.30±8.87. And in Group B, the subjects were ranging within the age of 21-48 with mean and SD of 33.67±9.78. The unpaired t-test was carried to compare the means, which was found to be not significant at 5% level (i.e. p>0.05). It revealed that the baseline characteristic of age was similar in both the groups. When proper muscoskeletal functioning doesn't happen there is a restriction in the range of motion in any joints and also if flexibility is hampered. And insufficient flexibility can lead one to become vulnerable to overuse syndrome and acute injuries. Also, having sufficient flexibility is important to improve exercise performance [15].

Studies have suggested that IASTM can significantly improve ROM and help in reducing the pain. Myofascial Release Technique can help in reducing the pain also increase the tissue flexibility [16, 17, 19]. IASTM was performed on Group A the subjects with non-specific neck pain, where 8(53.3%) of them were females and 7(46.7%) of them were males. In group-B, same gender proportion of 8(53.3%) females and 7(46.7%) males. The Chi-square test was worked out and it was found to be not significant at 5% level (p>0.05). It is evidenced that the baseline characteristic gender is homogeneous in both the groups 64.

In the present study, higher number of females were seen to be affected when compared to the males, which suggests that females are more prone to Non Specific Neck Pain. Both Group A and B had 8(53.3%) females and 7(46.7%) males. This is supported by a study done by D. G Hoy *et al.* 2011, the study stated that prevalence is generally higher in women in higher urban areas than in rural areas, but when compared between male and female, the females are prone to neck pain easily.

In a study done earlier on 30 subjects with chronic low back ache, the back ache had reduced drastically in 4 weeks of IASTM application. Similar results have taken place in studies with sports injury where IASTM was applied twice a week for 2 weeks in female volleyball players with acute costochondritis. Also, reduced pain in plantar fasciitis in youth football players where IASTM was applied once a week for 6 weeks.28 Outcome measures were NDI and PBU, In Group A: The pre test, of NDI was ranging within 14-28 with mean and SD of 20.67±3.31. But in post test, it was found to be decreased to the range 3-6 with mean and SD of 4.20 ± 0.9. The Non-parametric test for significance of depending on the outcomes when the scores of NDI were ordinal, the Wilcoxon test was carried out and it was found to be significant (p0.05). It evidenced the baseline characteristic of gender is homogeneous in both the groups.

NDI is one of the most commonly used questionnaire for neck pains as it includes questions pertaining to ADLs and Quality of Life. In most of the studies conducted on NDI it suggests that NDI has acceptable reliability, although interclass correlation coefficients range from 0.50 to 0.98. And was concluded that NDI has sufficient support and usefulness to be the most commonly used self-report measure for neck pain. In the current study In Group-A, the Pre test, NDI was

ranging within 14-28 with mean and SD of 20.67±3.31. But in post test, it was found to be decreased to the range 3-6 with mean and SD of 4.20 ± 0.9. The Non-parametric test for significance of dependent outcomes when the scores of NDI were ordinal, the Wilcoxon test was carried out and it was found to be significant ($p<0.001$) [23, 24].

And in Group B, the Pre test, NDI was ranging within 10-24 with mean and SD of 17.13±4.19. But in Post test, it was found to be decreased to the range 3-7 with mean and SD of 4.67 ± 1.44... The Non-parametric test for significance of dependent outcomes when the scores of NDI were ordinal, the Wilcoxon test was carried out and it was found to be significant ($p<0.001$).

The Intraclass correlation coefficient for Numeric Pain Rating Scale (NPRS) was $p<0.001$) and was held reliable for patients with musculoskeletal disorders who do not have any problems with cognition. The relative reliability of NPRS in test-retest design study on 50 subjects were substantial with intra class correlation coefficient and the standard error of measurement and smallest real difference at 90% confidence interval were 0.81.56,78,79 In group-A, the pre test scores were ranging within 7-10 with mean and SD of 8.00±0.92. But in post test, the scores were found to be decreased to the range of 1-3 with mean and SD of 1.60±0.94. The Non-parametric test for significance of dependent outcomes when the scores of NPRS were ordinal, the Wilcoxon test was carried out and it was found to be significant ($p<0.001$)

Since measuring the strength of Deep Cervical Flexors was difficult and previously studies have been done on measuring the strength of Deep Cervical Flexor Muscles, In a previously conducted study by Kjersti Storheim *et al*. 2002, to measure the intra-tester reproducibility of PBU on transverse abdominis functioning where practicing contraction of the transverse abdominis in prone lying with PBU placed at the transverse abdominis then instructed to draw their abdomen inwards. The results post intervention were coefficient varience V= 21.0% and SD 1.59. 52,24,57 It was concluded that the Pressure Biofeedback Unit not only has a role in providing biofeedback and assisting but also helps in strengthening. According to pressure biofeedback (seconds) in Group-A, pre test, the scores were ranging within 5-9 with mean and SD of 7.47±1.05. But in post test, the scores were found to be increased to 10 with SD of 0. The parametric test for significance of dependent outcomes and metric the paired t-test was carried out and it was found to be significant ($p<0.001$)

In group B, pressure biofeedback (seconds) the pre test scores were ranging within 6-9 with mean and SD of 7.87±1.06. But in post test, the scores were found to be increased to 10 with SD was 0. The parametric test for significance of dependent outcomes and metric the paired t-test was carried out and it was found to be significant ($p<0.001$). It is evident that there is a significant reduction in NDI and NPRS and also significant increase in pressure biofeedback outcomes seconds as well as mmHg among subjects with non-specific neck pain in group-A.

It is also evident that there is a significant reduction in NDI and NPRS and also significant increase in pressure biofeedback outcomes seconds as well as mmHg among subjects with non-specific neck pain in group-B. Both the interventions in group-A and group-B were found to be individually effective in treating subjects with non-specific neck pain in reducing neck disability and pain and also increasing pressure biofeedback outcomes.

But, while compared the post-test outcomes in between the groups, there was no much difference in between the groups. Hence the present study accepts the Null Hypotheses.

Conclusion

The present study concludes that both IASTM and MFR have significantly contributed to reduce pain, disability and increase mobility at the neck. Also, Pressure Biofeedback played a major role in strengthening of the Deep Cervical Flexors. Thus it helped in increasing the work function and decreasing/ lowering the disability. It can be clinically recommended to consider either of IASTM or MFR along with Strengthening of the Deep Flexors with Pressure biofeedback unit as it was found effective in subjects with Non Specific Neck Pain.

Limitation of the study

Small Sample Size.

Follow up with subjects was not done

Recommendations for future research

Further study can be done measuring the effect on other outcome measures.

Further scope in knowing the long term effect of both IASTM and MFR along with deep Cervical Flexor Strengthening.

To find further effectiveness of the techniques after 3 weeks.

Sample size can be increased.

Can combine these techniques adjunct to other electrotherapy modalities.

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