Comparative Effectiveness of Muscle Energy Technique and Static Stretching for Treatment of Subacute Mechanical Neck Pain

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Background: Neck pain is a common problem within our society. Upper trapezius and the levator scapulae are the most common postural muscles that tend to get shorten leading to restricted neck mobility. If these group 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 (MET) when compared with stretching exercises for relieving mechanical neck pain. It would be interesting to study if these two techniques yield comparable outcomes and if one technique is superior to the next which should be the alternate choice of therapy.

Objective: To evaluate the comparative effectiveness of Muscle energy technique and static stretching on pain and active cervical range of motion (ROM) in subacute mechanical neck pain

Subjects and methods: 45 patients with subacute mechanical neck pain were randomly assigned to receive Muscle Energy Technique plus conventional physiotherapy (group 1, n = 15), static stretching plus conventional exercise program (group 2, n = 15) and conventional physiotherapy only (group 3, n = 15).

Intervention: Group 1 received 6 sessions of Muscle Energy Technique and 10 sessions of conventional physiotherapy. Group 2 received 6 sessions of static stretching and 10 sessions of conventional physiotherapy. Group 3 received 10 sessions of conventional physiotherapy. All groups were treated for 2 weeks.

Outcome measures: Pain intensity on 100mm VAS, active cervical lateral flexion range of motion, active cervical rotation range of motion.

Results: Paired t-test was used for within group analysis. ANOVA followed by post hoc analysis was employed for between group comparisons. No significant difference was found in any of the outcome measure between MET and static stretching groups (p > 0.05) while both were found to be significantly better than the conventional exercise group (p < 0.05) between the 3 groups. Statistically significant improvements were found in all the 3 groups for all the outcome measures (p < 0.05).

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 increasing active cervical range of motion as there was no significant difference between the two groups, however MET was superior than static stretching in decreasing pain intensity and increasing active cervical range of motion.

Keywords: Mechanical neck pain, Muscle energy technique, Static stretching
INTRODUCTION

Neck is the most common site of non-traumatic musculoskeletal pain.\(^1\) Roughly two thirds of the general population have neck pain at some time in their lives, and the prevalence is highest in middle age.\(^2\) Prevalence of neck pain has an increasing trend up to 50 years followed by a decline and it has found to be more in females.\(^3\) With up to 37% of individuals developing persistent symptoms, neck pain is a condition that places a large economic burden on the health care system.\(^4\)

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 first thoracic spinous process and laterally by sagittal plane tangential to the lateral borders of the neck.”\(^5\) Most patients who present with neck pain have ‘non-specific (simple) neck pain,’ where symptoms have mechanical or postural basis.\(^2\)

Aetiological factors are poorly understood and are usually multifactorial, including poor posture, anxiety and depression, neck strain, occupational injuries, or sporting injuries.\(^2\) Neck pain with limitation of mobility is a common complaint.\(^6\) Limited range of motion and a subjective feeling of stiffness may accompany neck pain, which is often precipitated or aggravated by neck movements or sustained neck postures.\(^7\)

Although many interventions are accepted as standard of care for mechanical neck pain, substantial evidence regarding the effectiveness of nonoperative interventions is lacking.\(^5\)

MET is a method of treatment that involves the voluntary contraction of a subject’s muscle(s) in a precisely controlled direction, against a counterforce provided by the operator.\(^9\) MET may be used to decrease pain, stretch tight muscles and fascia, reduce muscle tonus, improve local circulation, strengthen weak musculature and mobilise joint restrictions.\(^9\) Stretching involves the application of manual or mechanical force to elongate (lengthen) structures that have adaptively shortened and are hypomobile.\(^10\) Stretching is believed to provide many physical benefits including improved flexibility, injury prevention, improved muscle or athletic performance, improved running economy, promotion of healing, and possibly decreased onset of muscle soreness.\(^11\) Static stretching involves stretching a muscle to a point of discomfort and holding the stretch for a length of time, followed by a return to normal resting muscle length.\(^12\)

Janda suggests that before any attempt is made to strengthen weak muscles, any hypertonicity in their antagonists should be addressed by appropriate treatment which relaxes (and if appropriate lengthens) them.\(^13\)

Need of the study

Neck pain is a common problem within our society affecting individual’s physical and social functioning considerably and interfering with sufferer’s daily activities. Upper trapezius and levator scapulae are the most common postural muscles that tends to get shorten leading to restricted neck mobility as they are most frequently used to maintain posture. If these group of muscles are treated it may provide with best results. A wide variety of treatment protocols for mechanical neck pain are available however, the most effective management remains an area of debate. There is lack of evidence to allow conclusions to be drawn about the effectiveness of MET when compared with stretching exercises for relieving mechanical neck pain. Therefore this study will add to the growing body of knowledge that if these two techniques yield comparable outcomes and if one technique is superior to the other, which should be the alternate choice of therapy.

Purpose of the study: To find out the effectiveness of MET when compared with static stretching on pain and active range of motion at cervical spine in patients with subacute mechanical neck pain.

MATERIAL AND METHODS

45 subjects (males and females) with subacute mechanical neck pain were recruited for the study. Ethical approval was obtained from outpatient department of physical therapy of Indian Spinal Injuries Centre. The subjects were invited for participation and their consent was received after explaining them about the study of purpose, procedure, risk factors, benefits,
Muscle Energy Technique and Static Stretching for Treatment of Mechanical Neck Pain

Procedure

Baseline measurements were taken for all patients for pain intensity (on VAS), active cervical ROM and NDI scores.

Measurement of pain: VAS was described to patients using a 100 mm horizontal line with 0 representing “no pain” and 100 representing “worst pain imaginable”. Patient marked a point on the line that matched the current amount of the pain he or she felt.

Measurement of active cervical ROM18: Universal goniometer was used to measure the cervical range of motion for lateral flexion and rotation.

Measurement of neck disability index (NDI): NDI captures perceived disability in patients with neck pain. It was filled by the patient himself/herself. It took about 5 minutes to fill the scale.
Muscle Energy Technique and Static Stretching for Treatment of Mechanical Neck Pain

Patients in group 1 received 6 treatment sessions of MET for upper trapezius and levator scapulae muscle (3 times a week) and 10 sessions of conventional physiotherapy. Patients in group 2 received 6 treatment sessions of static stretching of upper trapezius and levator scapulae (3 times a week) and 10 sessions of conventional physiotherapy. Dosage for stretching: 3-5 repetitions held for 10-30 sec. Patients in group 3 received 10 treatment sessions of conventional physiotherapy (for 2 weeks) consisting of 20 min 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 active cervical lateral flexion and rotation ROM.

DATA ANALYSIS

The statistical test used was paired t-test for comparing the pre intervention and post intervention scores of each variable for all the 3 groups separately. Analysis of variance was done at the baseline and at the end of intervention to assess baseline and post intervention between group differences. When interactions were detected, a post hoc analysis with Bonferroni test was employed. Statistical significance was set at P < 0.05. P value > 0.05 was considered as non significant difference while P value ≤ 0.05 was considered to have represented a significant difference. Value of confidence interval was set at 95%.

RESULTS

42 subjects completed the study and 3 subjects were dropped out as they could not complete all treatment sessions. The results obtained from ANOVA applied on demographic data showed that there were no significant differences in the mean age between the three groups as shown in figure 1. No baseline differences were found on any of the outcome measures (pain intensity (on VAS) and active cervical ROM). Significance level was set at 95%. Figure 2 shows the baseline comparison of all the outcome measures.

Comparison for the pre test and post test scores of pain intensity (on VAS) and ROM 1 (lateral flexion to opposite side of tightness), ROM 2 (lateral flexion to same side of tightness), ROM 3 (rotation to opposite side of tightness) and ROM 4 (rotation to same side of tightness) for all 3 groups are shown in figures 3, 4, 5, 6, 7 respectively.

Paired t test for the pre and post test comparisons revealed a significant improvement (p=.000) for pain intensity, ROM1, ROM 3 and ROM 4 for all the 3 groups and significant improvement (p=.002 for group 1 & 2) and
Muscle Energy Technique and Static Stretching for Treatment of Mechanical Neck Pain

{p=.006 for group 3}) for ROM 2. One way ANOVA for between group comparisons revealed significant difference (p=.000) for ROM 1, ROM 2, ROM 3, ROM 4 and for VAS scores (p = .030). Further post hoc analysis for VAS scores revealed an insignificant difference (p=.272) between group 1 and group 2 and insignificant difference (p=1) between group 2 and 3 but significant difference (p=.027) between group 1 and group 3. Post hoc analysis revealed no significant difference between the MET and Static stretching group for any of the outcome measure.

DISCUSSION

The aim of the current study was to compare the effectiveness of muscle energy technique and static stretching in patients with subacute mechanical neck pain.

Within group analysis revealed that there was a significant decrease in patient reported pain scores when pre and post intervention scores were compared in all the three groups. However, the improvement in MET group was more (77.46%) as compared to static stretching group (57.93%) and conventional group (47.87%).

The possible mechanism for the reduction in pain intensity in the MET group can be attributed to the hypoalgesic effects of MET. This can be explained by the 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 plays a role in descending modulation of pain.

The results obtained for pain in the MET group were in consensus with the previous studies in which pain intensity reduced following MET over neck area or other areas of the body. Nagrale et al demonstrated significant levels of improvement in MET group for pain intensity at 2 and 4 week follow-up. Rajarajeswaran et al showed significant reduction in pain level in MET group. Our results were not supported by Richard et al as their patient’s pain worsened in the group in which MET was given. However, their patient population was very less (n=6) and HVLA SM was also given to the patients along with MET. So it can’t be concluded whether this increase in pain was due to application of MET or manipulation or both.

The reduction in the pain following static stretching can be explained on the basis of inhibitory effects of GTO (which causes a dampening effect 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 the group treated with passive stretching of upper trapezius. Ylinen et al found significant decrease in neck pain in the stretching group after 4 weeks. Between group analysis revealed that there was no significant difference between MET and static stretching group in reducing pain scores. Within group analysis revealed statistically significant improvement in active cervical ROM in all the three groups. Both the MET and Static stretching groups showed greater improvement [ROM1 - 31.15%, ROM3 - 14.3%, ROM4 - 18.41% for MET group and ROM1 - 30.55%, ROM3 - 12.30%, ROM4 - 14.25% for static stretching group] than the conventional group (ROM1 - 14.3%, ROM3 - 4.32%, ROM4 - 6.06%).

The effects of MET component for increase in ROM post intervention can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility - reflex relaxation, viscoelastic change, and changes to 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 pool. Combination of contractions and stretches (as used in MET) might be more effective for producing viscoelastic change than passive stretching alone, because the greater forces could produce increased viscoelastic change and passive extensibility.

Results of the present study for MET group for improvement in ROM were similar to previous studies conducted over neck area and other muscles/joint. Classidy et
Muscle Energy Technique and Static Stretching for Treatment of Mechanical Neck Pain

al\(^6\) found immediate increase in ROM of neck in all three planes in patients with mechanical neck pain who were mobilized using MET. Schenk et al\(^{12}\) found that the group treated with MET demonstrated increased range in each of the six directions of motion. Denise et al\(^{33}\) reported that MET produced a significant increase in overall regional cervical ROM in the treatment group.

Proposed mechanisms by which passive manual stretch facilitates the laying down of collagen and regain of muscle length are a 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. This would then allow for increased joint ROM.\(^{23}\)

The result that static stretching significantly improves ROM was consistent with the study conducted on other areas of body. Significant improvement in ROM of shoulder\(^{35}\), hip\(^{36}\) and knee\(^{37}\) was found within group when heat was followed by stretching. Claudia et al\(^{38}\) found that the conventional stretching and muscle chain stretching in association with manual therapy were equally effective improving the ROM in patients with chronic neck pain.

The present study found no significant difference in improvement of cervical ROM between the MET and Static stretching group. The possible explanation of the increase in ROM in both groups relies on the effects of autogenic inhibition.\(^{39}\) The results were similar to the studies done on other joints done by Parmar et al\(^{23}\) and Hashim et al.\(^{39}\)

The effects of conventional group cannot be overlooked. Moist heat therapy is known to have effects on pain and spasm and thus can attribute to pain relief and improved tissue extensibility in all three groups. Advice on the correction of postural abnormalities is important in preventing recurrence of pain.\(^{40}\) In a study done by Chhabra et al\(^{22}\), 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 trapezius only and see its efficacy. In our study we took both upper trapezius and levator scapulae as both are found to be commonly involved. Moreover it is very difficult for the patient to co-operate in stretching of many muscles in short duration.

Clinical relevance of the study

This study investigated the comparative effectiveness of MET and static stretching in patients with mechanical neck pain. Since neck pain is a common problem within our society this study would benefit this population in managing their symptoms. Both the techniques can be used for the treatment of mechanical neck pain as statistically significant improvement was seen (in terms of improvement in range of motion and reducing pain intensity) implying effectiveness of both the techniques. Physical therapist should be trained to incorporate the use of these techniques in their profession and practice wherever feasible as these provide the patient with holistic improvement of functional outcome. Lastly, this study adds to the scarce body evidences available in this respect.

Limitations of the study

The present study failed to sustain the sample size of 45 patients which was sanctioned at the beginning of this study. Secondly, patients in the present study had low levels of pain intensity. Third limitation is that we recruited only those patients who could read and understand English which greatly limits the generalization of the results to whole of the population. Lastly, intervention was given only to upper trapezius and levator scapulae muscle.

Recommendations of future research

Future researches with greater sample size is recommended. Future research is required to determine long lasting effects of the treatment by taking follow up assessments for longer duration. Giving intervention to other group of muscles (of neck) which might give more beneficial results is recommended.

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 increasing active cervical range of motion as there was no significant
difference between the two groups, however MET was superior than static stretching in decreasing pain intensity and increasing active cervical range of motion.

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