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CLINICAL RESEARCH

Mandibular kinesiographic pattern of women with chronic TMD after management with educational and self-care therapies: A double-blind, randomized clinical trial

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ABSTRACT

Statement of problem. Limited mandibular movements are one of the most important signs of temporomandibular disorders (TMDs) and may cause functional difficulties.

Purpose. The purpose of this double-blind, randomized clinical trial was to evaluate the effect of treatment with only educational or education associated with self-care therapies on the pattern of mandibular movements of women with chronic painful TMDs.

Material and methods. Forty-two women were selected and randomly divided into 3 groups, control group (CG, n=13), education group (EG, n=16), and education and self-care group (ESG, n=13), according to the sequence of treatment they received. A kinesiograph device recorded mandibular movements during maximum mouth opening and mastication at baseline (T0) and at 30-day (T1) and 60-day (T2) follow-up. Kinesiographic data were statistically analyzed using 1-way ANOVA, followed by the Bonferroni test for multiple comparisons of means (α=.05).

Results. The ESG group demonstrated an improvement in the maximum vertical opening (MVO= 5.1 ±3.4 mm; *P*=.012) and anteroposterior mandibular movement (MAM) during maximum opening (7.4 ±9.5; *P*=.019), significantly higher than that of the EG (MVO=1.8 ±3.5 mm; MAM=0.8 ±5.0 mm) and the CG (MVO=0.9 ±3.8 mm; MAM=0.8 ±4.4 mm) after 30 days of follow-up. Moreover, at T1, vertical mandibular movement during mastication was significantly higher in the ESG group (17.4 ±1.7 mm) than in the EG group (15.0 ±2.8, *P*=.027). No significant differences were found between the women who received treatment with educational and self-care therapies for 60 days and the women who received this treatment for 30 days.

Conclusions. In the short-term, education and self-care treatment positively influenced the mandibular movement pattern of women with chronic painful TMDs. (J Prosthet Dent 2016;116:749-755)

Temporomandibular disorders (TMDs) are recognized as a major cause of nondental pain in the orofacial region, negatively affecting oral function and quality of life.[1] TMD main signs and symptoms include pain in the masticatory muscles and temporomandibular joint (TMJ), muscle fatigue, joint sounds, and restrictions or deviations in mandibular movements.[1] Mandibular movement range can be restricted by increased muscle strain and internal derangements of TMJs.[2] Furthermore, the presence of pain due to alterations in arthrogenic and neuromuscular control affects nervous system defense responses and may alter the course and repeatability of the mandibular movements[3-5]; thus, changes in the mandibular

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Clinical Implications

Educational and self-care therapies for the treatment of TMD may reduce the need for irreversible and expensive treatments.

motor activity of individuals with TMDs can be a result of sensitization mechanisms and reflex adaptation.[6,7]

Parafunctional habits, neuromuscular factors, and psychosocial factors (anxiety, depression, and fatigue) are involved in the development and maintenance of the signs and symptoms of TMD.[8] Therefore, treatments that take into account only biomedical factors are often insufficient to promote long-term improvement of TMD.[9,10] Conservative and low-cost treatment approaches involving self-care strategies and behavioral therapies may help relieve musculoskeletal pain and restore mandibular function in individuals with TMDs[11,12] by reducing inflammation, relieving muscle tension, and improving psychological health.[13-17] Counseling and self-care approaches include extensive education about the disorder and the use of heat packs, jaw exercises, guidance in reducing parafunctional jaw activities, and muscular relaxation techniques.

Studies of these treatment approaches show that enforcing patient responsibility, stress management, and reducing harmful behaviors are powerful tools in the control of TMD signs and symptoms.[18,19] For this reason, they have been indicated as initial treatment of almost all TMDs.[17,20] Most studies investigating the impact of treatment with educational and self-care therapies on the pain and mandibular function of individuals with TMDs have used subjective parameters such as questionnaires and a visual analog scale,[14,16,20-22] whereas studies addressing objective analysis are still relatively scarce.[17,23]

Limited mandibular movements are one of the most important signs of TMDs and may cause functional difficulties.[24] The kinesiograph device provides accurate graphic records of mandibular movements and can be used in the diagnosis and objective investigations of the mandibular function of individuals with TMDs.[25-27] The purpose of the present study was to evaluate the impact of treatment with instruction about TMD or education associated with self-care therapies on the mandibular movement pattern of women with chronic painful TMDs, considering kinesiographic parameters. The null hypothesis was that the proposed treatment methods would not influence the pattern of mandibular movements in the women with chronic TMDs.

MATERIAL AND METHODS

The present study was approved by the institutional ethics committee of Araraquara Dental School, São Paulo State University, Brazil (CAAE: 0010.0.199.000-11) and registered in the Registro Brasileiro de Ensaios Clínicos (Brazilian Clinical Trials Registry; http://www.ensaiosclinicos.gov.br/database; identifier: RBR-45yn9v). Two hundred forty-nine women seeking treatment for orofacial pain in the TMD/Occlusion Clinic of the Araraquara Dental School over a 2-year period (2012-2014), were assessed for possible participation in the study. Their medical histories, complaints, and pain characteristics were recorded, clinical observations were made, and muscles and TMJs were examined. Additionally, diagnosis and classification of TMDs were performed according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC-TMD) axes I and II.[28-30] In (somatic) axis I, the clinical condition is diagnosed among individuals with masticatory muscle pain with or without limitation of mouth opening (group I), individuals with disk displacement with or without reduction (group II), and individuals with arthralgia, osteoarthritis, or osteoarthrosis (group III). In the (psychosocial) axis II, an assessment of the psychological state and of TMD-related pain, including degree of chronic pain and incapacity related to pain, is made.

Participants were enrolled based on the following inclusion criteria: they were between 18 and 50 years of age; had a diagnosis of muscle and joint TMD as defined by the RDC-TMD criteria of axis I consisting of groups Ib and II, where group Ib consisted of individuals with a maximal active mouth opening of less than 40 mm; presence of recurrent or constant pain for more than 3 months; had self-reported average jaw pain intensity based on assessment of no less than 3 on a visual analog scale (ranging from 0, no pain, to 10, worst pain imaginable); had grade II or III chronic pain according to RDC-TMD axis II; had received no treatment or insufficient treatment for this painful condition and had not started any treatment for other painful conditions; and manifested presence of natural dentition or fixed prostheses with posterior occlusal stability. Exclusion criteria were severe malocclusions, debilitating systemic diseases, and presence of a cardiac pacemaker (to avoid possible interference with the kinesiograph).

A calibrated researcher dentist (D.A.dG.G.) performed all clinical and functional examinations necessary to diagnose RDC-TMD. Fifty-two women who met the criteria agreed to participate. They were informed verbally about the research, and each participant gave written informed consent before enrollment.

The study was designed as a double-blind, randomized clinical trial with a 60-day follow-up to assess the mandibular movement pattern of women with chronic painful TMD after management with educational and self-care therapies. A sample size was calculated when a convenience sample of 30 women underwent the proposed protocol. Thus, 15 women per group was determined,

Table1. Study groups

Group	First Visit (T0-baseline)	Second Visit (T1-30 d)	Third Visit (T2-60 d)
Control	Kinesiographic assessment	Kinesiographic assessment + Education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions
Educational	Kinesiographic assessment + Education instructions	Kinesiographic assessment + Education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions
Education and Self-Care	Kinesiographic assessment + Education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions

which allowed detection of a minimal significant difference of 5 mm with α=.05 and β=.20. Because losses and drop-outs might occur during the study, 52 women were included.

Participants (n=52, mean [±SD] age was 36.4 ±8.8 years old) were assigned to 1 of 3 independent groups by means of block randomization. One researcher (V.B.P.) was responsible for randomizing the sample by using computer-generated numbers (BioEstat v5.0 software; Federal University of Pará). The CG (n=16, mean [±SD] age: 37.4 ±7.3 years old), the EG (n=18, mean [±SD] age: 34.8 ±6.7 years old), and the ESG (n=18, mean [±SD] age: 36.6 ±10.6 years old) were established according to the sequence of treatment received as described in Table 1. The women were not informed about the type of treatments evaluated in the study or about the existence of different groups.

The outcome variable was mandibular movement pattern as evaluated by means of kinesiographic records. This analysis was performed at baseline (T0), 30 days (T1), and 60 days (T2) and was conducted by the same researcher (G.G.), who was blinded to group assignment.

All instructions on educational and self-care therapies were transmitted by means of a video recording so that all participants received the information in the same way. One researcher (A.R.P.L.) monitored the video sessions and was responsible for clarifying any questions. Participants also received written instructions about TMD education and the sequence of self-care procedures that they should perform daily at home during the follow-up period proposed by the study.

The video of educational instructions addressed general information about TMD. Participants were reassured about the problem, the structures involved, the possible causes, and the good prognosis for these disorders. Furthermore, the video explained self care related to the mandibular muscles, emphasizing that overuse of these muscles could be one of the causes of the signs and symptoms of TMD. Participants were instructed to keep the mandibular muscles relaxed and to avoid harmful oral habits and excessive mandibular movement.

The video on self-care therapies taught a sequence of procedures recommended by the American Academy of Orofacial Pain[31] and considered effective for the relief of pain and control of dysfunction related to TMD. These procedures included thermotherapy to promote pain relief, improve muscle tone, and relax mandibular muscles. Participants were advised to place moist heat pads on the painful muscle for 15 minutes, 3 times per day. Mandibular exercises consisted of controlled movements of the mandible to improve muscle coordination and extension of mandibular movements and to increase muscle strength.[32] In order to stretch the mandibular muscles, participants were instructed to slowly open the mouth with the aid of the thumb and index fingers, until they experienced a sensation of initial pain and then maintain the stretch for 10 seconds; thereafter, they were to open and close the mouth, keeping the tongue on the palate. In addition, participants were told to perform mouth opening with resistance, that is, they should place 1 hand under the chin and force the mandible up, avoiding the opening movement. Coordination exercises consisted of opening and closing the mouth slowly in front of a mirror, trying to make the mandible perform straight movements. All exercises were to be repeated 6 times and performed 3 times per day. Self-massage was meant to promote improvement of local blood circulation and to relieve pain and muscle tension.[33] Thus, participants were instructed to bilaterally massage the masseter and temporal muscles 3 times per day with circular movements performed using the index, middle, and ring fingers.

In order to evaluate participants' adherence to treatment, a telephone interview was conducted every 15 days during follow-up. Participants were asked about compliance with the procedures prescribed, and the information was reinforced.

A kinesiograph device (K7-I Diagnostic System; Myotronics Research Inc) was used to assess the mandibular movement pattern during mouth opening and mastication. This instrument was connected to a computerized system that recorded, displayed, and measured the spatial coordinates of movements in the vertical, anteroposterior, and lateral axes, at 0.1-mm accuracy.[26,34]

Two tracing modes (scans) were selected for recordings: scan 1 recorded mandibular movement limits during maximum mouth opening, and scan 8 recorded

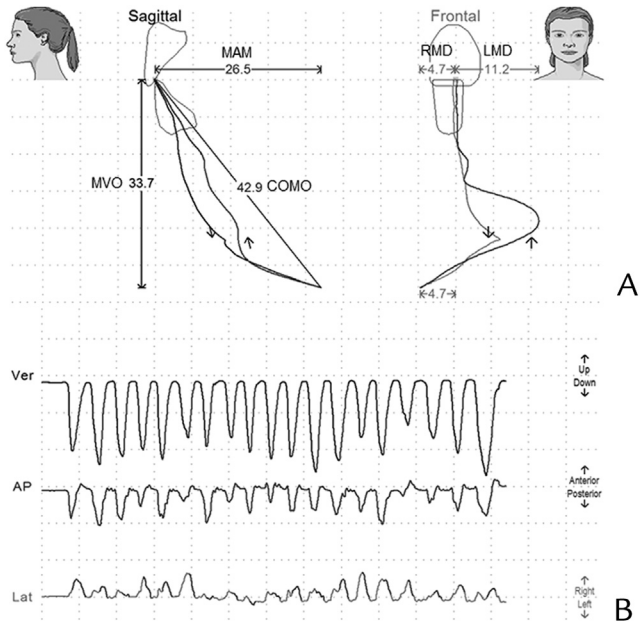

Figure 1. Representative graphic patterns. A, Mandibular movement during maximum mouth opening (scan 1). B, Mandibular movement during habitual mastication (scan 8) on vertical (Ver), anteroposterior (AP), and lateral (Lat) axes. COMO, centric occlusion to maximum opening; LMD, left maximum deviation; MAM, maximum anteroposterior movement from centric occlusion; MVO, interincisal maximum vertical opening; RMD, right maximum deviation.

mandibular movements during habitual mastication. For reliable registration, participants were asked to sit upright in a dental chair with the Frankfort plane parallel to the horizontal plane. A magnet (12×6×3 mm) was attached to the middle line of the mandibular incisors with an easily removable sticky adhesive, such that it did not contact the maxillary teeth at the time of occlusion. The sensor array that recorded mandibular movements was positioned in the participants according to the manufacturer's instructions. To scan 1 record, participants were instructed to slightly occlude the teeth and then perform maximum mouth opening movement, occluding immediately after. To record the masticatory cycle (scan 8), participants were instructed to masticate 5 almonds simultaneously for 20 seconds in the usual way.

Figure 1 shows a representative pattern of mandibular movement during maximum mouth opening and mastication. All procedures were carried out according to the manufacturer's instructions.[26] Three records were made for each scan, and mean values of the extension of mandibular movements were obtained for each axis.

Data were collected by 1 researcher (P.M.S.), and statistical analysis was performed by another (D.O.M.M.). The 1-way ANOVA was used to compare kinesiographic data among the groups, followed by the Bonferroni post hoc test (α=.05). All analyses were carried out using statistical software (PASW v19; SPSS Inc).

The main objective of this study was to determine whether the 3 groups (CG, EG, and ESG) would show different results when compared with each other after 30 days of proposed treatments. Differences among the mean values recorded at T1 and T0 were calculated (ΔT1T0), and these values were compared among the 3 groups.

The second aim of the study was to evaluate the impact of the duration of treatment with education and self-care (30 and 60 days). Thus, a third visit (T2) was made to record data of the 3 groups. At this time, the control and education groups had received the complete treatment (education and self-care) for 30 days and the education and self-care group for 60 days. Therefore, a comparison among groups was performed considering a single time point (T2), without presenting repeated measures.

RESULTS

Figure 2 displays a flow diagram of the participants throughout the course of the research. During follow-up, 17 participants dropped out of the study. Ten participants (3 from the CG, 2 from the EG, and 5 from the ESG group) dropped out after the first evaluation (T0), and 7 participants (4 from the CG and 3 from the EG) dropped out after the second evaluation (T1). Hence, 52 participants were evaluated at baseline (T0), 42 were evaluated after 30 days of follow-up (T1), and 35 were evaluated after 60 days of follow-up (T2). Reasons for dropout included lack of time because of job or family conflicts, illness, and improvement of symptoms.

Kinesiographic measurement data obtained during maximum mouth opening are shown in Table 2. Considering the values of ΔT1T0, improvement in maximum vertical opening (MVO) and anteroposterior mandibular movement (MAM) in the ESG was significantly higher than in the EG and CG. Also, right maximum deviation (RMD) and left maximum deviation (LMD) remained unaltered or increased after the proposed treatments.

Table 3 illustrates comparisons among the groups considering the kinesiographic measurements during mastication. Results showed that, at T1, vertical mandibular movement was significantly higher in the ESG than in the EG. At T2, no significant differences were found among the groups for either of the kinesiographic parameters (Table 4).

DISCUSSION

Epidemiologic studies show that the signs and symptoms related to TMDs occur predominantly in women.[1] This higher prevalence has been explained by hormonal characteristics and sociocultural behavior in response to pain.[35] Thus, only women were included in this study in

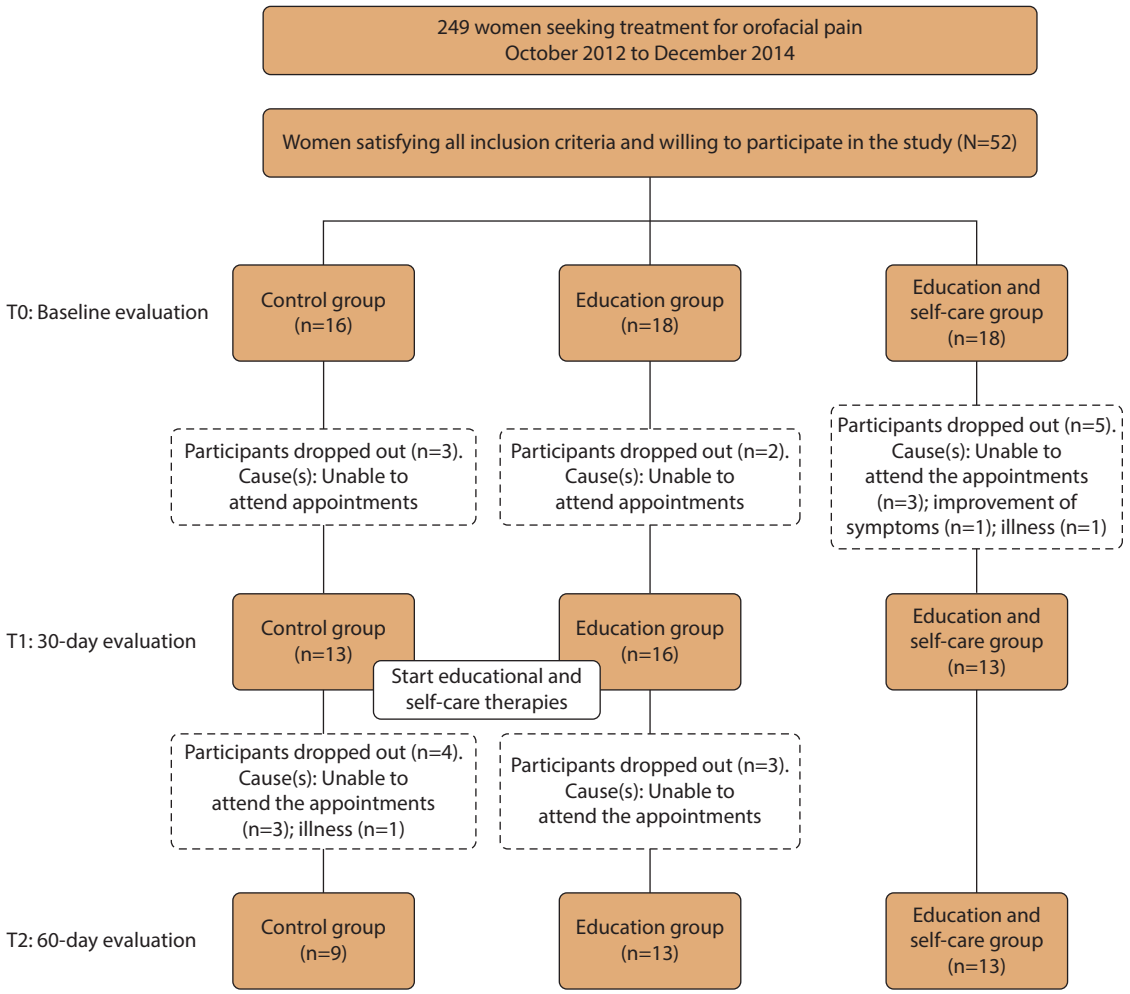

Figure 2. Flow diagram of participants.

order to form a homogeneous sample corresponding to the prevalence of TMDs.

The null hypothesis of the study was rejected as the treatment with educational and self-care therapies had a positive influence on the mandibular movement pattern of women with chronic muscular and articular TMDs. After 30 days of treatment, the ESG showed a significant increase (>5 mm) in the extension of vertical opening and anteroposterior mandibular movement during maximum mouth opening and also a significant increase (1.4 mm) in the extension of mandibular movements during the masticatory cycles on the vertical axis. These improvements in opening mandibular movement may have clinical relevance, as it was stated by Kropmans et al[36] that 5 mm is the smallest detectable difference in repeated measurements of the interincisal opening range.

Furthermore, for the EG, no change in kinesiographic parameters was found. The improvement observed in the ESG might have been attributed mainly to the mandibular exercises performed by the participants. Previous studies of myofascial pain[15,32] have suggested the effectiveness of such techniques to stretch and relax the muscles, thereby restoring their flexibility and functional capacity. In addition, the improvement of blood flow in the masticatory muscles and decreased muscle tension provided by massages followed by exercises and hot pads can reduce pain,[33] which also contributes to improvement in mandibular function.[5,6]

Michelotti et al[17] and Carlson et al[23] observed a significant decrease (>50%) in the intensity of spontaneous pain and in pain during mastication in individuals with TMD treated with educational and self-care therapies. They also found a clinically significant increase in the range of the maximum mouth opening movement (>5 mm). However, in those studies, only individuals with muscular TMD were included, and a millimeter ruler was used to record the measurements of mandibular movements. In this study, women with muscular and articular TMDs were included, and a kinesiograph device that records and displays spatial coordinates of mandibular movements in 3 dimensions was used. This device

Table 2. Mean (±SD) mandibular movement patterns during maximum mouth opening at T0 (baseline) and T1 (30 d)

Time Points	Pattern	Control Group (mm)	Education Group (mm)	Self-care and Education Group (mm)	*P* (1-way ANOVA)
T0	MVO	35.1 ±5.0^{A}	30.0 ±10.2^{A}	30.5 ±6.0^{A}	.171
	MAM	25.5 ±6.6^{B}	17.7 ±10.0^{A}	18.1 ±8.9^{A}	.046*
	LMD	13.8 ±8.5^{A}	7.4 ±9.9^{A}	6.1 ±5.5^{A}	.051
	RMD	0.5 ±0.7^{A}	5.3 ±6.7^{B}	0.8 ±1.1^{A}	.006*
30 d	MVO	36.0 ±2.9^{A}	31.8 ±9.4^{A}	35.6 ±6.4^{A}	.215
	MAM	26.3 ±6.5^{A}	18.6 ±8.3^{B}	25.6 ±9.5^{A}	.027*
	LMD	15.2 ±11.2^{A}	6.8 ±7.0^{B}	19.7 ±13.8^{A}	.009*
	RMD	1.5 ±2.0^{A}	3.7 ±4.5^{B}	0.6 ±0.5^{A}	.025*
ΔT1T0	MVO	0.9 ±3.8^{A}	1.8 ±3.5^{A}	5.1 ±3.4^{B}	.012*
	MAM	0.8 ±4.4^{A}	0.8 ±5.0^{A}	7.4 ±9.5^{B}	.019*
	LMD	1.4 ±14.3^{A}	-0.5 ±9.1^{A}	13.6 ±13.4^{B}	.009*
	RMD	1.0 1.0 ±2.2^{A}	-1.6 ±6.3^{A}	-0.2 ±1.3^{A}	.303

LMD, left maximum deviation; MAM, maximum anteroposterior movement; MVO, maximum vertical opening; RMD, right maximum deviation. *Statistically significant differences (*P*<.05). Different superscript letters indicate statistically significant differences among groups.

Table 3. Mean (±SD) mandibular movement patterns during mastication at T0 (baseline) and T1 (30 d)

Time Points	Pattern	Control Group (mm)	Education Group (mm)	Self-care and Education Group (mm)	*P* (1-way ANOVA)
T0	VER	16.2 ±2.0^{A}	14.7 ±2.0^{A}	16.0 ±1.4^{A}	.069
	AP	5.7 ±2.5^{A}	3.6 ±1.9^{A}	5.5 ±4.2^{A}	.135
	LAT	2.8 ±4.8^{A}	1.3 ±1.7^{A}	1.8 ±3.9^{A}	.546
T1	VER	16.3 ±1.7^{AB}	15.0 ±2.8^{B}	17.4 ±1.7^{A}	.027*
	AP	5.7 ±2.1^{A}	4.0 ±2.5^{A}	5.3 ±2.7^{A}	.179
	LAT	1.8 ±2.1^{A}	0.08 ±3.0^{A}	2.0 ±2.6^{A}	.102
ΔT1T0	VER	0.5 ±1.5^{A}	-0.3 ±1.7^{A}	1.4 ±1.1^{A}	.065
	AP	0.05 ±2.4^{A}	-0.2 ±1.7^{A}	0.1 ±3.4^{A}	.903
	LAT	-1.3 ±5.4^{A}	-1.5 ±3.3^{A}	-0.1 ±3.2^{A}	.638

AP, anteroposterior; LAT, lateral; VER, vertical. *Statistically significant differences (*P*<.05). Different superscript letters indicate statistically significant differences among the groups.

Table 4. Mean (±SD) mandibular movement patterns during maximum mouth opening (scan 1) and mastication (scan 8) at T2

Time Point T2	Pattern	Control Group (mm)	Education Group (mm)	Self-Care and Education Group (mm)	*P* (1-way ANOVA)
Scan 1	MVO	38.2 ±4.3^{A}	34.5 ±9.3^{A}	36.8 ±5.0^{A}	.447
	MAM	27.6 ±7.9^{A}	22.7 ±9.9^{A}	23.8 ±7.7^{A}	.408
	LMD	11.0 ±8.4^{A}	12.8 ±14.1^{A}	13.2 ±7.1^{A}	.880
	RMD	6.2 ±9.9^{A}	2.6 ±4.8^{A}	1.4 ±3.2^{A}	.204
Scan 8	VER	16.9 ±2.8^{A}	15.5 ±4.0^{A}	17.2 ±1.3^{A}	.051
	AP	6.5 ±3.0^{A}	4.6 ±2.8^{A}	3.8 ±2.7^{A}	.103
	LAT	2.3 ±3.4^{A}	0.7 ±4.0^{A}	1.8 ±3.8^{A}	.583

AP, anteroposterior; LAT, lateral; LMD, left maximum deviation; MAM, maximum anteroposterior movement; MVO, maximum vertical opening; RMD, right maximum deviation; VER, vertical.

provides accurate and reliable measurements and was recommended by previous studies[25] to investigate the mandibular function of individuals with TMD.

The benefits of education and exercises in TMD treatment were also reported by Craane et al[14] and Laat et al.[21] Those studies used a questionnaire as the outcome variable (Mandibular Function Impairment Questionnaire [MFIQ]) and observed considerable improvement in mandibular function of individuals after treatment with educational and physical therapies. The subjective analysis of mandibular function of individuals with TMD is important because it takes into account the perception and satisfaction of the individual. However, the study of objective parameters such as the recording and measurement of mandibular movements add valuable information about the functioning of the stomatognathic system of TMD sufferers.[3,37]

In the present study, no significant differences in kinesiographic parameters were found among the groups of participants who received educational and self-care therapies for 60 days and the group of participants that received these therapies for only 30 days. These results are not in accordance with previous studies that reported significant improvement of pain and functional variables over time of TMD treatment with education and self-care; however, different methodologies were used in these studies.[14,21]

Another important finding was that, although the participants demonstrated improvement in the extent of vertical and horizontal mandibular movements during maximum mouth opening, the deviations from the midline (RMD and LMD) remained unaltered or increased after the proposed treatments. The inclusion of women with muscular and articular TMDs may explain this finding. According to Leeuw et al,[31] deviations during opening mandibular movement are related mainly to TMJ derangement disorders such as articular disk displacement. Considering that educational and self-care therapies act to control stress and masticatory muscle disorders, the improvement of mandibular deviations in individuals with articular TMDs treated with these therapies would not be expected in the present study.

Educational and self-care therapies are low-cost treatments that can be successfully used for most TMDs. The present study revealed the efficiency of these therapies in restoring mandibular function, considering the analysis of the kinesiographic parameters in women diagnosed with chronic TMDs. The limitations of this study include the high dropout rate during the follow-up period and the follow-up of only 60 days. The long-term effect of treatment with educational and self-care therapies also needs to be evaluated and could be the topic of future research.

CONCLUSIONS

The findings of this study indicate that treatment with educational and self-care therapies during a 30-day period can positively influence the pattern of mandibular movements in women with chronic muscular and articular TMDs.

REFERENCES

1. Gonçalves DA, Dal Fabbro AL, Campos JA, Bigal ME, Speciali JG. Symptoms of temporomandibular disorders in the population: an epidemiological study. J Orofac Pain 2010;24:270-8.
2. Hesse JR, Naeije M, Hansson TL. Craniomandibular stiffness in myogenous and arthrogenous CMD patients, and control subject: a clinical and experimental investigation. J Oral Rehabil 1996;23:379-85.
3. Bakke M, Hansdottir R. Mandibular function in patients with temporomandibular joint pain: a 3-year follow-up. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:227-34.
4. Stiesch-Scholz M, Demling A, Rossbach A. Reproducibility of jaw movements in patients with craniomandibular disorders. J Oral Rehabil 2006;33:807-12.
5. Stohler CS. Muscle-related temporomandibular disorders. J Orofac Pain 1999;13:273-84.
6. Lund JP, Donga R, Widmer CG, Stohler CS. The pain-adaptation model: A discussion of the relationship between chronic musculoskeletal pain and motor activity. Can J Physiol Pharmacol 1991;69:683-94.
7. Murray GM, Peck CC. Orofacial pain and jaw muscle activity: A new model. J Orofac Pain 2007;21:263-78.
8. Suvinen TI, Reade PC, Kemppainen P, Könönen M, Dworkin SF. Review of aetiological concepts of temporomandibular pain disorders: towards a biopsychosocial model for integration of physical disorder factors with psychological and psychosocial illness impact factors. Eur J Pain 2005;9:613-33.
9. Navrátil L, Navratil V, Hajkova S, Hlinakova P, Dostalova T, Vranová J. Comprehensive treatment of temporomandibular joint disorders. Cranio 2014;32:24-30.
10. Sherman JJ, Turk DC. Nonpharmacologic approaches to the management of myofascial temporomandibular disorders. Curr Pain Headache Rep 2001;5:421-31.
11. Dworkin SF, Huggins KH, Wilson L, Mancl L, Turner J, Massoth D, et al. A randomized clinical trial using research diagnostic criteria for temporomandibular disorders-Axis II to target clinical cases for a tailored self-care TMD treatment program. J Orofac Pain 2002;16:48-63.
12. Dworkin SF, Turner EA, Mancl L, Wilson L, Massoth D, Huggins KH, et al. A randomized clinical trial of a tailored comprehensive care treatment program for temporomandibular disorders. J Orofac Pain 2002;16:259-76.
13. Alencar F Jr, Becker A. Evaluation of different occlusal splints and counseling in the management of myofascial pain dysfunction. J Oral Rehabil 2009;36:79-85.
14. Craane B, Dijkstra PU, Stappaerts K, De Laat A. One-year evaluation of the effect of physical therapy for masticatory muscle pain: a randomized controlled trial. Eur J Pain 2012;16:737-47.
15. Gawriołek K, Azer SS, Gawriolek M, Piotrowski PR. Mandibular function after Myorelaxation Therapy in temporomandibular disorders. Adv Med Sci 2015;60:6-12.
16. Michelotti A, Iodice G, Vollaro S, Steenks MH, Farella M. Evaluation of the short-term effectiveness of education versus an occlusal splint for the treatment of myofascial pain of the jaw muscles. J Am Dent Assoc 2012;143:47-53.
17. Michelotti A, Steenks MH, Farella M, Parisini F, Cimino R, Martina R. The additional value of a home physical therapy regimen versus patient education only for the treatment of myofascial pain of the jaw muscles: short-term results of a randomized clinical trial. J Orofac Pain 2004;18:114-25.
18. De Freitas RF, Ferreira MÂ, Barbosa GA, Calderon PS. Counselling and self-management therapies for temporomandibular disorders: a systematic review. J Oral Rehabil 2013;40:864-7.
19. Feine JS, Lund JP. An assessment of the efficacy of physical modalities for the control of chronic musculoskeletal pain. Pain 1997;71:5-23.
20. Truelove E, Huggins KH, Mancl L, Dworkin SF. The efficacy of traditional, low-cost and nonsplint therapies for temporomandibular disorder: a randomized controlled trial. J Am Dent Assoc 2006;137:1099-107.
21. De Laat A, Stappaerts K, Papy S. Counseling and physical therapy as treatment for myofascial pain of the masticatory system. J Orofac Pain 2003;17:42-9.
22. Kalamir A, Graham PL, Vitiello AL, Bonello R, Pollard H. Intra-oral myofascial therapy versus education and self-care in the treatment of chronic, myogenous temporomandibular disorder: a randomised, clinical trial. Chiropr Man Therap 2013;21:17.
23. Carlson CR, Bertrand PM, Ehrlich AD, Maxwell AW, Burton RG. Physical self-regulation training for the management of temporomandibular disorders. J Orofac Pain 2001;15:47-55.
24. Campos JA, Carrascosa AC, Bonafé FS, Maroco J. Epidemiology of severity of temporomandibular disorders in Brazilian women. J Oral Facial Pain Headache 2014;28:147-52.
25. Cooper BC. Parameters of an optimal physiological state of the masticatory system: the results of a survey of practitioners using computerized measurement devices. Cranio 2004;22:220-33.
26. Kümbüloğlu O, Saracoglu A, Bingöl P, Hatipoğlu A, Ozcan M. Clinical study on the comparison of masticatory efficiency and jaw movement before and after temporomandibular disorder treatment. Cranio 2013;31:190-201.
27. Sato S, Nasu F, Motegi K. Analysis of kinesiograph recordings and masticatory efficiency after treatment of non-reducing disk displacement of the temporomandibular joint. J Oral Rehabil 2003;30:708-13.
28. De Lucena LB, Kosminsky M, Da Costa LJ, De Goes PS. Validation of the Portuguese version of the RDC/TMD Axis II questionnaire. Braz Oral Res 2006;20:312-7.
29. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6:301-55.
30. Ohrbach R, List T, Goulet JP, Svensson P. Recommendations from the International Consensus Workshop: convergence on an orofacial pain taxonomy. J Oral Rehabil 2010;37:807-12.
31. De Leeuw R. American Academy of Orofacial Pain guidelines for assessment diagnosis, and management. 4th ed. Hanover Park, IL: Quintessence Publishing; 2008. p. 316.
32. Nicolakis P, Erdogmus B, Kopf A, Nicolakis M, Piehslinger E, Fialka-Moser V. Effectiveness of exercise therapy in patients with myofascial pain dysfunction syndrome. J Oral Rehabil 2002;29:362-8.
33. Tiidus PM. Manual massage and recovery of muscle function following exercise: A literature review. J Orthop Sports Phys Ther 1997;27:203-10.
34. Marin DO, Leite AR, Paleari AG, Rodriguez LS, Oliveira Junior NM, Pero AC, et al. Effect of a denture adhesive on the satisfaction and kinesiographic parameters of complete denture wearers: a cross-over randomized clinical trial. Braz Dent J 2014;25:391-8.
35. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain 2003;106:253-61.
36. Kropmans TJB, Dijkstra PU, Stegenga B, Stewart R, de Bont LGM. Smallest detectable difference in outcome variables related to painful restriction of the temporomandibular joint. J Dent Res 1999;78:784-9.
37. Huddleston Slater JJ, Lobezoo F, Chen Yj, Naeije M. A comparative study between clinical and instrumental methods for the recognition of internal derangements with a clicking sound on condylar movement. J Orofac Pain 2004;18:138-47.

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