Original article (short paper)

The effects of a global postural exercise program on temporomandibular disorder

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Abstract — Changes in the suboccipital muscles and the hamstrings may interfere with head posture and the biomechanics of the temporomandibular joint, both of which contribute to the severity of temporomandibular disorders (TMD). The objective of this investigation was to evaluate the effects of a global postural exercise program (GPEP) on pain intensity and mouth-opening range of motion (ROM) in women with TMD. The participants were comprised of 30 women with TMD who were divided into two groups: an experimental group (EG) and a control group (CG). A pressure algometer was used for pain assessment and a paquimeter was used to measure ROM. The duration of the GPEP was six weeks. In the EG, there was a reduction in pain intensity and an increase in mouth-opening ROM compared to the CG. Therefore, we concluded that the GPEP was effective in relieving pain in all of the evaluated muscles and regions, and in increasing mouth-opening ROM in women with TMD.

Keywords: temporomandibular joint; facial pain; range of motion

Introduction

Temporomandibular disorders (TMD) are a group of disorders with signs and symptoms that include joint noises, such as clicking and crepitus (grating), pain in the masticatory muscles, limited jaw movements, craniofacial pain, and temporomandibular joint (TMJ) pain[1].

TMD may involve alterations in the cervical roots, leading to pain in the cervical spine, craniofacial pain, and decreased mouth-opening range of motion (ROM)[2-4]. In addition, TMD are the major cause of non-dental orofacial pain[5-7].

Epidemiological investigations have shown that 40% - 75% of the population present with at least one TMD sign, such as joint noise, and 33% present with at least one TMD symptom, such as facial or joint pain[8-10].

Some researchers have investigated the relationship between TMJ and several changes in different parts of the human body, e.g., the suboccipital muscles and the hamstrings[11,12].

Myofascial chain tightness in any of the aforementioned parts of the body may interfere with head posture and TMJ biomechanics, which may in turn contribute to the severity of TMD[11,13].

Global postural exercises have been shown to contribute to pain relief and increase muscular strength, muscle chain stretching, and balance in young, sedentary women[14]. Therefore, the aim of this study was to assess the effects of a global postural exercise program on pain intensity and mouth-opening ROM in women with TMD.

Method

Design and ethical aspects

This study was a randomized controlled clinical trial, which was conducted at the Manual Therapy and Research Lab at the Universidade do Sagrado Coração (USC), in the city of Bauru/SP/Brazil. The research project was approved by the USC Research Ethics Committee (protocol number 541.201).

Participants

Sixty women who were diagnosed with TMD from the Dentistry and Physical Therapy School at USC were selected according to the inclusion and exclusion criteria.

The inclusion criteria were a diagnosis of TMD, according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[15], and the absence of any physical functional impairment that could prevent participation in the exercise program.

The exclusion criteria were participation in another exercise program, and treatment with painkillers or anti-inflammatory medications during the intervention period. According to the above criteria, 25 volunteers were unable to participate in the study. Consequently, 35 women were randomly selected into the exercise-experimental group (EG) and 17 into the control-inactive group (CG). During the course of the study, three subjects left the EG and two subjects left the CG, as shown in *Figure 1.*

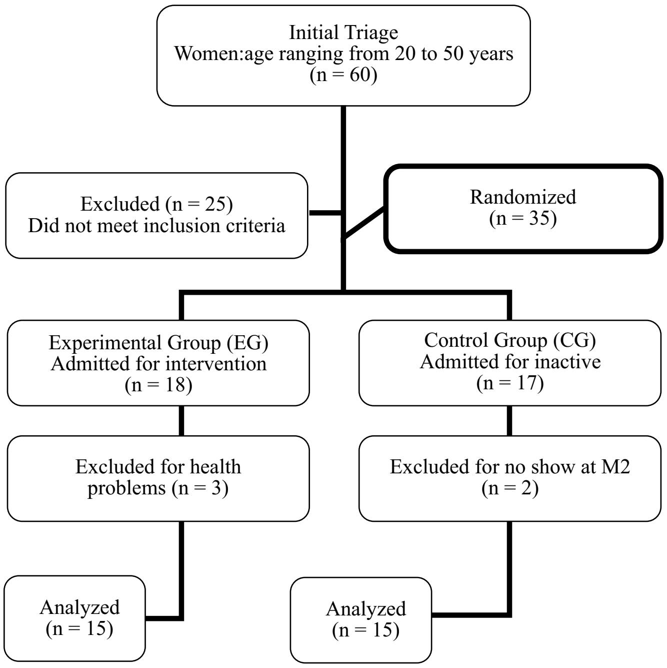

Figure 1.Randomization and subject follow-up.

Procedure

The participants were individually assessed at the Physical Therapy Research Lab at USC. Data on age, life habits, and health conditions were gathered. To measure pain, a mechanical pressure algometer was used (Palpeter®).

This consisted of a pressure gauge with a probe area, 1cm in circumference, through which a constant pressure of 1.0 kg in seven different locations was applied. These locations were bilaterally located on the temporalis muscle (anterior, middle, and posterior fibers), the superficial masseter (origin, body, and insertion), and the upper trapezius (middle part).

A pressure of 0.5 Kg was applied in three locations bilaterally, the submandibular region, the digastric muscle, and the lateral pole of the TMJ. Each procedure was repeated a maximum of three times in each location.

The pain intensity at each location was reported by the subjects as follows: 0 = no pain, only pressure; 1 = mild; 2 = moderate; and 3 = severe[15]. A paquimeter (JOMARCA®) was used to measure mouth-opening ROM. The subjects were seated, and the head was aligned with maximal active mouth opening. The paquimeter was positioned on the upper and lower central incisors (11, 21, 31 e 41) in accordance with a previous study[2].

The subjects in the EG were then submitted to a global postural exercise program (GPEP).The GPEP lasted for six weeks. Exercises were performed twice weekly for six weeks and each session had a duration of 45 min.

The exercises, which consisted of stretching of the vertebral column posterior muscle chain and the lower limbs, were associated with prolonged expiration techniques and self-stretching. In each session, a series of eight types of exercises were performed as follows: Exercise 1–supine position, hip flexion of one lower limb and hip extension of the other with dorsiflexion of the ankle, a total of three sets of 15 s each. Exercise 2–supine position, bilateral extension of the lower segments against the wall with ankle dorsiflexion, holding the position for 5 min. Exercise 3–supine position, one lower limb with foot dorsiflexion leaning on the wall and the contralateral segment resting, a total of three alternate sets of 15 s. Exercise 4–supine position, bilateral hip external rotation with knees flexed, feet leaning on the wall, holding the position for 5 min. Exercise 5–seated with vertebral spine against the wall, one flexed knee and the other extended, a total of three alternate sets of 15 s each. Exercise 6–seated with vertebral spine against the wall, knees extended, and feet in dorsiflexion, holding the position for 5 min. Exercise 7–seated with no support of the torso, and one knee flexed and the other extended, a total of three alternate sets of 15 s each. Exercise 8–seated position, with no support of the torso, and the knees extended with foot dorsiflexion, holding the position for 5 min.

At the end of the postural exercise program, a final assessment of the participants (M2), with the same procedures as the initial assessment (M1), was performed.

Data collection and analysis

The data obtained in the study were expressed as mean and standard deviations. The Mann-Whitney U-test was used to compare the groups and the Wilcoxon rank test was used to compare M1 and M2. A significance level of 5% was considered to be statistically significant.

Results

The casuistry consisted of 30 women (mean age: 36.2 ± 9.8 years) who were apparently healthy, sedentary, and not taking painkillers or anti-inflammatory medications. Table 1 shows the mean and standard deviation values, the respective results of statistical testing on muscle pain intensity [temporalis (posterior, middle, and anterior portions), masseter, trapezium, submandibular area, digastric, and the lateral pole of the TMJ], and comparisons between the EG and CG groups.

The EG moments showed statistically significant differences ($p < 0.05$) in the pain intensity of all variables studied. The CG moments did not show statistically significant differences in pain intensity, apart from the submandibular area. On comparison of the groups, there were no statistically significant differences in the superior portion of the left masseter, the inferior portion of the right masseter, the right trapezius, the temporalis muscle, the right digastric muscle, or the lateral pole of the TMJ.

Table 1. Descriptive values for assessment of pain intensity in temporalis, masseter, trapezius, the submandibular area, digastric, and the lateral pole of the TMJ in the respective groups and the assessed moments.

	Moments	Groups	Left	Right
TP	M1	Control	0.46±0.9C	0.53±0.7C
		Experimental	1.53±1.2Aa	1.53±1.3Aa
	M2	Control	0.60±0.9C	0.66±0.9C
		Experimental	0.60±0.7Ba	0.46±0.6Ba
TM	M1	Control	0.86±0.9C	0.53±0.7C
		Experimental	1.60±1.2Aa	1.53±1.1Aa
	M2	Control	0.80±0.9C	0.66±0.9C
		Experimental	0.60±0.6Ba	0.60±0.5Ba
TA	M1	Control	0.66±0.7C	0.66±0.9C
		Experimental	1.5±1.2Aa	1.6±1.1Aa
	M2	Control	0.73±0.9C	0.80±0.9C
		Experimental	0.40±0.6Ba	0.53±0.7Ba
OM	M1	Control	1.13±0.9C	1.20±0.6C
		Experimental	0.20±1.1Aa	1.86±1.1Aa
	M2	Control	1.20±0.7C	1.46±0.9C
		Experimental	0.66±0.6Ba	0.46±0.6Bb
BM	M1	Control	1.40±1.2C	1.53±1.1C
		Experimental	2.0±1.1Aa	2.20±1.1Aa
	M2	Control	1.73±1.1C	1.66±1.0C
		Experimental	0.80±0.6Bb	0.60±0.6Bb
IM	M1	Control	1.4±1.1C	1.60±1.1C
		Experimental	2.26±0.9Aa	2.33±0.9Aa
	M2	Control	1.46±1.8C	1.33±0.9C
		Experimental	0.60±0.8Bb	0.66±0.6Ba
TM	M1	Control	1.20±0.9C	1.13±1.0C
		Experimental	1.93±1.1Aa	1.7±1.1Aa
	M2	Control	1.4±0.9C	0.93±0.8C
		Experimental	0.46±0.7Bb	0.60±0.6Ba
SMA	M1	Control	1.0±1.1C	0.53±0.9C
		Experimental	1.53±1.1Aa	1.73±1.2Aa
	M2	Control	1.46±1.1D	1.1±0.9D
		Experimental	0.3±0.4Bb	0.33±0.6Bb
DM	M1	Control	0.93±1.1C	1.0±1.3C
		Experimental	1.80±1.1Aa	1.8±1.1Aa
	M2	Control	1.13±1.5C	1.06±1.1C
		Experimental	0.33±0.4Bb	0.33±0.4Ba
LPR	M1	Control	0.73±1.1C	0.53±0.9C
		Experimental	1.66±1.4Aa	1.7±1.4Aa
	M2	Control	0.93±1.2C	0.8±1.0C
		Experimental	0.66±0.8Ba	0.80±0.8Ba

M1: initial assessment; M2: final assessment; TMPF: Temporalis Posterior; TMMF: Temporalis Middle; TMAF: Temporalis Anterior; OM: Origin of Masseter; BM: Body of Masseter; IM: Insertion of Masseter; TM: Trapezius Muscle; SMA: Submandibular Area; DM: Digastric Muscle; RAPL: Lateral Pole Region. Different upper case letters indicate a statistically significant difference when comparing groups concerning M1 and M2 (Wilcoxon Test). Different lower case letters indicate a statistically significant difference when comparing M1 and M2 concerning groups (Mann–Whitney test).

Table 2. Descriptive values on maximal mouth-opening range of motion in the respective groups and the assessed moments.

Moment	Groups	Mouth ROM (cm)
M1	Control	43.80±8.1C
	Experimental	36.27±10.9Aa
M2	Control	43.20±7.3C
	Experimental	41.87±7.8Bb

M1: initial assessment; M2: final assessment; cm: centimeters; ROM: range of motion. Different upper case letters indicate a statistically significant difference when comparing groups concerning M1 and M2 (Wilcoxon Test). Different lower case letters indicate a statistically significant difference when comparing M1 and M2 concerning groups (Mann–Whitney test).

Table 2 shows the mean and standard deviation values, the respective results of statistical testing for maximal mouth-opening ROM, and comparison between the EG and the CG.

When comparing GE moments, there was a statistically significant difference ($p< 0.05$) in maximal mouth-opening ROM. The control group did not show a statistically significant difference. When comparing both groups, there was a statistically significant difference between the EG and the CG.

Discussion

The results of this study suggested that the GPEP significantly contributed to relief in pain intensity of the assessed muscles and increase in maximal mouth-opening ROM in women with TMD, due to the intervention program, which consisted of postural exercises based on a global approach focusing on posterior muscle chain balance.

The craniomandibular system is part of the upper quadrant, which involves the head, neck, and shoulder girdle. Therefore, muscles, ligaments, and TMJ fascia are closely related[11]. Any disorder, occlusal disturbance, postural change, or upper quadrant trauma may lead to problems in those structures or their adjacent components[16].

There is a functional relationship between the masticatory muscles, the paravertebral muscles, the hamstrings, soleus, and gastrocnemius, in addition to ascendant inhibitory coactivation as a result of the stretch reflex[11]. In light of this, the exercise program that was used in this study contributed to anti-gravitational postural adaptation because it used exercises in both the lying and sitting positions. A previous study compared subjects who received postural training and subjects with just awareness.

The postural training group showed significant improvements with decreased TMD severity, relief of TMJ and neck pain, maximal mouth opening without pain, and fewer TMD symptoms[17]. Another study assessed pain and quality of life in TMD individuals, using global postural re-education (GPR) and static stretching. It was concluded that both techniques were equally efficient in reducing symptom intensity, increasing pain thresholds in the evaluated muscles, and improving quality of life[18].

In addition, another study that examined the effects of inhibitory techniques on suboccipital muscles in individuals with tight hamstrings found a significant difference in the intervention group with a quantitative and gradual increase in lower limb angles[19].

Our findings showed a statistically significant difference between the groups, and a relationship between the TMJ and lower limbs through myofascial chains. Postural adaptations through the myofascial chains seem to explain the findings in the present study, and indicate a functional relationship between the masticatory muscles and other structures, such as the paravertebral muscles and the hamstrings[20].

All of these associations contributed to better positioning of the head and neck, and better structuring of the relationship between the agonist and antagonist muscles, thereby, decreasing pain intensity and improving mouth-opening ROM of the participants.

Strengths and limitations

The strengths of the present study were the methods and assessment tools that were used to measure the variables, and the intervention program. It is known that manual palpation has obvious limitations because it is extremely subjective, and is hard to quantify and standardize, thereby, compromising confidence in the data and research reproducibility.

Therefore, the authors of the present study used a validated pressure algometer to increase confidence in the results of variable pain[21]. In relation to the intervention program, we have highlighted its use in clinical practice. It can be used by several health care professionals, and the detailed description of the exercises makes their reproduction in future research easier.

However, the study has some limitations. Only female subjects participated in the study, which diminishes external validation of this study because the results may not be applicable to men. However, the internal validation for women was increased, which is important when considering that TMD has a greater incidence in women 20-45 years old, approximately 5 times compared to men. Therefore, this justifies the importance of this study, which was only directed toward women.

Conclusion

Based on the results of this study, we concluded that global postural exercises were effective on pain relief in all of the assessed muscles and areas. The exercise program was also effective on mouth-opening ROM in women with TMD. In future study, we recommend reassessing the patients after a period without the exercise program; analyzing other symptoms, such as crepitus, noises, and muscle strength; and comparison with other methods and physiotherapeutic techniques, the use of medication, and dental intervention.

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Manuscript received on March 09, 2016
Manuscript accepted on April 18, 2016