The Short Term Effects of Muscle Energy Technique on Thoracic Range of Motion

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ABSTRACT

Background: Muscle Energy Technique (MET) has been reported to produce an immediate increase in range of motion (ROM) of the spine. There is limited research in the application of MET to the thoracic spine and no evidence of the duration of any ROM change.

Objectives: The aim of this study was to determine the test-retest reliability of a thoracic ROM measurement device and investigate the immediate and short-term effects of MET on ROM of the thoracic spine.

Methods: 60 asymptomatic volunteers (23 male, 37 female; range 18-27) were randomly allocated to either a treatment (n=30) or sham treatment (n=30) group. ROM measurements were recorded pre, post-intervention and approximately post-thirty minutes after intervention. The examiner was blinded to group allocations.

Results: The ARMDno3 device was determined to be highly repeatable (ICC=0.99) in measuring range of motion and accurate within 2.8 degrees. Analysis of the pre-post intervention measurements using SPANOVA indicated that there was a significant main effect of Time ($F_{2,116}$= 10.757, p= <0.01), post hoc testing revealed that ROM was significantly increased over the three time periods for both treatment and sham treatment groups into the restricted direction. A significant main effect of Group was not found ($F_{1,58}$= 0.466, p= 0.498) indicating that MET did not increase ROM significantly more than the sham treatment.

Conclusion: The effect of Muscle Energy Technique was not significantly different from the sham treatment in increasing thoracic range of motion into a restricted direction within an asymptomatic sample population, either directly after MET application or at approximately thirty minutes post-MET. Range of motion was significantly different when comparing the restricted side to the non-restricted side, but not between the sham treatment and treatment groups.

Keywords: thoracic, muscle energy technique, range of motion, osteopathy

INTRODUCTION

Muscle energy technique (MET) is a treatment technique within osteopathic and manual medicine used to mobilise motion restrictions of the spine and extremities. MET has been described as a manual medicine treatment procedure that involves the voluntary contraction of patient muscle in a precisely controlled direction, at varying levels of intensity, against a distinctly executed counterforce applied by the operator.[1] It is deemed to be an effective mechanism to lengthen shortened muscle fibres and fascia, to improve local circulation and balance neuromuscular relationships to alter muscle tone.[1]

The principles behind the mechanism of MET are somewhat speculative and little evidence exists to determine the exact physiological changes that occur. MET involves the muscles, connective tissues surrounding the musculature and the neurological supply to the involved muscles. Muscles are theorised to undergo relaxation after the isometric contraction of the muscle against a counterforce allowing a new restrictive barrier to be engaged by the stretch. The relaxation of the muscle is thought to occur due to a reciprocal inhibition reflex arc initiated by the contraction of the agonistic muscles inducing a simultaneous inhibition of the antagonistic muscle providing a reflex relaxation of hypertonic muscle fibres.[2,3] It is also believed that MET when applied segmentally may recruit and re-activate muscle proprioceptors achieving restoration of motor control and co-ordination influencing active range of motion.[4]

Aside from the neurophysiological principles behind the action of MET, recent focus has been placed on the connective tissue surrounding the musculature. Taylor et al.[5] conducted a study comparing the effects of repeated passive stretching and repeated muscular contractions on the viscoelastic properties of muscle. The tibialis anterior muscles of eight male rabbits were studied suggesting that a reduction in passive muscle tension occurred after both lengthening and isometric contractions. This study indicated that isometric contraction creates a shortening of muscle fibres coinciding with a lengthening of connective tissues due to the fixation of musculotendinous junctions at either end for the muscle to contract. Lederman [6,7] also theorised viscoelastic changes of connective tissues with forced muscle contraction, thus proposing that MET functions to passively lengthen the muscle with physiological changes to the contractile and non-contractile elements of muscle.

The published research to date has been positive toward the efficacy of the treatment of ROM restriction in the cervical, thoracic and lumbar spinal regions.[8,9,10,12] Recently, Fryer et al.[8] conducted a double-blinded, controlled trial consisting of 52 asymptomatic subjects who displayed an axial rotation asymmetry of the atlanto-axial joint of the cervical spine. This study examined the influence of the length of time of the isometric contraction of the MET. Subjects who displayed a unilateral active atlanto-axial rotation asymmetry of 4° or more were included into the study. Subjects were randomly allocated to either a 5 or 20-second MET group or a sham treatment group, ROM measurement of atlanto-axial rotation was taken via a custom made goniometer. The MET was applied into the restricted direction three times for either 5 or 20 seconds with five second periods of relaxation. The sham treatment consisted of a functional technique where the operator held a stable position of the head for a period of 30 seconds, careful not to engage any motion barriers. Results indicated that MET using a 5 second period of contraction produced a significant increase in ROM, with the 20 second and sham treatment groups providing insignificant changes.

Schenk et al.[9] conducted a study that examined the effect of MET on cervical ROM. Eighteen subjects were recruited, nine in the treatment group and nine in the control. Subjects were required to have at least 10° restriction in any ROM. Subjects underwent seven MET treatment applications over a four week time frame applied to pre-determined cervical restrictions in movements of cervical flexion, extension, axial rotation and lateral flexion. Cervical flexion, extension and lateral flexion did not significantly increase, whereas a significant increase in post-treatment ROM of axial rotation was found. It is worth noting that subject's predetermined restrictions were in different planes of movements, despite MET isometric contractions being directed only into rotation. Schenk et al.[10] continued to investigate MET as an effective means to increase ROM with a follow up randomised control trial determining the effects of MET on increasing lumbar extension in twenty six asymptomatic individuals. Those included in the study were allocated to either a treatment or control group. The treatment group received MET treatments twice a week over a four week period. Each session lasted less than five minutes, of which MET was repeated four times. The results of the study showed a pre-post MET ROM change of 6.9° and a pre-post ROM change of -0.4° in the control. This study found that MET significantly increased lumbar extension after the treatment period.

Despite this, clinicians proposed that a learned effect may have occurred regarding the correct technique of active extension of the lumbar spine. If this was in fact the case, the control group should also have exhibited the same learned effect as the treatment group. This is due to both groups participating in the same measurement procedure. A potential flaw in the study was that the examiner was not blinded to the group allocation, therefore aware of the group assignment at both pre- and post-test measurements.

There is limited evidence that MET is effective for treating pain and disability. Wilson et al.[11] conducted a prospective, pilot clinical trial involving participants that experienced acute low back pain. Nineteen participants were matched according to age, gender and initial Oswestry Disability Index (ODI) score, with sixteen subjects completing the study. Participants were to be free of radiating low back pain of less than twelve weeks duration; a diagnosis of a flexed lumbar restriction was the final inclusion criterion. ROM was not objectively measured for this study. Patients were randomly assigned to one of two groups; the control received neuromuscular re-education and resistance training whilst the experimental group received the same exercises co-existing with MET. Patients were seen twice a week for a period of four weeks. MET was only applied if a motion restriction was determined on each visit, patients were also instructed to do a home exercise program including an MET stretch on every day other than experimental intervention days. Results of this trial demonstrated a significant difference in ODI scores between the experimental and control groups. Therefore MET coupled with supervised motor control and resistance exercises may be a more effective treatment of acute low back pain than neuromuscular re-training and resistance training in respect to self perceived disability, not ROM.

The effect of MET applied to the thoracic spine has been investigated by Lenehan et al.[12] This study employed a double-blinded, randomized control trial which examined a single application of MET to the thoracic region in 59 asymptomatic volunteers into the restricted side of rotation. Measurement of seated thoracic active ROM was observed pre and post-MET intervention. The ARMDno2 ROM measurement device was tested for test-retest reliability and found to be accurate in the left direction within 1.52° and to the right within 6.15°. Lenehan et al.[12] found that MET applied to the thoracic spine in the direction of the restricted rotation produced a significant immediate increase in active ROM (mean increase=10.66°, SD=9.8, $p < 0.0005$) but not to the non-restricted side or within the no treatment control group.

The aim of the current study was to examine the effect of MET on active trunk rotation immediately post-treatment and at a half an hour, using treatment and sham treatment groups. Therefore the present study hypothesised that gross thoracic ROM would be increased after a uniform application of MET, both immediately and approximately thirty minutes post-intervention and no observable increase in ROM within the sham treatment group. It was also of interest to examine the test-retest reliability of the ARMDno3 goniometric device prior to the commencement of the intervention study.

MATERIALS AND METHODS

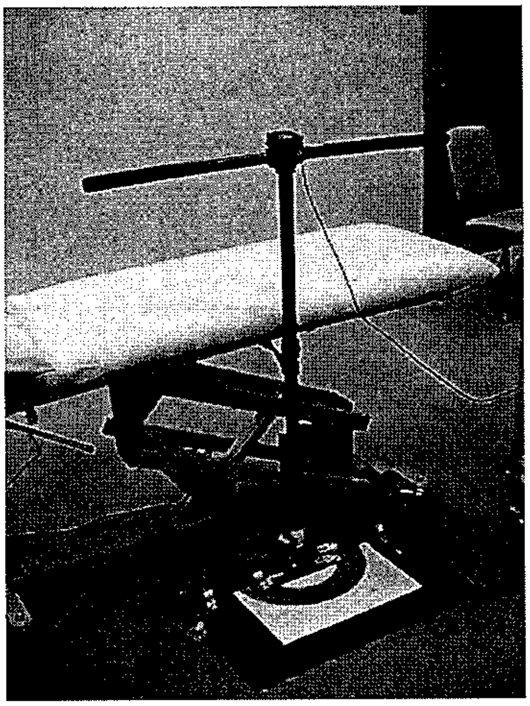
PARTICIPANTS

Sixty (60) asymptomatic volunteers (23 male, 37 female; age range 18 to 27; mean age 22) were included in the study after completion of a consent form and a screening procedure to establish compliance with the study criteria. Participants were included if they were free of any thoracic pathology or pain. Twenty volunteers also participated in an Axial Rotation Measuring Device Number 3 (ARMDno3) reliability pilot testing prior to commencement of the intervention study. The Victoria University Human Ethics Committee granted ethical approval for this study.

AXIAL ROTATION MEASURING DEVICE (ARMDno3)

The ARMDno3 was a modified version of the design used by Lenehan et al.[12] and consisted of a baseboard firmly supporting a 'poly-pipe' thread with two 30cm lengths of poly-pipe secured to the base with four metal 'horse shoe' clamps. Two 45cm poly pipes in series replaced the original 100cm metal pipe which was fitted to the base board enabling movement around a vertical axis. The metal pipe was replaced with plastic pipe because the measuring equipment relied on magnetic components for accurate ROM readings and digital output was skewed by the central metal pipe. A second thread was placed at the top of the vertical pipes which supported a 45cm poly pipe on either side of the thread. This formed the interscapular (IS) line. Directly above the T-junction formed by the vertical bar and the IS line was placed a digital magnomometer (3DM®, Solid State 3-axis Pitch, Roll and Yaw Sensor, Microstrain, USA) and connected via a lead to a near by computer station (Figure 1). This measuring component was fixed with strong adhesive glue and reinforced by heavy duty industrial gaffer tape providing firm attachment.

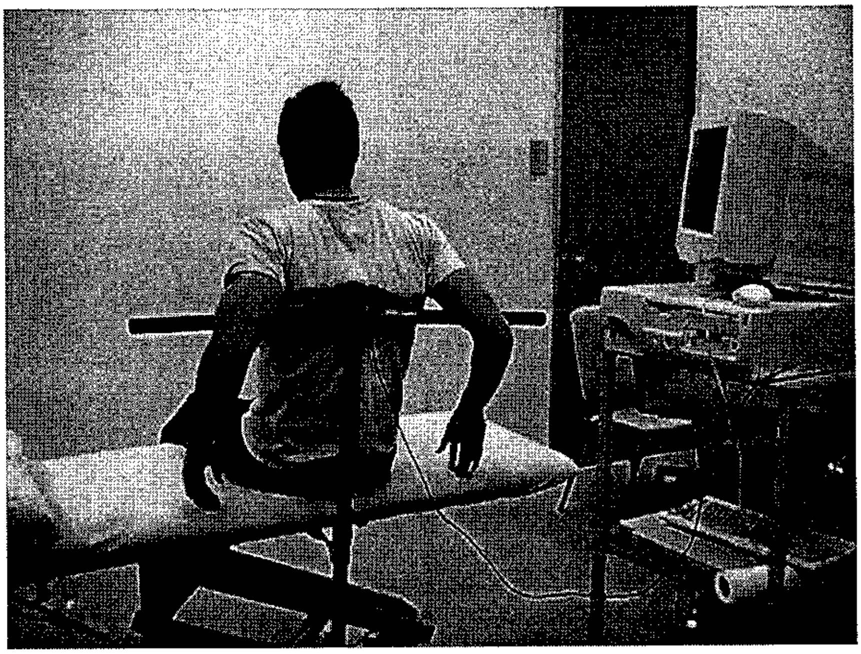
Figure 1: ARMDno3



MEASUREMENT OF TRUNK ROM

The procedures of this study were based on the study by Lenehan et al.[12] but introduced a modified measuring device and an additional period of time (approximately 30min) for ROM testing. To distinguish pure thoracic axial ROM from lumbo-pelvic and costal involvement is difficult, however a method described by Kapandji[13] and Sturges[14] was adapted which eliminate pelvic influence and stabilise the shoulder girdle. Although not entirely exempting the lumbar region, previous literature has indicated that the majority of trunk rotation occurs in the thoracic region with the lumbar spine contributing approximately 7° to overall rotation.[15] Kapandji[13] reported that 37° of axial rotation occurred bilaterally in the thoracic spine, approximately 3° for each thoracic level. This method was implemented by Lenehan et al.[12] and modified for this study. This involved the subject sitting with the arms draped over a horizontal bar at the inferio-medial aspect of the scapulae, creating the interscapular (IS) line (Figure 2). When end range active rotation was engaged, the angle between the frontal plane and the IS line determines the ROM available.[12] Subject's bilateral rotational movements were around a vertical axis in a smooth motion with ROM measured from neutral via the ARMDno3 device. Neutral was established via computer output of the magnomometer reading, such that the subject's rotation about the vertical axis equaled zero or approached zero degrees.

Figure 2: Measurement of trunk rotation



Each subject was positioned on the treatment table with the subject's arms draped over the IS horizontal bar. Height was adjusted accordingly. The subject was instructed to sit in an upright posture with the base of the vertical bar as close to the sacrum of the subject as possible. Each volunteer was informed to actively rotate to one side without pelvic involvement. Pelvic involvement was monitored and stabilised by a separate examiner. A reading was determined by computer and recorded at end range with the subject then returning to neutral for a latent period of three seconds. From neutral the subject repeated the active rotation to the contralateral side. Each participant completed alternate movements three times, measurements were recorded each time with the mean value of the three readings calculated.

ARMDno3 TEST-RETEST RELIABILITY PILOT STUDY

The ARMDno3 test-retest reliability was tested prior to the MET intervention study with twenty volunteers. Each subject was measured for trunk rotation using the methods previously described. Bilateral ROM measurements were taken three times. The initial reading was followed by the second ten minutes after the baseline measurement, and the last reading a further ten minutes after the second reading. After each reading the participant was free to move around and returned for measurement at 10- and 20-minute time intervals. Neutral readings were obtained via the computer output of the magnomometer as previously detailed. To increase reliability, the same examiner was used to read and record each measurement, as well as a separate examiner who monitored and stabilised the pelvis.

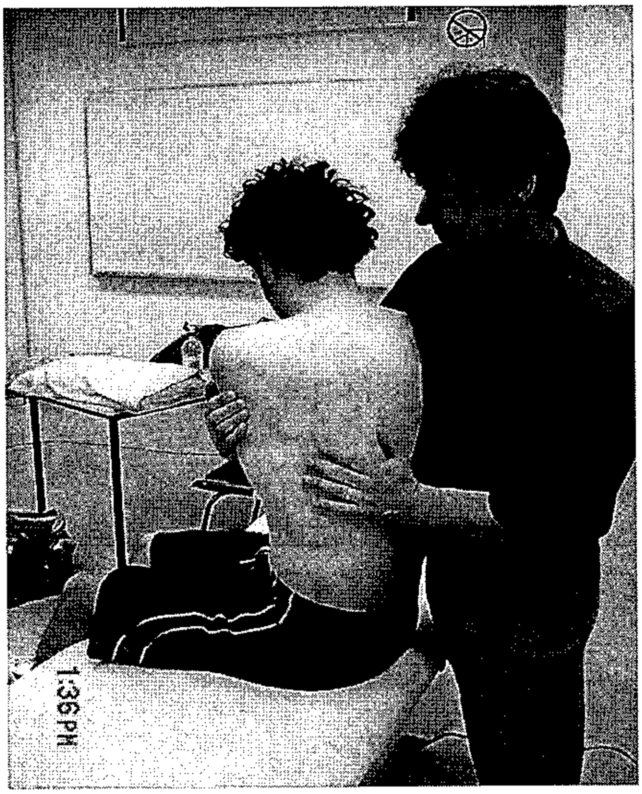
INTERVENTION PROCEDURE

Volunteers (n=60) were measured using the ARMDno3 to determine active trunk rotation as previously described. The examiner recording measurements of ROM was blinded to the treatment allocation of the participants. After pre-test ROM was recorded, the volunteer was given a card indicating the direction of the restriction of active movement, which was viewed by the treating examiner in a separate room. Volunteers were randomly assigned via lottery draw to either the treatment (n=30) or sham treatment group (n=30).

Muscle Energy Technique

The MET intervention procedure was exactly as outlined by Lenehan et al.[12] The examiner performing the MET was a registered osteopath with 13 years of experience of MET practice. The examiner applied a generalised MET to the thoracic region in the direction of the restriction,[1] according to the card carried by the subject. The participant was in a seated position with hands crossed on opposite shoulders. The examiner took up the restricted barrier and resisted a five second isometric contraction by the subject into side-bending (Figure 3). After each isometric effort, a new rotation barrier was engaged with the participant repeating the resisted movement. A new rotation barrier was engaged with subsequent isometric contractions four times on each subject.

Figure 3: Application of thoracic MET



'Sham' Treatment

The control group received a sham treatment which involved the patient lying prone and the examiner executing an ineffective counterstrain of the lumbar erector spinae musculature. This involved palpation of an aspect of the lumbar erector spinae followed by minimal extension and abduction of the ipsilateral lower limb. The technique did not apply any forces to the thoracic region or address any perceived motion barriers. Post-test ROM was immediately recorded following sham treatment. Sham treatment was performed instead of a no-treatment control because subject expectation and motivation may influence active ROM.

Subjects returned to the testing room and post-test ROM was immediately recorded in the same manner as before. Both the sham treatment and treatment groups were tested via ARMDno3 at a further approximated thirty minute interval after MET or sham intervention. Subjects were instructed to remain sedentary within this period.

STATISTICAL ANALYSIS

The test-retest reliability of the ARMDno3 device was calculated using Intraclass Correlation Coefficient and mean differences with Standard Deviations (SD) to establish accuracy to the nearest degree.

Range of motion measurements were analysed for both control, MET, restricted and non-restricted groups using a Mixed/Split plot design (SPANOVA), statistical significance was set at alpha <0.05 with effect size calculated for each group. Significance within SPANOVA was further investigated using paired sample t-tests.

Eta-squared (η^2) indicates the proportion of variability in the dependant variable that is associated with the independent variable.[16] Eta-squared can range from 0 (weak relationship) to 1.00 (strong relationship).

RESULTS

ARMDno3 TEST-RETEST RELIABILITY

The test-retest reliability of the ARMDno3 device was determined by analysing the three ROM measurements using Intraclass Correlation Coefficient (ICC). The average measure ICC for right rotation was 0.9902 ($F_{19,38}$=102.47, $p < 0.001$, 95% CI: 0.9794-0.9958), and for the left rotation the ICC was 0.9919 ($F_{19,38}$=123.85, $p < 0.001$, 95% CI: 0.9830-0.9966). The results indicate that the ARMDno3 was highly reliable in respect to reproducing the procedure for measurement of ROM, therefore highly repeatable.

The ARMDno3 test-retest reliability pilot study revealed that the mean (μ) difference between the first and last measurement to the left was 0.415° (SD 2.41°) therefore all left rotation measurements were accurate within 2.83°. In the right direction the mean difference between the first and last measurements was 0.185° (SD 2.51°) therefore accurate within 2.34°

MET INTERVENTION

Comparison of pre-, post- and thirty minutes post-intervention ROM scores indicated small improvements in rotation ROM in both treatment and sham treatment groups into the restricted side. The treatment group revealed a change of ROM into the restricted side immediately after MET (μ=3.06°, SD=5.17°), however after thirty minutes the ROM difference was reduced (μ=1.74°, SD=7.32°). The treatment group demonstrated a decrease in ROM away from the restriction after intervention (μ=-2.27°, SD=8.06°). After the thirty minute follow up ROM was still less than baseline value (μ=-1.40°, SD=7.20°). The sham treatment group tested into the restricted side indicated a change of ROM from pre-MET over both post-MET (μ=3.01°, SD=6.02°) and after the thirty minute latent period (μ=4.77°, SD=6.88°). The sham treatment group observed minimal change in ROM in the non-restricted direction immediately after intervention (μ=0.04°, SD=4.24°) and again after the 30 minute latent period (μ=-0.71°, SD=9.94°) (Table 1 and 2).

Analysis with SPANOVA indicated that there was a significant main effect of Time (η^2=0.156, $F_{2,116}$= 10.757, p = 0.00), such that ROM was significantly increased over the three time periods for both treatment and sham treatment groups into the restricted direction. There was not, however, a significant Time by Group interaction (η^2=0.42, $F_{2,116}$= 2.542, p = 0.091). A significant main effect of Group was not found (η^2=0.008, $F_{1,58}$ = 0.466, p = 0.498) indicating that MET did not increase ROM significantly more than the sham treatment group.

To further investigate the main effect of Time, independent paired sample t-tests were employed. Thus, a statistically significant difference existed between the baseline measurements and the post-intervention results towards the restricted side in both the treatment (t(29)=3.240, p = 0.003) and sham treatment groups (t(29)= 2.735, p= 0.011). However, the sham treatment group ROM measured towards the restriction was significantly different after the thirty minute latent period (t(29)=3.802, p = 0.001), whereas the treatment group into the same direction was not (t(29)=1.299, p = 0.204).

A significant difference was not observed for the sham treatment when measuring ROM into the non-restricted side post-intervention (t(29)=0.052, p = 0.959) and 30 minutes post-MET (t(29)=0.558, $p = 0.581$). A similar finding was demonstrated found within the treatment group ROM measurements away from the restriction, post-intervention ($t(29)=-1.540, p = 0.134$) and after the thirty minute latency period ($t(29)=-1.068, p = 0.294$).

On further comparative analysis between the sham treatment and treatment groups into the restriction side of motion, t-tests indicated that there is no statistical difference between the two groups at either pre and post-intervention ($t(29)=-0.033, p = 0.974$) and pre- and post-thirty ($t(29)=1.728, p = 0.095$) Into the non-restricted side, again no significant difference was present between sham treatment and treatment groups over pre and post-intervention ($t(29)=1.496, p = 0.145$) and pre and post-thirty ($t(29)=1.138, p = 0.264$).

Table 1: Group means (SD) pre- and post-intervention, mean differences and significance (*p* value)

Group	Sham Treatment restricted	Sham Treatment non-restricted	MET restricted	MET non-restricted
Pre-	45.98° (10.47)	52.93° (12.57)	48.77° (9.97)	55.43° (9.13)
Post-	48.99° (9.84)	52.97° (12.77)	51.83° (10.83)	53.17° (10.10)
Mean Difference	3.01 (6.02)	0.04 (4.24)	3.06 (5.17)	-2.27 (8.06)
***p* value**	**0.011***	0.959	**0.003***	0.134

* $p < 0.05$

Table 2 Group means (SD) pre- and post-30 minutes, mean differences and significance (*p* value)

Group	Sham Treatment restricted	Sham Treatment non-restricted	MET restricted	MET non-restricted
Pre-	45.98° (10.47)	52.93° (12.57)	48.77° (9.97)	55.43° (9.13)
Post- 30 min	50.75° (10.74)	53.64° (12.63)	50.51° (12.64)	54.03° (11.38)
Mean Difference	4.77 (6.88)	0.71 (9.94)	1.74 (7.32)	-1.40 (7.20)
***p* value**	**0.001***	0.581	0.204	0.294

* $p < 0.05$

DISCUSSION

The results indicated that a significant increase in ROM was observed over the three time periods for both the treatment and sham treatment groups into the restricted direction ($p < 0.001$), however, there was not a significant difference between the two groups over the three time periods. This suggests that the MET treatment was of no more benefit than the sham treatment group in increasing ROM of the thoracic spine and thus rejecting the hypothesis.

On further analysis, a significant difference existed between pre and post-intervention in the treatment group on the restricted side, which was also demonstrated in the sham treatment group over the pre and post-intervention period. The sham treatment group, unlike the treatment group, showed a significant change post the thirty minute latent period.

ROM changes in both the treatment and sham treatment groups could be possibly explained by viscoelastic change and lengthening of thoracic rotational muscles via repetitive active stretching during end range rotation bilaterally during the experimental procedure. It is difficult to accurately identify segmental patterns of muscular recruitment within active gross trunk rotation and therefore is hard to distinguish reasons for an increase in ROM in both experimental groups. Motivation may have been a contributing factor as both groups believed that they were receiving treatment, and may have been motivated to improve on their initial ROM score. Subjects were not informed of their baseline scores but may have simply assumed that the greater the effort employed to actively rotate, the larger their ROM scores. Nevertheless, motivation alone does not account for the unilateral changes in ROM into the restricted side as a symmetrical increase would be expected in both treatment and sham treatment groups.

As the methodology of this study was based on those used in previous studies, the results were expected to reflect the outcomes of previous investigations to find MET an effective means to improve spinal ROM. Differences in the results found between the present study and that of Lenehan et al.[12] may be explained by the following reasons. The present study incorporated a sham treatment as a control, whereas Lenehan et al. did not. This may have increased the motivation of the subjects in the sham treatment group, therefore increasing personal ROM scores. Another difference worth noting is the accuracy of the ROM measurement devices. More specifically, ROM measurements were accurate in this study to 2.83° to the left and 2.34° to the right in contrast to Lenehan et al.,[12] which calculated 1.52° accuracy to the left and 6.15° to the right. The previous study appeared to be less accurate than the current study, and may possibly account for the greater improvements in thoracic ROM. Although the device used in the current study was similar to that used by Lenehan et al. a direct comparison of the measurement devices cannot be made. The vertical metal pole of the ARMDno2 was replaced in the present study with a plastic poly-pipe due to the magnetic effects on the magnomometer and a digital magnomometer was employed for the rotation scores rather than the visual analogue scale.

Although increasing accuracy of the magnomometer, it appeared that the modified device sacrificed stability and thus resulted in a greater degree of flexibility due to the less sturdy poly-piping and plastic joinery. The thread of the joinery positioned in the centre of the vertical pole rotated in the same plane as the thoracic ROM measurements, therefore loosening and tightening on left and right rotations. The magnomometer could not be fixed with metal parts, therefore fixated with adhesive glue and thus less stable. This left the magnetic device susceptible to external pressure as a result from the subject's position for measurement. The magnomometer may have increased or decreased ROM scores for this reason.

The increased flexibility of the device may explain the overall increase in ROM measurements when compared with those of Lenehan et al.[12] The baseline value calculated for the restricted side pre-MET in the previous study was 26.43°, whereas the present study recorded the same measurement via the modified device as 45.98°. The large differences in ROM may indicate that the device utilised in the present study may not have measured pure thoracic rotation and thus, may account for the discrepancy in the results. Although the subject's movements were monitored, the subject's position was not fixed. As the observed changes of ROM were minimal in the current study, accuracy of the measurement procedure must be more precise. Modifications could include strapping the participant's pelvis and lower limbs to a chair or table to reduce additional torsion. Future studies might employ a fixed rotational asymmetry device with goniometric measurement of ROM and thus a higher degree of precision can be executed when measuring thoracic ROM. A rotational asymmetry has been used in previous studies [8,18,19,20] as the inclusion criteria and perhaps could have been employed in the current study to further separate the restricted side from the non-restricted side and/or demonstrate gross asymmetry in movements. This may demonstrate greater sensitivity to ROM changes by the intervention procedures.

Schenk et al.[10] employed multiple MET applications, Fryer et al.[8] and Lenehan et al.[12] utilised single applications of MET in one plane of movement, and demonstrated a change in ROM. Schenk et al.[9] measured changes in several planes of movement, and found only significant changes in cervical rotation. Previous studies also suggest that the number of applications of MET have not been distinguished in order to observe a change in ROM.[8,9,10,12] This study however, did not demonstrate a difference between the treatment and sham treatment groups therefore not supporting previous literature.

The results of the present study suggest that MET maybe less beneficial in the short term for improving spinal ROM than previously expected. [8,9,10,12] However, the application of MET in a clinical setting would be applied to symptomatic patients with spinal pain or dysfunction, and only one study has so far examined the use of MET with symptomatic subjects.[11] Wilson et al. [11] used subjects with a mean age of 32 years, and included those only with acute low back pain· The population group recruited for the present study was a sample of young, fit and healthy participants with no thoracic spinal symptoms with a mean age of 22 years. The subjects in the present study do not reflect the population presenting to osteopathic clinics and so MET may produce increased ROM in a different symptomatic population. Wilson et al. [11] demonstrated MET as an effective technique in conjunction with neuromuscular re-training and resistance training to lower perceived disability. ROM was not measured and motion restrictions were palpated but not objectively measured.

It is important to note that the validity of the observed significance is questionable in the current study. This could be explained by the large standard deviation values of the mean

ROM scores, as well as the calculated error margins in the accuracy of the measuring device. As the greatest observed ROM change was 4.77° and the accuracy was within 2.83° to the left and 2.34° to the right, the validity of the data recorded is questionable. The proposed error of the ROM scores, as a direct result of the reliability of the ARMDno3, may have altered the direction of the restriction as well as the observed changes in ROM over each time period.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should be directed towards the effects of MET on thoracic ROM with the intention to observe changes within a symptomatic population. Although more research must be undertaken with symptomatic populations, studies using asymptomatic subjects, are still important to encourage further understanding of the exact mechanisms of MET. Future research might examine changes over a greater length of time, and use outcome measures for perceived pain and disability, as well as ROM.

Researchers should also verify and thoroughly investigate the reliability of both the ARMDno2 and the ARMDno3. A comparison of the effect of MET measured with both the ARMDno2 and the more flexible ARMDno3 could be pursued to determine if either device is more sensitive to the changes in active seated rotation following manual treatment.

CONCLUSION

Muscle Energy Technique applied to symptomatic subjects did not significantly increase thoracic range of motion into a restricted direction compared to the sham treatment group either immediately or approximately thirty minutes post-MET. Range of motion was significantly different when comparing the restricted side to the non-restricted side but not between the sham treatment and treatment groups. These results do not support previous literature regarding the effect of MET on ROM in the cervical, thoracic and lumbar spine, and highlight the need for clinically based research and the use of reliable ROM measuring devices.

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