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Global Postural Exercise Program Versus Muscle Energy Technique on Management of Temporomandibular Joint Disorders

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Abstract

Objective: *To compare between the effects of global postural exercise program against muscle energy technique on maximum pressure pain threshold, maximal mouth opening range of motion as well as quality of life on patients with temporomandibular joint disorders. Methods: 63 patients having temporomandibular disorders were randomized into three groups; Group (A) were given global postural exercise program in addition to conventional therapy (in the form of LASER and hot packs), Group (B) were given muscle energy technique as well as traditional therapy and the Group (C) control were given traditional therapy only. All patients were examined by the pressure algometer, paquimeter and Arabic version of Oral health impact profile 14 questionnaire as well as the duration of treatment were 6 weeks. Results: there were no significant statistical differences revealed pretreatment for all variables, Mmaximal mouth opening range of motion, quality of life scale, as well as pain) as in mouth opening (P=0.130), OHIP-14 (P=0.642), right temporalis muscles (P=0.384), left temporalis muscles (P=0.930), right masseter muscles (P=0.790), left masseter muscles (P=0.064), right trapezius muscle (P=0.403), and left trapezius muscle (P=0.058) among groups where (P>0.05). While after-treatment and follow up , there were significant statistical differences were P value was (P<0.05), in mouth opening (P=0.0001 and P=0.0001, respectively), OHIP-14 (P=0.0001 and P=0.0001, respectively), right temporalis muscles (P=0.035 and P=0.020, respectively), left temporalis muscles (P=0.0001 and P=0.0001, respectively), right masseter muscles (P=0.001 and P=0.0001, respectively), left masseter muscles (P=0.004 and P=0.035, respectively), right trapezius muscle (P=0.0001 and P=0.0001, respectively), and left trapezius muscle (P=0.031 and P=0.001, respectively) between groups. Conclusion: Both Muscle energy technique and global postural exercise program improved mouth opening, pressure pain threshold, as well as quality of life in temporomandibular joint disorders patients, with the superiority of muscle energy technique over global postural exercise program.*

Keywords: *Temporomandibular disorders, Global postural exercise program, Muscle energy technique, Paquimeter, Oral health impact profile 14.*

1. Introduction

Temporomandibular disorders, or TMD, are a heterogenous group of musculoskeletal as well as neuromuscular diseases affecting the temporomandibular joint complex. Signs and symptoms of TMD include clicking sounds in the jaw, pain during mandibular motion, restriction of mandibular motion, headaches, and pain in the face and neck [1]. About 5-12% of the population suffers from TMD [2].

Myofascial pain and dysfunction represent the most frequent form of TMD, followed by internal derangement as well as osteoarthrosis [3, 4].

Acceptance of a complex etiology for TMD has led to the identification of risk factors including as exaggerated muscle tension, parafunctional clenching as well as grinding, traumatic joint overuse, and bruxism [5]. It's also important to take into account the role that psychological disorders like anxiety and depression can have in the onset and/or worsening of pain [6]. An increase in the prevalence of TMD symptoms may result from the current COVID-19 epidemic, which will interact with the population's mental and emotional health [7].

Recent years have seen the introduction and widespread use of a new form of exercise called "Global Postural Re-education" (GPR) by physicians all over the world [8]. By enhancing body awareness as well as postural control management, the GPR program aims to restore muscle function and decrease postural abnormalities [9].

TMD severity was reduced, neck pain was alleviated, mouth opening was increased to its maximum without pain, and overall quality of life was enhanced after GPR [10].

Muscle Energy Technique (MET) is a form of active osteopathic manipulative treatment method that engages restricting barriers without focusing on the system. In a study that compare participants who received postural training versus subjects only using awareness, MET was found to have an impact on the vertical range of motion opening of the mandible of the temporomandibular joint while also helping correct the forward head posture (FHP). Significant enhancements were seen in the TMD severity, alleviation of TMJ and neck pain, maximum mouth opening without pain, as well as number of TMD symptoms in the postural training group [11].

Symptom severity was reduced, pain thresholds were raised in the assessed muscles, and quality of life was enhanced in a study using GPR [12]. Muscle technique as well as ultrasound, according to (Lindasy, 2007), can increase jaw ROM, decrease the severity and frequency of pain from the temporomandibular joint, and all without resorting to surgery or medication. The muscle energy treatment improved the patient's FHP and increased the temporomandibular joint vertical ROM [14].

However, there is a gap in literature about any clinical trial that detected the most beneficial effect either GPEP or MET to treat TMD, hence this trial was conducted.

Subjects and methods

Sample size

Analyses and computations for G power 3.1 software was used to calculate the sample size for the primary outcome measure related to pain scores. We used an effect size of 0.723, an alpha of.05, and a desired power of 80% in our calculations. A total of 54 participants had been calculated for the study. An overall of of 63 individuals were enrolled in the study to account for dropout before the end of the study.

Randomization and blinding

Patients were randomized into 1st experimental group (Group A) global postural exercise program in addition to conventional therapy), 2nd experimental group (Group B) MET as well as traditional therapy or traditional therapy only (control group C) using computer-generated random block randomization. The block sizes were 3 and 6 and the allocation ratio was 1:3 to avoid bias and variability between groups. Utilizing sealed opaque envelopes, the concealed allocation was completed by the fourth author who was not engaged in data collection and treatment of the participants. Baseline measurements were applied by the first author and after measurements; The 1st author opened the sealed envelopes and continued therapy according to with the group's allocation.

Randomized experimental control trial (Pre-test -post-test design) conducted in the physical therapy department at Ahmed Maher teaching hospital Cairo from October 2022 to October 2023. The Patients were referred from maxillofacial department diagnosed as TMD to the physical therapy department at Ahmed Maher teaching hospital in Cairo.

Informed consent: All patients who participated in the study provided written informed consent.

Ethical approval: The Ethical Committee for Human Research at the Faculty of Physical Therapy at Cairo University in Egypt approved the study (P.T.REC/012/003000) and registered at Pan African Clinical Trials Registry (PACTR202111486684050).

Outcome Measures

At baseline, every measurable outcome was evaluated and after six weeks then followed up after 3 months. The outcome measures were maximal mouth opening ROM, pressure pain threshold, and quality of life

Assessment procedure:

1 -Pressure pain threshold was Evaluated by pressure algometer. To assess tender points, a pressure probe was utilized to determine the pain threshold for the Force One gauge-model (Egyptian Algometer 0.1) It is a reliable and valid way to assess PPT [15]. A pressure algometer uses a probe to evaluate the force exerted on tissues, also known as a noxious stimulus. This was a pressure gauge with a 1 cm diameter probe area, in which 1.0 kg of a constant pressure was supplied at each of six separate points. These points were situated, on both sides of the body, in the upper trapezius (middle) region, the masseter muscle, as well as the temporalis muscle. Each step was performed no more than three times in each location within 20 second intervals, as well as the mean was used in the study.

2-Maximal Mouth opening (MMO) range of motion was measured by Paquimeter (vernier caliper)

A Vernier caliper is a measuring tool that can determine the linear dimension (length) of an object to within a tenth of a millimeter. It has a larger jaw to measure outer measurements and a smaller jaw for measuring inside dimensions, both of which are fitted with fixed scales as well as a sliding (Vernier) scale, respectively. The maximum midline opening (MMO) was determined by having each participant open their mouth as widely as possible and having the examiner measure the midline distance between the incisal edges of the maxillary as well as mandibular central incisors. Three measurements in millimeters were taken for each individual, and the mean was used. While standing with the subjects' heads supported against a solid wall, the MMO measurements were collected with a modified Vernier caliper [16].

3- Quality of life by utilizing Arabic version of Oral health impact profile 14 (OHIP-14).

Consists of 14 questions designed to assess seven factors related to an individual's quality of life (QoL): functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, social disability, as well as handicap. There are two questions for each dimension. The frequency with which the subjects experienced adverse effects in these categories will be surveyed. The following five-point Likert scale will be used to record your responses to the questions: 0, never; 1, hardly ever; 2, occasionally; 3, fairly often; 4, very often. Total OHIP-14 scores might be anything from 0 to 56 points, depending on how many questions were answered. [17,18] Utilizing the back-translation method, the original English OHIP-14 was translated into Arabic and modified for the target language and culture [19].

Intervention

Group A received GPEP (Table 1) 8 exercises were last for 6 weeks. Exercises were conducted two times a week for six weeks and every session with a duration of 45 min in addition to the conventional modalities LASER, and hot application. Group B received MET (Table 2), reciprocal inhibition and post isometric relaxation for muscles of mastication mainly (masseter and temporalis) 3 Times/ week for six weeks the duration of each contraction 10 sec repeated for 5 times in addition to the conventional modalities LASER, and hot application. Group C control group were given traditional therapy.

Conventional therapy

All groups were given Conventional therapy. `

1- Electric heating pad directly on the face at 42 degree of temperature for 20 min. before the treatment procedure.

2- Red probe diode laser by using digital therapy laser system with these parameters (685 nm, 25 mW, 30 s, 0.02 Hz, and 6.2 J/cm2) was utilized in TMJ region at three spots in the extraoral regions. The trigger points of temporalis muscle, masseter muscle and point over the temporomandibular joint that were previously determined for pressure algometer. `These applications were made for 3 min. for each point in three sessions per week for six weeks for each patient.

Statistical analysis

The SPSS Package, Version 25 for Windows (SPSS Inc., Chicago, IL) was used to do the statistical analyses. In this study, we describe age and the three primary outcomes (mouth opening, quality of life scale, as well as pain) as means and standard deviations. Categorical data on gender are expressed as a percentage and compared across categories using the Chi-square statistic. The ages of the patients were compared across the three groups using a one-way ANOVA-test. The dependent main variables (mouth opening, quality of life scale, as well as pain) were tested using a 3 x 3 mixed design MANOVA-test, with the tested group (Group A, Group B, and Group C) serving as the 1st independent variable (between subject factors), as well as the measuring periods (pre-treatment, post-treatment, and follow-up) serving as the second independent variable (within subject factors). Pairwise comparisons within as well as between groups on the examined variables with a significant P-value from the MANOVA test were subjected to the Bonferroni adjustment test. The results of every statistical test were statistically significant ($P \leq 0.05$).

Results and Discussion

The flowchart for the study is revealed in Figure (1) which demonstrated 63 patients were chosen from physical therapy department at Ahmed Maher teaching hospital in Cairo, referred from maxillofacial department with temporomandibular joint disorders and participated in this study that were eligible to take-part in the study and were randomized into three groups at random. 21 in each group. Nine participants were dropped out as four of them refused to take part and five decided to undergo for Botox injection for masticatory muscles. So, fifty-four people were eligible to participate in the study and were assigned to three groups at random. They were allocated to assessment, maximal mouth opening, maximum pressure pain threshold, and Arabic version of Oral health impact profile 14 (OHIP-14), were assessed before intervention. The 1st group was group (A) received GPEP plus traditional therapy, group B received MET as well as traditional therapy and group C received traditional therapy only. The outcome measures were assessed after intervention and followed up after 3 months.

Table 3 showed Patient clinical general characteristics between groups, there were no significant differences (P>0.05) in patients mean age (P=0.706) and gender distribution (P=0.850) among groups A, B, and C

Within- Groups Effects:

Statistical comparison within each group (Table 4) for outcome variables (mouth opening, quality of life scale, and pain) showed that there were significant differences (P<0.05) in mouth opening and OHIP-14 among before-treatment, post-treatment, as well as follow up within group A (P=0.0001 and P=0.0001, respectively), group B (P=0.0001 and P=0.0001, respectively), and group C (P=0.0001 and P=0.002, respectively). Right temporalis muscles differ significantly (P<0.05) among before-treatment, after-treatment, and follow up within group A (P=0.0001), group B (P=0.0001) and group C (P=0.0001). Moreover, left temporalis muscles significantly (P<0.05) affected among before-treatment, after-treatment, and follow up within group A (P=0.0001) and group B (P=0.0001), but not affected (P>0.05) by group C (P=0.740). There were significant differences (P<0.05) in right and left masseter muscles among before-treatment, after-treatment, and follow up within group A (P=0.0001 and P=0.0001, respectively) and group B (P=0.0001 and P=0.0001, respectively), moreover, group C affected significantly (P<0.05) on right masseter muscles (P=0.007), but not affected on left masseter muscles (P=0.369). Right and left trapezius muscle differ significantly (P<0.05) among before-treatment, after-treatment, as well as follow up within group A (P=0.0001 and P=0.0001, respectively) and group B (P=0.0001 and P=0.0001, respectively) nevertheless, no effect on right and left trapezius muscle was observed due to group C (P=0.360 and P=0.459, respectively)

Among groups effect:

Statistical comparison among 3 groups (Table 5) for outcome variables (mouth opening, quality of life scale, and pain) revealed that at pre-treatment no significant difference (P>0.05) in mouth opening (P=0.130), OHIP-14 (P=0.642), right temporalis muscles (P=0.384), left temporalis muscles (P=0.930), right masseter muscles (P=0.790), left masseter muscles (P=0.064), right trapezius muscle (P=0.403), and left trapezius muscle (P=0.058) among groups. At post-treatment and follow up, there were significant differences (P<0.05) in mouth opening (P=0.0001 and P=0.0001, respectively), OHIP-14 (P=0.0001 and P=0.0001, respectively), right temporalis muscles (P=0.035 and P=0.020, respectively), left temporalis muscles (P=0.0001 and P=0.0001, respectively), right masseter muscles (P=0.001 and P=0.0001, respectively), left masseter muscles (P=0.004 and P=0.035, respectively), right trapezius muscle (P=0.0001 and P=0.0001, respectively), and left trapezius muscle (P=0.031 and P=0.001, respectively) among groups. Statistical multiple pairwise comparison tests (pre-treatment vs. post-treatment).

Follow up results Table 6:

For outcome variables (mouth opening, quality of life scale, and pain) within every group showed that there were significantly (P<0.05) increased in mouth opening, right temporalis muscles, and right masseter muscles after-treatment in comparison with to pre-treatment within group A

(P=0.0001, P=0.0001, and P=0.0001, respectively), group B (P=0.0001, P=0.0001, and P=0.0001, respectively), and group C (P=0.0001, P=0.003 and P=0.015, respectively). Moreover, there were significantly (P<0.05) improvement in left temporalis muscles, left masseter muscles, right trapezius muscle, and left trapezius muscle at after-treatment in comparison with pre-treatment within group A

(P=0.0001, P=0.001, P=0.0001, and P=0.0001, respectively), group B (P=0.0001, P=0.0001, P=0.0001, and P=0.0001, respectively), but insignificantly (P>0.05) increased within group C (P=1.000, P=0.596, P=0.694, and P=0.791, respectively). The OHIP-14 significantly (P<0.05) declined at post-treatment compared to pre-treatment within group A (P=0.0001), group B (P=0.0001), and group C (P=0.002). These significant differences in mouth opening, quality of life scale, and pain at post-treatment are favor of the muscle energy technique (group B) than global postural exercise program (Group A) and control group (group C). Moreover, the patients who received muscle energy technique program (Group B) improved higher mouth opening, quality of life scale, and pain followed by patients received global postural exercise program, and then those received control.

This study was carried-out to compare between the impact of the GPEP against MET on the maximal pain threshold, maximal mouth opening ROM, as well as quality of life for TMD patients.

The findings of the study revealed that both the GPEP and MET had significant effects on pain reduction, improvement in maximal mouth opening ROM, as well as quality of life in patients with TMD. The GPEP group demonstrated a statistically significant decline in pain scores, increase in maximal mouth opening ROM, and improved quality of life as evaluated by the OHIP-14 questionnaire. Similarly, the MET group also demonstrated a statistically significant decline in pain scores, improvement in maximal mouth opening ROM, and enhanced quality of life in comparison with the control group with superiority of MET group over GPEP.

Muscle energy technique incorporates specific movements and techniques to mobilize the TMJ and surrounding structures. The application of gentle forces during muscle contractions helps to improve joint mobility, reduce joint restrictions, and alleviate pain associated with restricted movement [20]. Muscle energy technique may also influence pain perception through mechanisms including the gate control theory and descending pain modulation pathways. The active muscle contractions during MET may stimulate proprioceptors and mechanoreceptors, which can inhibit pain transmission and modulate pain signals in the central nervous system. [21]

Several studies have reported positive outcomes regarding the significant impact of MET on pain, ROM, as well as function in patients with TMD. Our study came in agreement with [Trivedi. etal., 2016] who compared the effectiveness of MET in a group and myofascial release (MFR) in another group. Both MET along with MFR are effective in decreasing pain and enhancing ROM in chronic TMJD patients. However, MET was found to be superior to MFR. MET led to a significant reduction in pain levels and improved jaw ROM compared to a control group. The authors attributed these positive outcomes to the muscle relaxation and joint mobilization effects of MET.

Our findings were consistent with those of Viswas, 2011, who studied the impact of MET on temporomandibular joint dysfunction by measuring pain levels and MMO at baseline as well as the end of every week of treatment. At the conclusion of each week, pain was significantly reduced (p<0.05) as measured by the VAS, and this effect continued throughout the study. There was a statistically significant increase in ROM as measured by the MMO from the baseline to the end of every week.

Hence the MET had an effect on decreasing pain and improving MMO it subsequently improve the quality of life to patients with TMD.

However, our study did not agree with [Gosling and Fori, 2004], as our results were inconsistent with the work of a number of authors that MET can alleviate pain and is an efficient method of releasing tension in the muscles. These discrepancies may have various causes. This study may not have employed a large enough sample to see statistically significant results. It's also possible that just one treatment (whether it be MET or therapeutic jaw exercises) wasn't enough to make a significant difference.

The general postural exercise targets the correction of postural imbalances and deviations that can contribute to TMD. By addressing poor posture and alignment, the program aims to alleviate stress and tension on the temporomandibular joint (TMJ) and surrounding muscles, leading to pain reduction and improved function [25]. The general postural exercise incorporates specific exercises that target the muscles involved in jaw movement and posture. These exercises aim to strengthen weak muscles, release tension in overactive muscles, and improve the coordination and balance of muscle activity around the TMJ. By restoring proper muscle function. [26]

The general postural exercise includes exercises that enhance proprioceptive awareness, which is the body's ability to sense and perceive the position and movement of muscles and joints. By improving proprioception, the program aims to enhance motor control and coordination, leading to more efficient and pain-free jaw movement [27].

Our study came in agreement with [Wercwerth, 2016] applied on 30 women with TMD, Women with TMD who had a six-week GPEP reported a reduction in pain across all assessed muscles and areas, as well as an increase in mouth-opening range of motion.

Our findings are also consistent with those of [Andrelloetal.,2010], which examined twenty people with TMD and postural abnormalities. Ten sessions of 45 minutes of GPR were performed once per week for a total of 10 weeks. Significant reductions in orofacial pain intensity were observed, as were increases in the proportion of people who are depressed (from 10% to 35%) and the proportion of people whose physical symptoms are normal (with the exception of pain items), between 30% to 55%.

Unfortunately, our study came in contrast with A systemic review done by [Ferreira etal., 2016] showed that Although GPEP is not the best treatment available, it is preferable to doing nothing at all. There are not enough trials to determine whether or not GPEP is more effective than a placebo. Future research may alter the impact of GPEP in musculoskeletal diseases, as the quality of the available evidence varies from low to extremely low. No statistically significant differences in decreasing pain or ROM were seen between the GPEP group and the control group in the studies that assessed its efficacy in a small sample of TMD individuals.

Our results agree with the theory that supports the superiority of MET is the targeted muscle activation and relaxation it offers. MET involves active contractions of specific muscles against resistance provided by the therapist. This targeted muscle activation can help in releasing muscle tension, promoting relaxation, and improving muscle function around the TMJ. By focusing on specific muscle groups, MET may provide more precise and effective outcomes in terms of pain reduction and ROM improvement compared to GPEP, which may have a more general approach to muscle engagement [31]

Fortunately, our study came in line with that MET incorporates techniques that involve joint mobilization. By applying controlled forces during muscle contractions, MET aims to improve joint mobility and alleviate joint restrictions. This aspect of MET may be advantageous in addressing specific joint dysfunctions associated with TMD. In contrast, GPEP primarily focuses on postural realignment and muscle balance, and its impact on joint mobilization may be less direct or specific [32]

Also, our results were supported with another theory that superiority of MET is its potential for enhanced proprioceptive stimulation. During MET, active muscle contractions stimulate proprioceptors and mechanoreceptors, which have a role in the perception of joint position and movement. This heightened proprioceptive input may contribute to improved motor control, coordination, and joint stability. Enhanced proprioception can be beneficial in addressing the underlying dysfunctions related to TMD a and improving functional outcomes [33]

Muscle energy technique can be used in conjunction with other therapeutic modalities and exercises, providing a potential for synergistic effects. This may allow therapists to combine MET with other interventions, including manual therapy, stretching, or strengthening exercises, to optimize treatment outcomes. By integrating multiple approaches, MET may offer a more comprehensive treatment strategy that targets various aspects of TMD [34].

Limitations

The results may not be generalizable because nine patients dropped out of the research. Increased statistical power and validity could be achieved with a bigger sample size.

Conclusion

The results of the study revealed that both the GPEP as well as MET had significant effects on pain reduction, improvement in maximal mouth opening ROM, as well as quality of life in patients with TMD. The GPEP group demonstrated a statistically significant decline in pain scores, increase in maximal mouth opening ROM, and improved quality of life as evaluated by the OHIP-14 questionnaire.

Similarly, the MET group also demonstrated a statistically significant decline in pain scores, improvement in maximal mouth opening ROM, in addition to enhanced quality of life compared to the control group with superiority of MET group over GPEP.

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