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Comparative Study of Effectiveness of Muscle Energy Technique and Static Stretching on Pain and Functional Performance in Patient with Mechanical Neck Pain

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Abstract: ***Background: Neck pain is common problem with in our society. Upper trapezious and the levator scapulae are the most common postural muscles that tends to get tight and leading to the restricted neck mobility. If these groups of muscles are treated it may provide with best results. There is lack of evidence to allow conclusions to be drawn about the effectiveness of Muscle Energy Technique when compared with stretching exercises for relieving mechanical neck pain. Objective: To evaluate the comparative effectiveness of Muscle Energy Technique and Static Stretching on pain and functional performance in patient with mechanical neck pain. Study design: A pre-post experimental design was used in this study. Subjects and method: 30 patients of mechanical neck pain, aged 18-40 years, to receive Muscle Energy Technique plus static stretching plus conventional physiotherapy (group A, n= 15) Static stretching plus conventional physiotherapy (group B, n=15). Outcome measures: Pain intensity on VAS, Neck Disability Index. Conclusion: This study concluded that both the treatment techniques, Muscle Energy Technique and Static Stretching were effective in alleviating the mechanical neck pain in terms of decreasing pain intensity and decreasing tightness of muscle. However Muscle Energy Technique was superior than Static Stretching in decreasing pain intensity and decreasing tightness of upper trapezius and levator Scapulae.***

1. Introduction

Neck pain is the most common site of non traumatic musculoskeletal pain. Neck pain as defined by Mersky is the pain "anywhere within the region bounded superiorly by superior nuchal line, inferiorly by an imaginary line through the tip of the first thoracic spinous process and laterally by saggital plane tangential to the lateral borders of the neck"[2]

Neck pain is one of several regional pain problems affecting the musculoskeletal system. Neck pain is rivalled only by low back pain and osteoarthritis in general, among disorders of the musculoskeletal system.

International figures indicate that at any point in time approximately 10-15% of the population will be suffering an episode of neck pain, and 40% will suffer neck pain during a twelve-month period (ariens et al 1999). Figures for the Australian population are lacking, although one survey reported that 18% of individuals woke with cervical pain, and 4% suffered from it all day (Gordon et al 2002).[1]

Prevalence peaks at middle age, and women are more often affected than men. Risk factors include repetitive work, prolonged periods of the cervical spine in flexion, high psychological job strain, smoking, and previous neck/shoulder injury[6].

Neck Pain is a common global problem, at least in the industrialized world, and it constitutes an important source of disability. The functional task of the cervical spine is to control head movements in relation to the rest of the body. Since the eyes and the vestibular organs are located in the head, information from mechanoreceptors in the structures of the neck is crucial for interpreting vestibular information and for controlling motor tasks that rely on visual information. Neck pain may therefore also have profound functional consequences.[2,3,4]

Mechanical neck pain is a significant societal burden and may include symptoms in the neck and upper extremity. It has been reported that the lifetime and point prevalence of neck pain are almost as high as those of low back pain. Mechanical neck pain results in substantial disability and costs. Determining the most appropriate intervention for individuals with neck pain remains a priority for researchers. Physical therapy is usually the first management approach for patients with mechanical, idiopathic insidious neck pain, and manual therapy is often the preferred intervention.[5]

The cause of neck pain may be associated with degenerative processes or pathology Identified during diagnostic imaging, the tissue that is causing a patient's neck pain is most often unknown. Thus, clinicians should assess for impaired function of muscle, connective, and nerve tissues associated with the identified pathological tissues.[6]

Neck pain affects 30–50% of the general population annually. 15% of the general population will experience chronic neck pain (>3 months) at some point in their lives. 11–14% of the working population will annually experience activity limitations due to neck pain.

The patho -physiology for the majority of neck pain conditions is not clarified. There is evidence for disturbed oxidative metabolism and elevated levels of pain-generating substances in neck muscles, suggesting that impaired local muscle circulation or metabolism can be part of the pathophysiology.[6]

Isometric contraction is contraction of the muscle against a counterforce so that no movement occurs. Two forms of isometric met are post-isometric relaxation (pir) and reciprocal inhibition[19]

Post-isometric relaxation refers to the subsequent reduction in tone of the agonist muscle after isometric contraction. This occurs due to stretch receptors called *Golgi tendon organs* that are located in the tendon of the agonist muscle. These receptors react to overstretching of the muscle by inhibiting further muscle contraction. This is naturally a protective reaction, preventing rupture and has a lengthening effect due to the sudden Mechanical neck pain is a significant societal burden and may include symptoms in the neck and upper extremity. It has been reported that the lifetime and point prevalence of neck pain are almost as high as those of low back pain. Mechanical neck pain results in substantial disability and costs. Determining the most appropriate intervention for individuals with neck pain remains a priority for researchers. Physical therapy is usually the first management approach for patients with mechanical, idiopathic insidious neck pain, and manual therapy is often the preferred intervention.[5]

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Osteopaths and other manipulative therapists developed Muscle Energy Techniques (METs) beginning with Fred Mitchell (1909-74), in the 1950s, who started with the pelvis. They are a gentle but highly effective treatment of musculoskeletal dysfunction. MET uses isometric or isotonic contractions as a way of lengthening tight muscle; strengthening weak muscle; mobilizing joints and relieving congestion in the tissues. Good quality results require skilled application and an accurate diagnosis of muscle condition.[19]

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Reciprocal inhibition refers to the inhibition of the antagonist muscle when isometric contraction occurs in the agonist. This happens due to stretch receptors within the agonist muscle fibres – *muscle spindles*. Muscle spindles work to maintain constant muscle length by giving feedback on the changes in contraction, in this way muscle spindles play a part in proprioception. In response to being stretched, muscle spindles discharge nerve impulses, which increase contraction, thus preventing over-stretching.

In brief, when the agonist muscle contracts against equal force (isometrically) two stretch receptors respond. Firstly muscle spindles react to the stretch of the muscle and respond by inhibiting the antagonist, secondly Golgi tendon organs respond to the stretch on the tendon; they act by inhibiting further contraction of the agonist muscle (pir), as this occurs the muscle spindles also cease to discharge – effectively relaxing the agonist.

Concentric isotonic contraction occurs when the therapist's counterforce is weaker than the contractile force allowing some movement to occur in the direction of the muscle force, therefore shortening and strengthening the muscle. This technique is used to strengthen physiologically weak muscles.[19]

The muscle tissue. This is effective in short, fibrotic muscles allowing a controlled micro trauma to the muscle. This results in a change to the muscles shortened structure and improves elasticity and circulation.[19]

MET methods have many possible variations that will affect the results. For example, the muscle length at starting position; the effort of the client or therapist; the duration of the contraction; whether the contraction is pulsed or single;

the number of repetitions of the contraction; whether the position changes with each repetition, i.e. Moving to tissue tension; the direction of effort, i.e. Whether it is an eccentric or concentric contraction; client breathing and eye movements in the direction of the force; type of resistance, i.e. Gravity, therapist or immovable object. These variables need to be combined and controlled depending on the particular needs of the case.[19]

Static Stretching - Commonly used method of stretching in which soft tissues are elongated just past the point of tissue resistance and then held in the lengthened position with a sustained stretch force over a period of time.

Conventional Physiotherapy- for 20 minutes application of hot pack to neck region along with postural advice.

Inclusion Criteria

- The inclusion criteria will be age between18 – 43 year,
- Mechanical neck pain of sub acute duration, unilateral tightness (of upper trapezius & levator scapulae), ability to read and understand english.[1]

Exclusion Criteria

- Patients will be excluded from the study if they had fracture of the cervical spine, neck pain with radiation into arms or upper extremity or associated with headaches or facial pain,
- Diagnosed with serious pathology like malignancy, infection, inflammatory disorder.
- Osteoporosis, diagnosed cases of disc prolapsed, stenosis1, spondylolisthesis, sprain and Strain, diagnosed pregnancy any deformity (eg. torticollis , sprengel's deformity, scoliosis),
- History of surgery of the cervical spine during the previous 12 months4, patients who are taking Analgesics or currently taking physiotherapy treatment.[1]

Variables

Dependent Variables

- VAS
- NDI

Independent Variables

- Muscle Energy Technique
- Stastic Stretching

Outcome Measurements

- VAS
- NDI

Treatment Protocol

The purpose of study was explained to the subject and a verbal description of all the procedure was given. Ethical approval was granted by scientific and ethical committee for the thesis project at integral university. Subject meeting inclusion criteria were selected for the study. All the selected subject was informed in details about the type nature of study. Prior to participation subject was required to read and sign an informed consent.

2. Procedure

Baseline measurements were taken for all patients for pain intensity (on VAS), and NDI scores. Measurement of pain: VAS was described to patients using horizontal line with 0 representing 'no pain' and 10 representing 'worst pain'. Patient marked a point on the line that matched the current amount of pain he/she felt.

Measurement of Neck Disability Index (NDI): NDI captures perceived disability in patient with neck pain. It was filled by the patient himself/herself. It took about 5 minutes to fill the scale.

Patient in group A received 4 session of MET of upper trapezious and levator scapulae muscle (3 times in a week) and stastic stretching (3 times in a week) and conventional physiotherapy (for 2 week). Patient in group B recived 4 treatment session of stastic stretching of upper trapezious and levator scapulae (3 times in week) and conventional physiotherapy(for 2 week) consisting of 2o minute application of hot pack to neck region along with postural advice. The independent variables for the study included MET, Static stretching and conventional physiotherapy. Dependent variables of the study were pain intensity (as measured by VAS) and Functional score measured by NDI.

3. Results

Total 30 subjects were complete the treatment sessions. The study the statistical test used was repeated measure analysis for comparing the test and post test scores of each variable for all two group seperatly.

There are total 30 patients out of them there are 2 male and 13 female in group A and group B each. The Chi square test shows there is no significant gender wise distribution of patients in two groups. The mean age of patients in group A is 36.40with SD 19.30 while the mean age of patients in group B is 319.193 with SD 19.10. The student's t-test shows that there is no significance difference in mean age of patients in two groups.

Gender					
Group			Frequency	Percent	Cumulative Percent
Muscle energy technique and Static stretching	Valid	Male	8	53.3	53.3
		Female	19	46.19	100.0
		Total	15	100.0	
Static stretching and Physiotherapy	Valid	Male	8	53.3	53.3
		Female	19	46.19	100.0
		Total	15	100.0	

Descriptive Statistics				
GROUP		Mean	Std. Deviation	N
Muscle energy technique and Static stretching	Visual analog scale base line	6.00	.1956	15
	Visual analog scale after one day	5.20	.19195	15
	Visual analog scale after seven day	2.53	.915	15
	Visual analog scale after fourteen day	1.40	.5019	15
Static stretching and Physiotherapy	Visual analog scale base line	6.33	.6119	15
	Visual analog scale after one day	5.60	.19319	15
	Visual analog scale after seven day	4.219	.1999	15
	Visual analog scale after fourteen day	2.193	.1999	15

The Tests of Within-Subjects Effects table tell us if there was an overall significant difference between the means at the different time points.

Tests of Within-Subjects Effects							
Measure: MEASURE_1							
GROUP	Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Muscle energy technique and Static stretching	Time	Sphericity Assumed	212.450	3	190.8119	105.099	.000
	Error(Time)	Sphericity Assumed	28.300	42	.6194		
Static stretching and Physiotherapy	Time	Sphericity Assumed	112.933	3	319.644	64.358	.000
	Error(Time)	Sphericity Assumed	24.5619	42	.585		

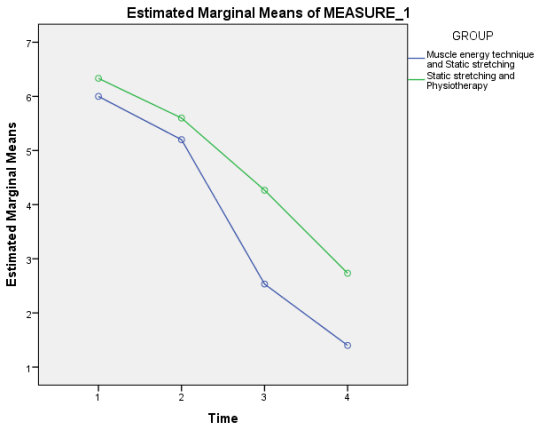
From the above table we are able to discover the F value for the time factor, its associated significant lavel and effective size. we can say that when using the Repeated measure ANOVA with a **Sphericity Assumed** correlation, the mean score for the VAS was found statistically significant different because the p value is less than 0.05.

The Above table represent that there is a overall significant difference in mean, but

We do not know where the difference occur in the time period of treatment. This table give result of the Bonferroni post hoc test which discover specific mean differed.

Pairwise Comparisons							
Measure: MEASURE_1							
Group	(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Muscle energy technique and Static stretching	1	2	.800	.223	.018	.1119	1.483
		3	3.4619	.363	.000	2.351	4.582
		4	4.600	.254	.000	3.819	5.381
	2	3	2.6619	.398	.000	1.444	3.889
		4	3.800	.223	.000	3.1119	4.483
	3	4	1.133	.291	.010	.242	2.025
Static stretching and Physiotherapy	1	2	.1933	.248	.063	-.028	1.495
		3	2.0619	.330	.000	1.053	3.081
		4	3.600	.306	.000	2.662	4.538
	2	3	1.333	.2190	.001	.504	2.163
		4	2.8619	.2194	.000	2.0219	3.19019
	3	4	1.533	.236	.000	.808	2.259
Based on estimated marginal means							
b. Adjustment for multiple comparisons: Bonferroni.							

A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean **VAS** concentration differed statistically significantly between time points (F(105.09,64.38), P < 0.0001)in both the group Muscle energy technique & Static stretching and Static stretching & Physiotherapy. Post hoc tests using the Bonferroni correction revealed that exercise training elicited a slight reduction in concentration from pre-training to 1-day of training (6.0± 0.195 *vs.* 5.20± 0.1919 and 6.33± 0.61 *vs.* 5.6± 0.193 respectively), which is also statistically significant (p <0.0001), post-training to 19 day of training (6.0± 0.195 *vs.* 2.53± 0.91 and 6.33± 0.61*vs.* 4.219± 0.199 respectively), which is also statistically significant (p <0.0001) and finally after 14 days of training (6.0± 0.195 *vs.* 1.4± 0.50 and 6.33± 0.61*vs.* 2.19 ± 0.199 respectively), which is also statistically significant (p <0.0001) .Therefore, we can conclude that a long-term training program (14 days) elicits a statistically significant reduction in VAS concentration in both the group Muscle energy technique & Static stretching and Static stretching & Physiotherapy.



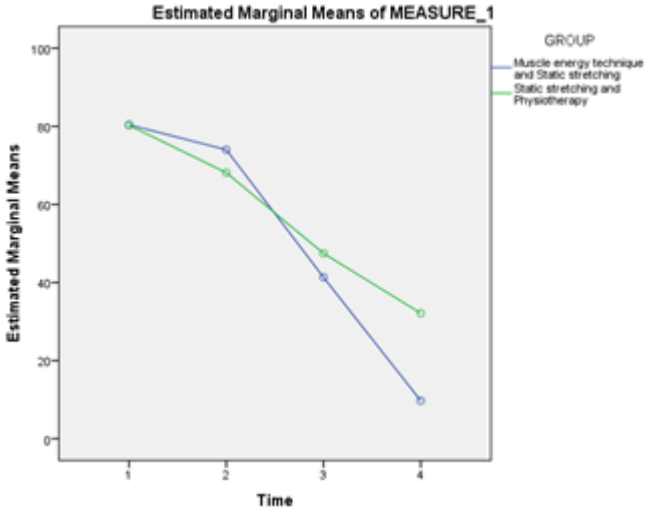
Descriptive Statistics				
GROUP		Mean	Std. Deviation	N
Muscle energy technique and Static stretching	Neck disability index base line	80.40	3.641	15
	Neck disability index after one day	194.00	3.381	15
	Neck disability index after seven day	41.33	6.619	15
	Neck disability index after fourteen day	9.193	2.815	15
Static stretching and Physiotherapy	Neck disability index base line	80.219	5.1195	15
	Neck disability index after one day	68.13	6.906	15
	Neck disability index after seven day	419.419	6.1939	15
	Neck disability index after fourteen day	32.13	19.190	15

Tests of Within-Subjects Effects							
Measure: MEASURE_1							
Group	Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Muscle energy technique and Static stretching	Time	Sphericity Assumed	419838.0619	3	15946.022	955.4819	.000
	Error(Time)	Sphericity Assumed	1900.933	42	16.689		
Static stretching and Physiotherapy	Time	Sphericity Assumed	206119.8619	3	68192.622	215.1911	.000
	Error(Time)	Sphericity Assumed	1338.133	42	31.860		

Pairwise Comparisons							
Measure: MEASURE_1							
GROUP	(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Muscle energy technique and Static stretching	1	2	6.400	.940	.000	3.515	9.285
		3	39.0619	1.931	.000	33.141	44.992
		4	190.6619	1.063	.000	619.404	193.929
	2	3	32.6619	1.968	.000	26.6219	38.1906
		4	64.2619	.191919	.000	61.881	66.653
	3	4	31.600	1.19190	.000	26.1190	319.030
Static stretching and Physiotherapy	1	2	12.133	1.1962	.000	6.19219	119.540
		3	32.800	2.008	.000	26.639	38.961
		4	48.133	2.212	.000	41.344	54.922
	2	3	20.6619	2.153	.000	14.060	219.2193
		4	36.000	2.019	.000	29.804	42.196
	3	4	15.333	2.1199	.000	8.646	22.021
Based on estimated marginal means							
b. Adjustment for multiple comparisons: Bonferroni.							

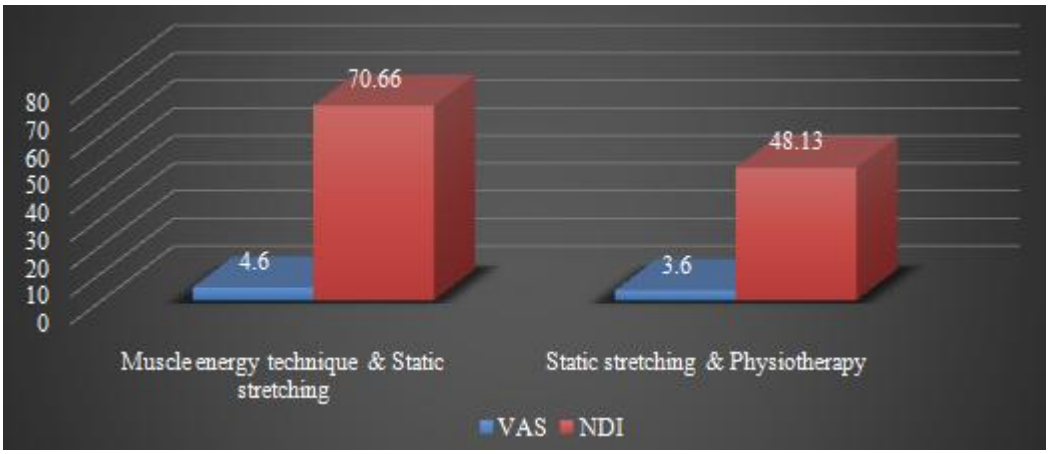
A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean **NDI** concentration differed statistically significantly between time points (F (955.48, 215.191) , P < 0.0001)in both the group Muscle energy technique & Static stretching and Static stretching & Physiotherapy. Post hoc tests using the Bonferroni correction revealed that exercise training elicited a slight reduction in concentration from pre-training to 1-day of training (80.40± 3.64 *vs.* 194.0± 3.38 and 80.219± 5.119 *vs.* 68.13± 6.90 respectively), which is also statistically significant (p <0.0001), post-training to 19 day of training (80.40± 3.64 *vs.* 41.33± 6.61 and 80.219± 5.119 *vs.* 419.419± 6.193 respectively), which is also statistically significant (p <0.0001) and finally after 14 days of training (80.40± 3.64 *vs.* 9.193± 2.81 and 80.219± 5.119 *vs.* 32.13 ± 19.19 respectively) which is also statistically significant (p

<0.0001). Therefore, we can conclude that a long-term training program (14 days) elicits a statistically significant reduction in NDI concentration in both the group Muscle energy technique & Static stretching and Static stretching & Physiotherapy.



A t-test helps you compare whether two groups have different average values .we use an independent t-test when you want to compare the mean of one sample with the mean of another sample to see if there is a statistically significant difference between the two. As the name suggests, you use an independent t-test when our samples are independent.

Variable name	Muscle energy technique & Static stretching		Static stretching & Physiotherapy		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
VAS	4.60	0.98	3.60	1.18	0.018
NDI	190.66	4.11	48.13	8.56	0.000



By the student t-independent test we interpret that which treatment is batter in **Muscle energy technique & Static stretching** or **Static stretching & Physiotherapy** from the above table we see that there is reduction in both **Muscle energy technique & Static stretching** and **Static stretching & Physiotherapy** so we conclude that **Muscle energy technique & Static stretching** is more efficient in **VAS, NDI** in comparison to **Static stretching & Physiotherapy.** so we can say that there is a decrease in both the group but statically we cannot calculate that because we have a small set of observations.

4. Discussion

The results shows that group A & B both have improved significantly with the respective treatment procedures applied to them. When analyzed with due respect to each factor, it is seen that in study group A, which was given Muscle Energy Technique (trapezious upper fibre and levator scapulae) in addition to static stretching, hot pack and in control group B static stretching and hot pack . Group A improved significantly in terms of VAS for pain, and improvement in tightness of both muscle (upper trapezious and levator scapulae) in comparison to group B.

The VAS for pain shows the decrease in pain level in experimental group can be attributed to the hypoalgesic effects of MET. This can be explained by inhibitory Golgi tendon reflex, activated during the isometric contraction that leads to reflex relaxation of the muscle. Activation of muscle and joint mechanoreceptors leads to sympathoexcitation evoked by somatic efferents and localized activation of the periaqueductal gray matter that play a role in decending modulation of pain.

Result shows that for the pain in the MET group were in consensus with the previous studies in which pain intensity reduced following MET over neck area. Nagrale et al demonstrated significant levels of improvement in MET group for pain, Intensity at 2 week follow-up.Rajarajeswaran et al showed significant reduction in pain level in MET group.

The reduction in the pain following static stretching can be explained on the basis of GTO (which causes a dampening effects on the motor neuronal discharges, thereby causing relaxation of the musculotendinous unit by resetting its resting length) and Pacinian corpuscle modification. These reflexes will allow relaxation in musculotendinous unit

tension and decreased pain perception. Kostopoulos et al found significant pain reduction in group treated with static stretching of upper trapezious and levator scapulae decrese in neck pain in the stretching group after 2 week. The effect of MET component for decrease in tightness of upper trapezious and levator scapulae can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility-reflex relaxation, viscoelastic change, and changes to the stretch tolerance. Reflex muscle relaxation following contraction that has been proposed to occur by activation of the Golgi tendon organs and their inhibitory influence on the a-motor neuron poo.[18] Combination of contractions and stretches (as used in MET) might be more effective for producing viscoelastic change and passive extensibility.[18]

Results of the present study for MET group for improvements in tightness were similar to previous studies conducted over neck area and other muscles. Classidy et al found immediate decrease in tightness muscle (upper trapezious and levator scapulae) in patient with mechanical neck pain.

Proposed mecahanisms by which passive manual stretch facilitates the laying down of collagen and regain of muscle length area direct decrease in muscle stiffness via passive viscoelastic changes or an indirect decrease because of reflex inhibition and consequent viscoelasticity changes from decreased actin myosin cross bridging. Heat therapy is known to have effects on pain and spasm and thus can attribute to pain relief and improved tissue extensibility in all two groups. Advice on the correction of postural abnormalities is important in preventing recurrence of pain. In ca study done by Chhabra et al[25], the subjects showed marked reduction in pain intensity but not much significant difference in the disability scores and neck range of motion between two groups.

However it has been seen that in mechanical neck pain many muscles are found to be shortened. Majority of the studies however give intervention to the upper trapezious only and see its efficacy. In our study we took both upper trapezious and levator scapulae as both are found to be commonly involved. Moreover it is very difficult for the patient t co-operate in stretching of many muscles in short durations.

5. Conclusion

This study concluded that both the treatment techniques, Muscle Energy Technique and Stastic Stretching were effective in alleviating the mechanical neck pain in terms of decreasing pain intensity and decreasing tightness of muscle.

However Muscle Energy Technique was superior than Stastic Stretching in decreasing pain intensity and decresesing tightness of upper trapezious and levator Scapulae.

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