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Muscle energy technique and static stretching in patients with mechanical neck pain – a randomized study

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ABSTRACT

Introduction and aim. Neck pain is becoming increasingly common throughout the world with a considerable impact on individuals. This study compared the effects of muscle energy techniques (MET) and static stretching (SS) on pain intensity and functional disability of patient with mechanical neck pain.

Material and methods. Fifty subjects with mechanical neck pain recruited were randomly allocated into MET and SS groups equally. Subjects in MET received MET protocol, and SS groups were treated with SS; both groups had treatment twice a week for six weeks. Pain intensity and functional disability at baseline, 3rd and 6th week of treatment were measured. Descriptive and Inferential statistics were used to analyze the data. Alpha level was set at <0.05.

Results. There were 12 males and 13 females for MET with age ranged between 31–53 years mean was 42.41 ± 7.35 years and 11 males and 14 females in SS group with age range 22–60 years and mean age of 42.91 ± 10.44 years. There was a significant reduction in pain intensity and disability in MET's and SS group ($p < 0.05$) when pre-treatment, 3rd week and 6th week treatment were compared. Pain intensity was lower at SS than MET while functional disability was lower in MET than SS $p < 0.05$ at 6th week

Conclusion. MET reduces ND more than SS and SS reduces pain intensity better MET.

Keywords. muscle energy techniques, neck disability index, neck pain, static stretching, visual analogue scale

Introduction

Neck pain is becoming increasingly common throughout the world with a considerable impact on individuals, communities, health-care systems and businesses.¹ Neck is the most common site of non-traumatic musculoskeletal pain.² Roughly two-thirds of the general population have neck pain at some time in their lives and the prevalence is highest in middle age.³ Prevalence of neck pain has an increasing trend up to 50 years followed by a decline and it has been found to be more in females.⁴ With up to 37% of individuals developing persistent symp-

toms, neck pain is a condition that places a large economic burden on the health care system.⁵

Mechanical neck pain is a generalized neck pain with mechanical characteristics, including symptoms provoked by maintained back postures, neck movement, or by palpation of the cervical muscles.⁶ Causes of neck pain are poor posture, muscle tension and strain, injury, osteoporosis, fibromyalgia, disc herniation and protrusion, spinal stenosis, meningitis.⁷ The neck is particularly vulnerable to injury, especially in falls, car accidents, and sports where the muscle and ligaments of the neck are forced to move

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outside of their normal range, neck injury due to sudden jerking of the head is commonly called ‘Whiplash.’⁸ In an estimated 50-80% of cases involving back or neck pain, an underlying pathology cannot be definitively determined.⁹

Combined manual therapy and exercise has resulted in improved patient outcomes or satisfaction levels when compared to spinal manipulation or exercise alone.¹⁰ Muscle Energy Technique (MET) is a manual medicine procedure that has been described as a gentle form of manipulative therapy effective for treating movement restrictions of both the spine and extremities.¹¹ 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. Muscle energy techniques may be used to decrease pain, stretch tight muscles and fascia, reduce muscle tonus, improve local circulation, strengthen weak musculature and mobilizes joint restrictions. MET was reported to be effective in the management of long term neck pain, it increases joint range of motion, chronic lateral epicondylitis and is useful to increase range of motion when there is limitation in function. This technique can also strengthen physiologically weakened muscles and reduce localized edema through muscle pump action.¹² Muscle energy technique has been demonstrated to be effective in increasing the restricted range of trunk rotation and ameliorating rotational asymmetry in asymptomatic subjects.¹³

Stretching involves the application of manual or mechanical force to elongate structures that have adaptively shortened and are hypo-mobile.¹⁴ 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 of set of muscle soreness.¹⁵ 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.¹⁶

Both MET and stretching are widely used techniques in the field of physiotherapy.¹⁷ Studies using these two techniques individually in symptomatic as well as in asymptomatic population have been shown improvement, but very few studies have compared these techniques in a symptomatic population, where conflicting results are seen.^{18,19}

Neck pain is a common problem within our society affecting individual’s physical and social functioning considerably and interfering with the patient’s daily activities. A wide variety of treatment protocols for mechanical neck pain are available. However, the most effective management remains an area of debate.

Aim

Therefore, this study was done to compare effect of MET with static stretching in the management of pain and functional disability in patients with mechanical neck

pain. The intension was to be able to pick the best effective protocol for the management of neck pain.

Material and methods

Subjects

Subjects for this study were patients diagnosed of mechanical neck pain in Physiotherapy Outpatient Department of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife, Nigeria

The following categories of individuals were considered for this study;

- a. Male and female patients with history of mechanical neck pain of more than 3 months,

Exclusion criteria

- a. Patients with acute neck pain
- b. Subjects were excluded if they have neck pain associated with an underlying pathology such as fracture of the cervical spine, neck pain radiating into the arms or upper extremity or associated with headaches or facial pain, malignancy, infections, inflammatory disorders, osteoporosis or cases of disc prolapse.
- c. Patients with history of surgery of the cervical spine during the previous 12months

Sample Size Determination

$$N = \frac{4\sigma^2 (Z_{crit} + Z_{pwr})^2}{D^2}$$

Where,

N is the total sample size

σ is the assumed SD of each group (assumed to be equal for the groups),²⁰ this is assumed to be 16.63 from a previous study of Ojoawo et al.,²¹

Z_{crit} is the standard normal deviate corresponding to the selected significant criterion, i.e. .05 (95% = 1,960)

Z_{pwr} is the standard normal deviate corresponding to the selected statistical power (i.e. 0.80 = 0.842)

D is the minimum expected difference among the three means and D = 18 from a previous study of Ojoawo et al.²¹

$$\text{Therefore, } N = \frac{4 \times (16.3)^2 (1.96 + 0.842)^2}{18^2}$$

Thus, N = 41.22

10% which is 4 of the sample size was added to make making 46, but the sample was rounded up to 50 to accommodate for non-response and attrition. Fortunately, all the 50 completed the study

Research design

This was a quasi-experimental study

Sampling technique

Purposive sampling technique was used to recruit patients with mechanical neck pain.

Randomization

Individuals who meet the inclusion criteria were randomly allocated to MET Group and SS Group using the simple random assignment method without replacement (Fish Bowl) Fig 1

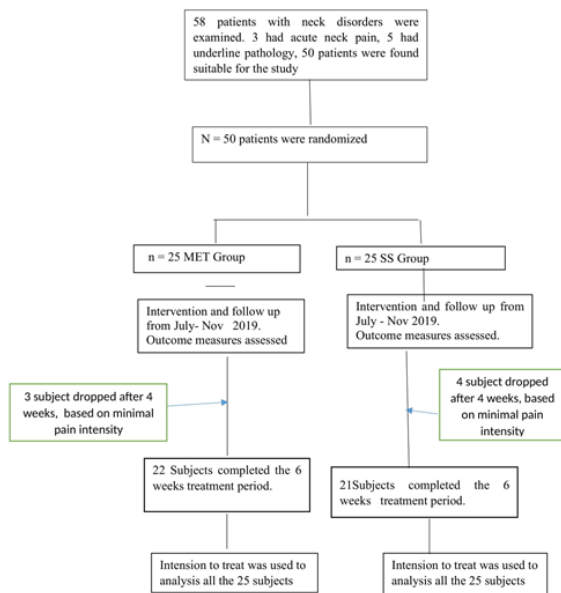


Fig. 1. Flow chart for the Randomized Control Trial (RCT)

Instrumentation

Neck disability index (NDI)

The neck disability index (NDI) was used for patients with neck pain and assess two domains (pain and disability) perceived in the last three months. The NDI for measuring disability in patients with neck pain has a pivotal role in research and clinical settings and is interpreted to have a good reliability.²² The NDI is strongly correlated ($r=0.70$) to a number of similar indices and moderately related to both physical and mental aspect of general health.²³

The NDI can be scored as a raw score or doubled and expressed as a percent.²⁴ Each session is scored on a 0 to 5 rating scale, in which zero means 'No Pain' and 5 means 'Worst Imaginable Pain'. All the points can be summarized as a total score. The test can be interpreted as a raw score with a maximum score of 50 or as a percentage.

Some benchmark has been found in literature but methodologically, they were not described and their validity and reliability are questionable. Vernon and Moir presented the following interpretations: 0-4 points (0-8%): No disability, 5-14 points (10-28%): Mild disability, 15-24 points (30-48): Moderate disability, 25-34 points (50-64%): Severe disability 35-50 points (70-100%): Complete disability.²⁴

Visual analogue scale

The visual analogue scale (VAS) is a frequently used method for the assessment of variations in intensity of pain. In

clinical practice, the percentage of pain intensity assessed by VAS, is often considered as a measure of the efficacy of treatment. VAS is considered to be one of the best methods available for the estimation of the intensity of pain.²⁵ High correlations have been reported between VAS and verbal and numerical rating scales.²⁶ Visual analogue scale and NRS were found reliable in the assessment of pain at the without an appreciable differences between them.²⁷ Based on the distribution of pain VAS scores in post-surgical patients (knee replacement, hysterectomy, or laparoscopic myomectomy) who described their postoperative pain intensity as none, mild, moderate, or severe, the following cut points on the pain VAS have been recommended: no pain (0-4 mm), mild pain (5-44 mm), moderate pain (45-74 mm), and severe pain (75-100 mm).²⁸

Procedure

Application of muscle energy techniques (MET)

Patient was positioned at sitting position on a chair with a pillow to support the back, the neck range of motion was free from all obstructions. Muscles energy technique (MET) with Post Facilitation Stretch protocol was applied to the patients according to Nagrale et al.⁵ There was a set of 5 repetitions per session, and 2 sessions per week for six weeks according to Sadria et al. each stretching was held for 10 seconds.²⁹ Kneading massage was administered for the patient with methyl salicylate ointment for 5 minutes. Subjects in MET Group received 12 treatment sessions of MET two times a week.⁵

Application of static stretching (SS)

Subjects in SS Group received 12 treatment sessions of static stretching according to Reid et al., two times a week.³¹ The neck was placed in a side flexion position first to the right side, the shoulder on the contralateral side was stabilized with one hand and the other hand was used to stretch the neck towards the side of flexion. This was held for 20 seconds and ten repetition per a section.³⁰

Kneading massage was applied to the patients with methyl salicylate ointment for 5 minutes according to Weerapong.³² Kneading massage was administered as follows: muscles of the neck were held, lifted up, rolled and squeezed in a compressive action using methyl salicylate gel as coupling medium. The techniques was applied to the muscles of the posterior region of the neck as well, the underline muscles were well compressed with deep pressure.³¹

Pain intensity and functional disability were assessed at the baseline, after 3rd week and at the end of 6 weeks intervention. The application of methyl salicylate was considered as base line for all the subject as adjunct.

Ethical approval

Approval (no.:IRB/IEC/0004553; NERC/27/02/2009a) of the Health Research and Ethical Committee, Obafemi

Awolowo University Teaching Hospitals Complex Ile-Ife was obtained before the commencement of data collection. The study procedure and rationale were explained to the subjects and their informed consent to participate was obtained. They were assured that all information provided by them on the questionnaire would be treated with utmost confidentiality.

Data analysis

The data collected were analyzed using Statistical package for social sciences International Business machine IBM 21 ((SPSS Inc., Chicago, IL, USA). Descriptive statistics and Mixed Model ANOVA was used to compare the mean values of outcome measures within and across the group. Alpha level was set at 0.05

Results

Physical characteristics of subjects

Shown in Table 1 is the physical characteristics of the subjects in the two groups. The age range for MET group is 31-53 years and the mean of age, height, weight and BMI were 42.92±10.45/yr.s., 1.65±0.1/m, 67.50±13.36/kg, and 24.55±3/kg/m² respectively while the age range for SS group was 22 -60 years, the mean age, height, weight and BMI for the Static Stretching group were 42.42±7.35/yr.s., 1.66±0.05/m, 70.67±10.59/kg and 25.65±3.76/kg/m² respectively. There was no significant difference (p>0.05) when the physical characteristics of the two groups were compared. There were 12 males and 13 females for MET and 11 males and 14 females in SS group.

Effect of muscle energy technique on pain intensity and functional disability

Shown in Figure 2 is the line graph of mixed method ANOVA comparing the pre-treatment, 3rd week and 6th week treatments of the subjects in MET group. The results revealed that there was a significant difference in the VAS as well as ND of pre-treatment, 3rd week and 6th week treatment (p<0.001). The mean values were stated in table 1.

Effects of static stretching technique on pain intensity and functional disability

Shown in Figure 3 is line graph from mixed model ANOVA comparing the mean values of the pre-treatment, 3rd week and 6th week treatments of the subjects

in static stretching group. The results revealed that there was a significant difference in the PI and ND when the pre-treatment, 3rd week and 6th week treatment p<0.001). The actual mean values could be found in table 1.

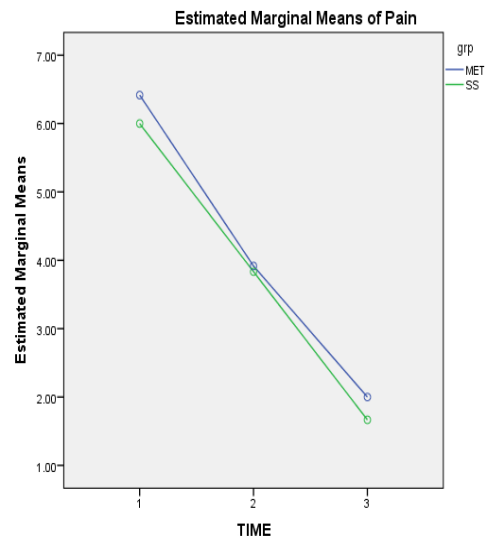


Fig. 2. Effect of muscle energy techniques on pain intensity and disability

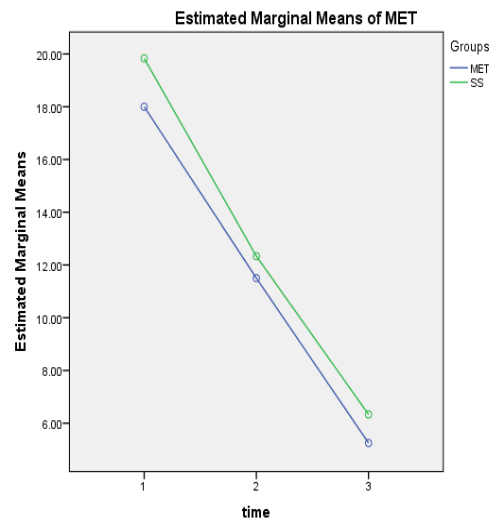


Fig. 3. Effect of static stretching techniques on pain intensity and disability

Table 1. Physical characteristics of the subjects (N= 50)*

Variables	MET	SS	Total	t	p
	Mean±SD, n=25	Mean±SD, n=25	Mean±SD, N=50		
Age (yrs.)	42.92±10.45	42.42±7.35	42.67±8.84	-0.136	0.893
Height (m)	1.65±0.1	1.66±0.05	1.66±0.08	0.643	0.527
Weight (kg)	67.50±13.36	70.67±10.59	69.08±11.9	0.263	0.795
BMI (kg/m ²)	24.55±3	25.65±3.76	25.10±3.38	0.795	0.435

* MET – muscle energy techniques SS – static stretch, BMI – body mass index

Comparisons between the effect of muscle energy technique and static stretching on pain intensity and functional disability

Shown in table 2 is the Mixed Model ANOVA comparing the mean values of the pre-treatment, 3rd week and 6th week of PI and ND of subjects in MET and SS Groups. There was a significant difference in both 3rd and 6th week PI ($P=0.001$) and ND ($P=0.001$) when the MET and Static Stretching groups were compared. The means value of PI and ND in MET (2.00 ± 1.92 ; 5.25 ± 2.52) at the 6th week was also found to be more than that of SS (1.66 ± 0.98 ; 6.33 ± 3.33). This implied that SS may be more effective in pain management while MET may be more effective in ND management.

Discussion

The specific objectives of this study were to evaluate the effectiveness of MET, SS and compare their effects on pain intensity and functional disability of patients with mechanical neck pain.

In this study, a significant reduction among the pre-treatment, 3rd and 6th post-treatment pain intensity and functional disability of subjects that received MET and SS was observed. Study revealed that perception of pain intensity was ameliorated by MET due to raise in stretch tolerance of the patient. In every muscle and joints, there are mechanoreceptors and proprioceptors; these organs are stimulated whenever a group of muscle contract isometrically and stretched.¹¹ The effects of these will consequently lead to drop in discomfort, the muscle is easier to be stretch and patient has more tolerance. The results obtained for pain reduction in the MET group could be similar to the previous studies where pain intensity was reduced following MET over the neck area and also at other areas of the body.^{5,32,33} A study by Gupta et al., on effects of post-isometric relaxation versus isometric exercises in nonspecific neck pain also concluded that MET showed significant improvement in pain and functional status.³² However, the results of our study when compared the two groups indicated that SS relieves pain than MET but MET reduced disability than MET. Results of a study by Sharmila on effects of the MET versus conventional exercises in nonspecific neck pain in secondary school teachers are in accordance with the results for

MET Group, which concluded that post-isometric relaxation had better reduction in pain and disability.³⁴

The reduction in the pain following static stretching could be due to the inhibitory effects of Golgi tendon organs, which reduces 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.³⁵ Kostopoulos et al. found a significant pain reduction in the group treated with passive stretching of upper trapezius, which is in accordance with this study.³⁶ The results of this study for the stretching group was in tandem with study conducted by Paolo et al. on effects of global posture re-education and static stretching on pain, range of motion and quality of life in women with chronic neck pain which concluded that stretching showed significant improvement in outcome measures.³⁷

There was a statistically significant difference found in ND in the treatment groups. This could be because the NDI assesses different aspects of neck pain which consists of pain intensity, daily activities, suggesting that improvement in the score might be due to the reduction in pain.

However, comparing the mean values of the 6th week of PI and ND of subjects in MET and SS groups in this study, there was a reduction of ND in the MET group than that of SS, indicating that MET may be better than SS in improving functional disability. The higher the values of NDI the more the disability, hence MET seems to have improved neck disability than SS. On the other hand, there was a reduction in the values of pain intensity in the SS group than that of MET. The lower the values of visual analogue scale, the less the pain. This implies that SS seems to have improved pain intensity better than MET. The results of this study was not totally in line with the study of Shady et al., and Apoorva et al., they both VAS and NDI scores showed better improvement in the MET group as compared to the stretching group.^{17,38} The work of Apoorva et al. was very similar with our own study however their study was for six days whereas our study was for six weeks.¹⁷ The similar results found in the two separate researches is an affirmation of the authenticity of the findings. However, Hatefi et al. though it was on nonspecific low back pain report-

Table 2. Mixed Method ANOVA comparing the METG and SSG pretreatment, third week and sixth week mean values of pain intensity and neck disability, N= 50 *

Variables	METG				SSG				p
	Pre Rx	W3Rx	W6Rx	Change	PreRx	W3Rx	W6Rx	Change	
PI	6.42 (1.31) ^a	3.92 (0.90) ^b	2.00 (1.92) ^c	4.37 (4.40)	6.00 (0.74) ^d	3.83 (0.94) ^e	1.66 (0.98) ^f	4.34 (0.154)	<0.0001
NDI	18.00 (6.42) ^g	11.50 (4.1) ^h	5.25 (2.52) ⁱ	12.75 (3.4) ^j	19.83 (6.65)	12.33 (6.38) ^l	6.33 (3.33) ^m	13.50 (1.01)	<0.0001

* METG – muscle energy techniques group, SSG – static stretching group, Rx – treatment, W – week, indicate significant at $p<0.001$. Post-hoc List of Significant Difference: mean mode with the same superscript (a,b,c,d -----) show no significant difference but mean mode with different superscript shows significant different

ed improvement in pain intensity using static stretching exercises which was in agreement with our study.³⁹

Recommendation

There may be an interaction between the treatment effects of conventional exercise program and muscle energy technique/ static stretching. Therefore, the results could demonstrate only the relative effectiveness of the two protocol. To find out whether each program was indeed effective in treating mechanical neck pain, further studies are required.

Limitation

There was no blinding in the study. This may have influence on the assessment of outcome measures. The use of methyl salicylate as massage medium could have effect on the outcome measure especially pain intensity. However, massage was carried out for the two groups. The effect may be generalized.

Conclusion

It can be concluded from the study that both Muscle Energy Technique and Static Stretching are effective in improving pain intensity and functional disability in patients with mechanical neck pain. However, MET reduces both disability more than SS while SS reduces pain more than MET.

Declarations

Funding

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Author contributions

Conceptualization, A.O.O. and I.B.; Methodology, A.O.O. and I.B.; Software, A.O.O.; Validation, I.B. and K.K.; Formal Analysis, A.O.O.; Investigation, K.K.; Resources, I.B.; Data Curation, I.B.; Writing – Original Draft Preparation, A.O.O. and I.B.; Writing – Review & Editing, A.O.O.; Visualization, K.K.; Supervision, A.O.O.; Project Administration, I.B. and K.K.; Funding Acquisition, I.B. and A.O.O.

Conflicts of interest

The authors declare no conflict of interest.

Data availability

Data supporting the results of this study shall, upon appropriate request, be available from the corresponding author.

Ethics approval

Approval of the Health Research and Ethical Committee, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife (no.:IRB/IEC/0004553; NERC/27/02/2009a) was obtained for the study

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