UNESP - Universidade Estadual Paulista
"Júlio de Mesquita Filho"
Faculdade de Odontologia de Araraquara

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Impacto do tratamento com terapias educacionais e de autocuidados no padrão cinesiográfico mandibular e no desempenho mastigatório de mulheres com disfunção temporomandibular crônica dolorosa

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Orientadora: Profª. Drª. Ana Carolina Pero
Co-orientadora: Profª. Drª. Daniela Ap. de Godoi Gonçalves

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IMPACTO DO TRATAMENTO COM TERAPIAS EDUCACIONAIS E DE AUTOCUIDADOS NO PADRÃO CINESIOGRÁFICO MANDIBULAR E NO DESEMPENHO MASTIGATÓRIO DE MULHERES COM DISFUNÇÃO TEMPOROMANDIBULAR CRÔNICA DOLOROSA

Tese apresentada ao Programa de Pós-Graduação em Reabilitação Oral - Área de Prótese, da Faculdade de Odontologia de Araraquara, da Universidade Estadual Paulista, para obtenção do título de Doutor em Reabilitação Oral.

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DADOS CURRICULARES

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" Cada pessoa que passa em nossa vida passa sozinha,

porque cada pessoa é única e nenhuma substitui a outra!

Cada pessoa que passa em nossa vida passa sozinha e não nos deixa só,

porque deixa um pouco de si e leva um pouquinho de nós.

Essa é a mais bela responsabilidade da vida

e a prova de que as pessoas não se encontram por acaso. "

(Charles Chaplin)

Vou levar um pouquinho de cada um de vocês comigo, no meu coração!

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Giro G. Impacto do tratamento com terapias educacionais e de autocuidados no padrão cinesiográfico mandibular e no desempenho mastigatório de mulheres com disfunção temporomandibular crônica dolorosa [Tese de Doutorado]. Araraquara: Faculdade de Odontologia da UNESP; 2015.

RESUMO

A Disfunção Temporomandibular (DTM) pode acarretar limitações funcionais, como restrições dos movimentos mandibulares e redução da capacidade mastigatória. O objetivo deste estudo foi avaliar o impacto do tratamento com educação sobre DTM e terapias de autocuidados no padrão de movimento mandibular e no desempenho mastigatório de mulheres com DTM crônica dolorosa. Cinquenta e duas mulheres com diagnóstico de DTM de acordo com o *Research Diagnostic Criteria for Temporomandibular Disorders* (RDC/TMD), Eixos I e II – versão em português, foram selecionadas e aleatoriamente divididas em 3 grupos, controle (GC, n=16), educação (GE, n=18), e educação e autocuidados (GEA, n=18), de acordo com a sequência de tratamento que elas receberam. Um cinesiógrafo foi utilizado para registrar os movimentos mandibulares durante a abertura bucal máxima e mastigação habitual de um alimento teste (amêndoa), e o desempenho mastigatório foi avaliado pelo método dos tamises. Estas análises foram realizadas em 3 momentos, no baseline (T0), após 30 (T1) e 60 (T2) dias de acompanhamento. O teste t de Student para amostras pareadas foi utilizado para comparar os dados cinesiográficos e as porcentagens de desempenho mastigatório obtidos em T0 e em T1, para cada grupo. Além disso, a comparação entre os grupos em cada momento foi realizada utilizando one-way Anova, seguido do teste de Bonferroni para comparação múltipla das médias (α=0.05). Em relação aos registros cinesiográficos, resultados semelhantes foram encontrados em T0 comparado com T1, para os grupos GC e GE. Já, o grupo GEA mostrou um aumento significativo nos movimentos mandibulares vertical (T0=30.5±6.0mm; T1=35.6±6.4mm (p=0.000)) e anteroposterior (T0=18.1±8.9mm; T1=25.6±9.5mm (p=0.016)) durante a abertura bucal máxima, e um aumento no movimento mandibular vertical (T0=16±1.4mm; T1=17.4±1.7mm (p=0.023)) durante a mastigação, após 30 dias de tratamento. Considerando o desempenho mastigatório, não foram encontradas diferenças significantes entre os períodos (T0-T1), para todos os grupos. Ainda, após 30 e 60 dias de acompanhamento, os resultados foram semelhantes entre os grupos GC, GE e GEA. Conclui-se que, em curto prazo, o tratamento proposto neste estudo

influenciou positivamente o padrão de movimento mandibular das participantes. Entretanto, o desempenho mastigatório das pacientes permaneceu inalterado.

Palavras-chave: Articulação Temporomandibular. Exercícios de Alongamento Muscular. Mastigação.

Giro G. Impact of treatment with educational and self-care therapies on mandibular Kinesiographic pattern and masticatory performance of women with chronic painful temporomandibular disorders [Tese de Doutorado]. Araraquara: Faculdade de Odontologia da UNESP; 2015.

ABSTRACT

The temporomandibular disorders (TMD) may cause functional limitations, such as restrictions of mandibular movements, and reduced capacity masticatory. The aim of this study was to investigate the impact of treatment with educational about TMD and self-care therapies on the mandibular movement pattern and masticatory performance of chronic painful TMD women. Fifty-two women diagnosed with TMD according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC / TMD) Axis I and II - Portuguese version, were selected and randomly divided into 3 groups: control (CG, n=16) , education group (EG, n=18), and education and self-care (ESG, n=18), according to the treatment sequence that they received. A kinesiograph device recorded mandibular movements during maximum mouth opening and chewing, and the masticatory performance was evaluated by the sieves method. These analyzes were performed at baseline (T0), after 30 (T1) and 60 (T2) days of follow-up. The paired sample t-test was used to compare the data obtained at T0 and T1, for each group ($\alpha = 0.05$). Moreover, a comparison among the groups in each moment, was performed using the parametric test 1-way ANOVA, followed by Bonferroni test for multiple comparisons of means ($\alpha=0.05$). Regarding to kinesiographic records, similar results were found at T0 compared with T1, for the CG and EG groups. Already, the ESG group showed a significant increase in vertical (T0=30.5±6.0mm; T1=35.6±6.4mm (p=0.000)) and anteroposterior (T0=18.1±8.9mm; T1=25.6±9.5mm (p=0.016)) mandibular movements during maximum mouth opening, and an increase in the vertical mandibular movement (T0=16±1.4mm; T1=1.7mm±17.4 (p=0.023)) during chewing, after 30 days of follow-up. Considering the masticatory performance, no significant differences were found between the periods (T0-T1), for all groups. In addition, after 30 and 60 days of follow-up, the results were similar among the CG, EG and ESG groups. It was concluded that, in the short-term, the treatment proposed in this study positively influenced the mandibular movement pattern of participants. However, the masticatory performance of patients remained unaltered.

Keywords: Temporomandibular Joint. Muscle Stretching Exercises. Mastication.

SUMÁRIO

1 INTRODUÇÃO

Disfunção temporomandibular (DTM) é um termo coletivo que abrange vários problemas clínicos envolvendo o sistema mastigatório. Os principais sinais e sintomas incluem: dor na articulação temporomandibular (ATM) e/ou nos músculos mastigatórios, sons articulares, e limitações ou desvios nos movimentos mandibulares (American Academy of Orofacial Pain[10], 2008; Carlsson[7], 1999), podendo acarretar dificuldades na mastigação, fala e outras funções orofaciais (Ferreira et al[13], 2014; Greene et al[17], 2010; Kümbüloğlu et al[22], 2013).

Estudos epidemiológicos apontam que essa disfunção acomete predominantemente indivíduos adultos jovens do gênero feminino (Gonçalves et al[16], 2010; LeResche et al[23], 2003; Manfredini et al[28], 2011, Oliveira et al[36], 2006). De acordo com Bagis et al[3] (2012) e Poveda et al[38] (2007) a chance de desenvolvimento de DTM entre as mulheres é cerca de quatro vezes maior que entre os homens, e a explicação para essa alta prevalência em mulheres tem sido relacionada à características hormonais, comportamentais e psicológicas (LeResche et al[24], 1997; LeResche et al[23], 2003; Licini et al[25], 2009).

A etiologia da DTM é considerada complexa e multifatorial, pois uma variedade de fatores pode contribuir para a sua predisposição, iniciação e manutenção, o que dificulta a determinação de um tratamento efetivo (Bonjardim et al[4], 2009; Costa et al[8], 2015; Garofalo et al[14], 1998; Mello et al[30], 2014). Atualmente sabe-se que hábitos parafuncionais, fatores neuromusculares e psicológicos, como ansiedade, depressão e fadiga, desempenham um papel importante no desenvolvimento dessa disfunção (McNeill[29], 1997). Assim, tratamentos que abordam apenas fatores biomédicos (prescrição de medicamentos, ajuste oclusal, placas oclusais) são considerados insuficientes para promover uma melhora em longo prazo dos sinais e sintomas da DTM (Maísa Soares, Rizzatti-Barbosa[26], 2015; Navrátil et al[34], 2014; Sherman, Turk[42], 2001; Gatchel et al[15], 2007). Estudos prévios mostram que abordagens biopsicossociais, que oferecem igual ênfase ao tratamento dos fatores fisiológicos, psicológicos e sociais, podem proporcionar melhora substancial na dor relacionada à DTM crônica (Maísa Soares, Rizzatti-Barbosa[26], 2015; De Freitas et al[9], 2013). Com este propósito, abordagens envolvendo estratégias de autocuidados e terapias comportamentais vêm sendo desenvolvidas, e são altamente recomendadas para o tratamento da DTM dolorosa. Essas abordagens consistem em extensiva educação sobre DTM, associado com o uso de compressas quentes sobre os músculos doloridos, exercícios mandibulares, estratégias para

reduzir a atividade parafuncional mandibular e técnicas de relaxamento muscular (De Freitas et al[9], 2013).

Adicionalmente, tem sido sugerido que terapias educacionais e de autocuidados ajudam a aliviar a dor musculoesqueletal e a restaurar a função mandibular pela redução da inflamação, diminuição da tensão muscular e melhora nos domínios psicológicos (Alencar, Becker[2], 2009; Michelotti et al[31], 2012; Michelotti et al[32], 2004). Uma recente revisão sistemática concluiu que essas abordagens representam um tratamento conservador de baixo custo e podem ser benéficas para o alívio e controle dos sinais e sintomas da DTM. Entretanto, mais estudos clínicos randomizados controlados são necessários para validar a efetividade dessa modalidade de tratamento (De Freitas et al[9], 2013).

Na literatura cientifica, a maior parte dos estudos encontrados sobre esse tipo de tratamento, investigou o seu efeito na dor e funções orofaciais dos sofredores de DTM utilizando parâmetros subjetivos, como questionários ou escala visual analógica (Carlson et al[6], 2001; Wright et al[44], 2000), e estudos que abordam análises objetivas são relativamente escassos. Considerando que movimentos mandibulares limitados são um dos principais sinais da DTM (American Academy of Orofacial Pain[10], 2008), e que a presença dessa disfunção pode influenciar negativamente a capacidade mastigatória (Kümbüloğlu et al[22], 2013; Henrikson et al[19], 1998; Peroz, Tai[37], 2002), torna-se relevante a avaliação objetiva do impacto do tratamento com terapias educacionais e de autocuidados no padrão de movimentação mandibular e no desempenho mastigatório de indivíduos com DTM dolorosa.

A cinesiografia é um método de registro das coordenadas dos movimentos mandibulares nos eixos vertical, anteroposterior e lateral. Por meio de suas avaliações, o cinesiógrafo pode fornecer registros gráficos precisos dos movimentos mandibulares durante a abertura e fechamento, e durante a mastigação (Sato et al[40], 1996). Este equipamento é composto por sensores eletromagnéticos conectados a um sistema computadorizado que capta os movimentos mandibulares. Os sensores destinam-se ao rastreamento de um magneto posicionado na região dos incisivos centrais inferiores do indivíduo. Apesar de sua ampla aplicação, poucos estudos têm abordado a utilização do cinesiógrafo no diagnóstico e investigação da função mandibular relacionada ao tratamento da DTM (Huddleston et al[20], 2004; Sato et al[41], 2003).

A literatura também não é conclusiva em relação à análise do desempenho mastigatório de indivíduos com DTM tratados com terapias educacionais e de autocuidados. O desempenho mastigatório pode ser definido como a capacidade de triturar certa porção de alimento com determinado número de ciclos mastigatórios (Kapur, Soman[21], 2006; Manly,

Braley[27], 1950). Diversos estudos têm demonstrado sua avaliação com diferentes métodos (Al-Ali et al[1], 1999; Eberhard et al[11], 2012; Mowlana et al[33], 1994; Nokubi et al[35], 2013; Toman et al[43], 2012), como, a utilização de análises de imagem após a trituração de um alimento-teste natural ou artificial, ou goma colorimétrica (Hayakawa et al 1998[39]; Santos et al[18], 2006). Atualmente, a metodologia que utiliza tamises para avaliar o produto final da trituração de alimentos teste, naturais ou artificiais, é amplamente utilizada na avaliação do desempenho mastigatório, sendo considerada o "padrão ouro", por ser um método simples, objetivo, e reprodutível. Tal metodologia consiste na submissão das partículas de um alimento-teste triturado a um sistema de tamises ou peneiras com malhas de diferentes diâmetros de orifícios e dispostas de maneira decrescente, para separação dos fragmentos de acordo com seu tamanho, ou grau de trituração atingido (Kapur, Soman[21], 2006; Manly, Braley[27], 1950; Edlund, Lamm [12], 1980). Desse modo, quanto mais partículas chegarem ou ultrapassarem as malhas mais finas, melhor será classificada a capacidade mastigatória do indivíduo. Esta análise fornece uma avaliação objetiva da função mastigatória e pode ser um importante parâmetro para investigação da dificuldade mastigatória em indivíduos com DTM (Boretti et al[5], 1995).

Os benefícios da utilização de terapias simples de autocuidados no tratamento da DTM podem se estender a pacientes de todas as classes sociais, já que são de fácil aplicação, baixo custo e aplicáveis a pessoas de todas as idades. Assim, a elucidação do impacto dessas terapias sobre variáveis fisiológicas, como o padrão de movimento mandibular e o desempenho mastigatório, pode colaborar para a redução da indicação de tratamentos irreversíveis e de alto custo, acessíveis à pequena parcela da população.

2 PROPOSIÇÃO

O objetivo do presente trabalho foi investigar o impacto do tratamento com apenas instruções de educação ou educação associada com terapias de autocuidados no padrão cinesiográfico mandibular e no desempenho mastigatório de mulheres com disfunção temporomandibular crônica dolorosa.

3 CAPÍTULOS

Os dois capítulos apresentados nessa seção originaram-se a partir da avaliação de uma amostra composta por 52 mulheres adultas, que foram cuidadosamente selecionadas de acordo com critérios de inclusão e exclusão, e aceitaram participar do presente estudo. Elas foram informadas de forma verbal e escrita sobre a pesquisa, e um Termo de Consentimento Livre e Esclarecido contendo as informações eticamente necessárias, foi obtido para cada participante (Anexo 1).

Cabe ressaltar que o projeto foi submetido ao Comitê de Ética em Pesquisa com seres humanos da Faculdade de Odontologia de Araraquara (FOAr-UNESP) e foi aprovado sob o protocolo nº 10/11 (Anexo 2). Após a aprovação do projeto de pesquisa, o trabalho foi registrado na base de Registro Brasileiro de Ensaios Clínicos (http://www.ensaiosclinicos.gov.br/) com o identificador RBR-45yn9v (Anexo 3).

Ambos os artigos foram submetidos no dia 26/07/2015 ao periódico *Journal of Oral Rehabilitation* e encontram-se em revisão, conforme pode ser visualizado no Anexo 4.

Nos Apêndices 1 e 2 encontram-se as figuras relacionadas aos métodos utilizados para realização das análises do padrão cinesiográfico mandibular e do desempenho mastigatório, respectivamente.

3.1 Capítulo 1

Educational and self-care therapies for the treatment of chronic TMD women. Part I: Kinesiographic parameters of mandibular movements

Running title: Movement mandibular pattern of chronic TMD women

Article category: Original research

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Educational and self-care therapies for the treatment of chronic TMD women. Part I: Kinesiographic parameters of mandibular movement

Summary

Background: Temporomandibular disorders (TMD) represent clusters of clinical problems involving the masticatory muscles and the temporomandibular joint (TMJ). They are characterized by pain, joint sounds, and restrictions of mandibular movements. Objective: the aim of this study was to evaluate the impact of treatment with educational about TMD and self-care therapies on the pattern of mandibular movements of chronic painful TMD women, considering kinesiographic parameters. Methods: fifty-two women were selected and randomly divided into 3 groups, control (CG, n=16), education (EG, n=18), and education and self-care (ESG, n=18), according to the treatment sequence that they received. A kinesiograph device recorded mandibular movements during mouth opening and chewing. These analyzes were performed at baseline (T0), 30-days (T1) and 60-days (T2). The paired sample t-test (α=0.05) was used to compare the kinesiographic records before (T0) and after 30 days of follow-up (T1), for each group. Furthermore, a comparison among the groups was performed using the parametric test 1-way ANOVA (α=0.05), followed by Bonferroni test for multiple comparisons of means. Results: similar results were found at T0 compared with T1, for the CG and EG. However, ESG showed a significant increase in vertical opening and anteroposterior mandibular movement during mouth opening, and an increase in vertical mandibular movement during chewing, after 30 days of treatment. No significant differences were found between the women that received full treatment for 60 days and the women that received full treatment for 30 days. Conclusion: in the short-term, the proposed treatment positively influenced the mandibular movement pattern of the TMD patients.

Keywords: temporomandibular joint disorders, temporomandibular joint, self-care, education, exercise movement techniques, treatment outcome

Educational and self-care therapies for the treatment of chronic TMD women. Part I: Kinesiographic parameters of mandibular movement

Background

Temporomandibular disorders (TMD) are recognized as a major cause of nondental pain in the orofacial region, negatively affecting the oral function and quality of life of sufferers (1). Their main signs and symptoms include pain in the masticatory muscles and temporomandibular joint (TMJ), muscle fatigue, joint sounds, and restrictions or deviations of mandibular movements (1). The mandibular movement range can be restricted by increased of muscle strain and internal derangements of TMJ (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). Thus, the changes in mandibular motor activity of individuals with TMD can be attributed to a result of sensitization mechanisms and reflex adaptation, representing a functional response to protect the stomatognathic system from greater damage (4).

Individuals with TMD tend to exhibit chewing movements slower, smaller, and more irregular than health individuals (5). Another important aspect is that the pain and the limitation of mandibular movements directly impact the masticatory function of DTM sufferers (6); thus, the greater the severity these symptoms, the greater the masticatory difficulty (7). As a result, rehabilitation in order to relieve pain, improve mandibular movements, and, consequently, improve the masticatory function are the main goals of the treatment of TMD.

Currently, it is well known that parafunctional habits, neuromuscular factors and psychosocial factors (e.g., anxiety, depression and fatigue) are involved in the development and maintenance of the signs and symptoms of TMD (8). In this way, treatments that take into account only biomedical factors are considered insufficient to promote long-term improvement of DTM (9). It has been suggested that conservative and low-cost treatment approaches, involving self-care strategies and behavioral therapies help to relieve musculoskeletal pain and to restore mandibular function in individuals suffering TMD by reducing inflammation, relief of muscle tension and improving psychological domains (10-12). Counselling and self-care approaches include extensive education about the disorder,

associated with the use of heat packs, several jaw exercises, guidance regarding the reduction in parafunctional jaw activities and muscular relaxation techniques.

The literature on these treatment approaches shows that enforcing patient responsibilities, stress management and reduction of harmful behaviors are powerful tools for control of TMD signals and symptoms (13, 14). For this reason, they have been indicated as initial treatment of almost all DTM (12, 15). Most of the previous studies investigated the impact of treatment with educational and self-care therapies on pain and mandibular function of TMD individuals, using subjective parameters, such as questionnaires and visual analogue scale, whereas studies addressing objective analysis are still relatively scarce (10, 16).

Limited mandibular movements are one of the most important signs of TMD, and may cause functional difficulties (6). The kinesiograph device provides accurate graphic records of mandibular movements, such as opening-closure movements and chewing cycles. This apparatus is capable of detecting changes mandibular movements and can be used in the diagnosis and objective investigations of the mandibular function of individuals with TMD (17).

Thus, the aim of present study was to evaluate the impact of treatment with educational about TMD and self-care therapies on the pattern of mandibular movements of chronic painful TMD women, considering kinesiographic parameters. The null hypothesis was that the use of such treatment modalities would not influence quality of mandibular movements, during the proposed period.

Methods

The present study was approved by the institutional ethics committee (protocol number 10/11) and registered in the http://www.ensaiosclinicos.gov.br/ database (trial: RBR-45yn9v).

Participants

Two hundred forty-nine women seeking treatment for orofacial pain in the TMD/Occlusion Clinic of the Araraquara Dental School (Univ. Estadual Paulista), Brazil, over a 2-year period (2012-2014), were assessed for possible participation in the present study. A medical history was taken from the women. Their complaints and pain characteristics (quality, installation time, duration, aggravating and mitigating factors, frequency and intensity) were reported, clinical observations were made, and muscles and TMJ were examined. Additionally, the diagnosis and classification of the TMD was

performed according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC-TMD) - Axis I and II (18). In the (somatic) axis I, the clinical diagnosis is made among individuals with masticatory muscle pain with/without limitation of mouth opening (Group I), individuals with disc 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.

The selection of women was based on the following inclusion criteria: (1) age range between 18 and 65 years; (2) diagnosis of muscle and joint TMD as defined by RDC-TMD - Axis I, Groups Ib and II, whereas, the group Ib consist of patients with a maximal active mouth opening less than 40 mm; (3) presence of pain recurrent or constant for more than 3 months; (4) a self-report of an average jaw pain intensity on the assessment day of at least 3 on a visual analog scale (VAS) from 0 (no pain) to 10 (worst pain imaginable); (5) grade II or III of chronic pain according to RDC-TMD - Axis II; (6) not under treatment for this painful condition and not be starting any treatment for other painful condition; (7) presence of natural dentition or fixed prostheses with posterior occlusal stability. The exclusion criteria were: (1) severe malocclusions; (2) debilitating systemic diseases and (3) cardiac pacemaker, to avoid possible interference with the kinesiograph.

A calibrated researcher dentist (R1) performed all clinical and functional examinations necessary to make the RDC-TMD. Fifty-two women, who met the criteria specified, were selected and invited to participate this study. They were informed in verbal form about the research and a written informed consent was obtained from each participant before enrollment.

Study design

The present study was designed as a double blind, randomized clinical trial, with a 60-days follow-up, to assess the mandibular movement pattern of women with chronic painful TMD, after treatment with educational and self-care therapies. Participants (n=52, mean age (SD): 36,4 ±8,8 years) were assigned to three independent groups, control (CG, n=16, mean age (SD): 37,4 ±7,3 years), education (EG, n=18, mean age (SD): 34,8 ±6,7 years) and education and self-care (ESG, n=18, mean age (SD): 36,6 ±10,6 years), according to the sequence of treatment received, as described in Table 1. One researcher (R2.) was responsible for the randomization of the sample,

which was determined by age, using computer generated numbers (BioEstat 5.0; Federal University of Pará, Brazil).

The outcome variable was mandibular movement pattern, evaluated by means of kinesiographic records. This analysis was performed at baseline (T0), 30-days (T1) and 60-days (T2), and conducted by the same examiner (R3), who was blinded to group assignment. On the second visit, women in the control and education groups received full treatment approaches, including education about DTM and self-care instructions. Therefore, the third visit aimed to evaluate the impact of the treatment duration (30 and 60 days) on kinesiographic parameters of study participant, through the comparison between the results of participants who received the full treatment for 30 days and the results of participants who received the full treatment for 60 days.

Treatment

All instructions on educational and self-care therapies were transmitted by means of a video recording, allowing the information had been passed from identical way to all study women. One researcher (R2) monitored the video sessions and was responsible for clarifying possible questions. The women also received written instructions about TMD education and the sequence of self-care procedures that they should perform daily at home, during follow-up period proposed by study.

Video on educational instructions addressed general information about TMD. The women were reassured about the problem, the structures involved, the possible etiologic factors and the good prognosis of these disorders. Furthermore, the video explained the self-care related to mandibular muscles, emphasizing that overuse of these muscles could be one of the causes of maintenance of the signs and symptoms of TMD. The women were instructed to keep the mandibular muscles relaxed by maintaining the mandible in his postural rest position. To determine this position, they were asked to pronounce several times the letter “M”, then, position the tongue behind the upper incisors, keeping his lips in light contact. The women were also told to avoid harmful oral habits and excessive mandibular movement.

Video on self-care therapies taught a sequence of procedures recommended by the American Academy of Orofacial Pain (19), and considered effective for the relief of pain and control of dysfunction related to DTM. These procedures include:

(a) Thermotherapy: the application of heat promotes relief of pain, improves muscle tone and relaxation of the mandibular muscles. Whereas, the women were advised to heat compresses on the painful muscle for 15 minutes, 3 times a day.

(b) Mandibular exercises: controlled movements of the mandible collaborate for improvement in muscle coordination and extension of mandibular movements, and increase muscle strength. In order to stretch the mandibular muscles, the women were instructed to slowly open the mouth with the aid of the thumb and index fingers, until they experience a sensation of initial pain, maintaining the stretch for 10 seconds. Thereafter, they should open and close the mouth keeping the tongue on the palate. In addition, women were told to perform mouth opening with resistance, where they should place one hand under chin and force the mandible up, difficulting the opening movement. Coordination exercises consisted of opening and closing the mouth slowly in front of the mirror, trying to make the mandible performs straight movements. The women were also instructed to make movement of laterality, keeping lips closed. All exercises should be repeated 6 times and performed 3 times a day.

(c) Self-massage: promotes improvement of local blood circulation, relieves the pain and muscle tension. Thus, the women were instructed to bilaterally massage the masseter and temporal muscles with circular movements performed by index, middle, and ring fingers, 3 times a day.

In order to check adherence of the participants to treatment, a telephone interview was performed every 15 days, during follow-up period of the study. They were asked about compliance of the procedures prescribed, and the information were reinforced.

Outcome variable

A kinesiograph device (K7-I Diagnostic System; Myotronics Research Inc., Seattle, WA, USA) was used to assess the mandibular movement pattern of women, during mouth opening and chewing. This instrument is connected to a computerized system that records, displays and measures the spatial coordinates of movements in vertical, anteroposterior and lateral axes, at 0.1 mm accuracy (17).

Two tracing modes (scans) were selected for recordings: Scan 1 – mandibular movement limits during maximum mouth opening; and Scan 8 – mandibular movements during habitual chewing. For reliable registration, the women were asked to sit upright in a dental chair with the Frankfort plane

parallel to the horizontal plane. A magnet (12 mm x 6 mm x 3 mm) was attached on the middle line of the lower incisors using an easily removable sticky adhesive such that it does not contact with the upper teeth at the time of occlusion. The sensor array that records the mandibular movements was positioned in the women according to the manufacturer's instructions. To scan 1 record, the women were instructed to slightly occlude her teeth and then perform maximum mouth opening movement, occluding immediately after. Whereas, to record of the chewing cycle (scan 8), the women were instructed to chew 5 almonds simultaneously, for 20 seconds, in the usual way.

Figure 1 represents a common graphic pattern for mandibular movement during maximum mouth opening and chewing. All procedures were carried out according to the manufacturer's instructions (17). Three records were made for each scan and mean values of the extension of mandibular movements were obtained for each axis.

Statistical analysis

All data collected were preliminarily analyzed by Shapiro-Wilk test for evaluate normal distribution. To check the impact of treatment, we compare the kinesiographic measurements at baseline (T0) and after 30 days of follow-up (T1), for each group, using parametric paired sample t-test. Furthermore, a comparison among the groups (CG, EG and ESG) was performed using the parametric test 1-way ANOVA, and additionally, the Bonferroni test for multiple comparisons of means was used to identify when the kinesiographic measurements varied significantly. Statistical tests were conducted with statistics software (PASW v19; SPSS Inc), considering a significance level set at α=0.05.

Results

Figure 2 displays a flow diagram of the participants throughout the course of the research. During the follow-up, seventeen women dropped out of the study. Ten women (3 from the CG, 2 from the EG and 5 from the ESG) dropped out after the first evaluation (T0), and seven women (4 from the CG and 3 from the EG) dropped out after second evaluation (T1). Hence, fifty-two women were evaluated at baseline (T0), forty-two women were evaluated after 30 days of follow-up (T1) and thirty-five women were evaluated after 60 days follow-up (T2). The reasons for dropouts included practical problems (e.g., lack of time, job or family conflicts), illness and improvement of symptoms.

As illustrated in Table 2, similar results were found in T0 compared with T1, for the control (CG) and education (EG) groups ($p>.05$). However, education and self-care group (ESG) showed a significant increase in vertical opening and anteroposterior mandibular movement during maximum mouth opening (Scan 1), and an increase in vertical mandibular movement during chewing (Scan 8), after 30 days of treatment.

Table 3 illustrates the comparisons of kinesiographic measurements during maximum mouth opening (MVO, MAM, RMD and LMD) among the groups. Considering the difference between the mean values recorded at T1 and T0 ($\Delta T1T0$), the ESG showed an improvement in the vertical opening (MVO) and anteroposterior mandibular movement (MAM) significantly higher than the EG and CG. Regarding to lateral deviations (RMD or LMD) we did not observe significant improvement in either group after the proposed treatment, the deviations remained or increased. Already, the comparisons among the groups considering of kinesiographic measurements during chewing, are listed in Table 4. The results showed that at T1, vertical mandibular movement was significantly higher in the ESG than in the EG.

The aim of the third visit (T2) was to evaluate whether the participants who had received full treatment for 60 days (ESG) would show better results than the participants who had received full treatment for only 30 days (CG and EG). No significant differences were found between the groups at T2, for both the kinesiographic parameters (Table 3 and Table 4).

Discussion

Epidemiologic studies show that the signs and symptoms related to TMD occur predominantly in women (1). This higher prevalence has been explained by hormonal characteristics and sociocultural behavior in response to pain (20). Thus, only women were included in this study in order to form a homogeneous sample corresponding to the prevalence of TMD.

This study aimed to investigate the influence of treatment with educational and self-care therapies on the mandibular movement pattern of women with chronic muscular and articular TMD. After 30 days of treatment, the self-care and education group showed a significant increase (>5mm) in extension of vertical opening and anteroposterior mandibular movement during the maximum mouth opening, and also a significant increase (1.4 mm) in extension of mandibular movements during the chewing cycles on the vertical axis. On the other hand, for the education group any change in the

kinesiographic parameters was found. Thus, the improvement observed in the self-care and education group may be mainly attributed to the mandibular exercises that the participants were submitted. The effectiveness of such techniques stretch and relax the muscles, restoring its flexibility and functional capacity, has been suggested in previous studies on myofascial pain (21, 22). In addition, it has been stated that the improvement of blood flow in the masticatory muscles and decreased muscle tension, provided by massages followed by exercises and hot pads, can induce an analgesia (23), which also contributes to improvement of mandibular function (4).

Michelotti et al (12) and Carlson et al (24), observed a significant decrease (> 50%) in the intensity of spontaneous pain and in pain during chewing, in TMD sufferers treated with educational and self-care therapies. They also found a clinically significant increase in range of the maximum mouth opening movement (> 5 mm). However, in these studies, only individuals with muscular TMD were included, and a millimeter ruler was used to record the measurements of mandibular movements. We evaluated individuals diagnosed with muscular and articular TMD, and a kinesiograph device, that records and displays spatial coordinates of mandibular movements in three dimensions, was used. This device provides accurate and reliable measurements, and its adoption to investigate the mandibular function of individuals with TMD was recommended by previous studies (25).

The benefits of education and exercises in TMD treatment were also reported by Craane et al (10) and Laat et al (26). These researchers observed a considerable improvement in mandibular function of individuals after treatment with educational and physical therapies, but using a questionnaire as outcome variable (Mandibular Function Impairment Questionnaire - MFIQ), which can complement the results of objective analysis. The subjective analysis of mandibular function of TMD individuals is important because it takes into account the perception and satisfaction of 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 (27).

In the present study, no significant differences in kinesiographic parameters were found between the group of participants that 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, subjective analysis were carried out in these studies (10, 26).

Another important finding was that, although the participants have shown an improvement in the extent of vertical and horizontal mandibular movements during maximum mouth opening, the deviations from the midline (RMD and LMD) remained or increased after proposed treatment. The inclusion of women with muscular and articular TMD may be an explanation for this finding. According to Leeuw et al, deviations during opening mandibular movement are mainly related to TJM derangement disorders, such as articular disc displacement. Considering that the educational and self-care therapies act on the control of stress and masticatory muscle disorders, a non-improving of mandibular deviations can be observed in articular TMD individuals treated with these therapies.

Occlusal appliances and physiotherapy have been often used for treating TMD. Truelove et al (15) and Kalamir et al (16) reported that these treatment modalities provide results similar to obtained with educational and self-care therapies, in relation to spontaneous pain, pain during chewing and range of mandibular movements. In addition, Dworkin et al (28) concluded that non-invasive and reversible interventions emphasizing self-management of TMD and addressing both physiological and psychological factors, might offer real benefit to a significant number of individuals with muscular TMD.

Educational and self-care therapies are low cost treatment modalities and that can be indicated as initial treatment for most TMD. The present study revealed the efficiency of these therapies in restoring of mandibular function, considering the analysis of kinesiographic parameters in women diagnosed with TMD. 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 need to be evaluated and could be the topic of future research.

Conclusion

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

Acknowledgments

This research was approved by the institutional ethics committee (protocol number 10/11) and registered in the http://www.ensaiosclinicos.gov.br/ database (trial: RBR-45yn9v). The authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

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. Stiesch-Scholz M, Demling A, Rossbach A. Reproducibility of jaw movements in patients with craniomandibular disorders. J Oral Rehabil. 2006;33:807-12.
4. 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;69:683-694.
5. Radke JC, Kull RS, Sethi MS. Chewing movements altered in the presence of temporomandibular joint internal derangements. Cranio. 2014;32:187-92.
6. 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.
7. De Felício CM, Mapelli A, Sidequersky FV, Tartaglia GM, Sforza C. Mandibular kinematics and masticatory muscles EMG in patients with short lasting TMD of mild-moderate severity. J Electromyogr Kinesiol. 2013;23:627-33.
8. Suvinen TI, Reade PC, Kemppainen P, K€on€onen 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. 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.
11. 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.
12. 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.
13. 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.
14. Feine JS, Lund JP. An assessment of the efficacy of physical modalities for the control of chronic musculoskeletal pain. Pain. 1997;71:5-23.
15. 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;137:1099–1107.
16. 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;5:21-17.
17. 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.
18. Pereira Jr FJ (editor), Huggins KH, Dworkin SF. Critérios de Diagnóstico para Pesquisa das Desordens Temporomandibulares RDC/DTM – Portuguese Translation [online]. Accessed May 02, 2015. http://www.rdctmdinternational.org/TMDAssessmentDiagnosis/RDCTMD/Translations/Portuguese(Brazil).aspx.

19. de Leeuw, R., American Academy of Orofacial Pain Guidelines for Assessment, Diagnosis, and Management. Fourth Edition ed. 2008, Carol Stream: Quintessence Publishing Company, Inc. 316 p.
20. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain. 2003;106:253–261.
21. Gawriołek K, Azer SS, Gawriołek M, Piotrowski PR. Mandibular function after Myorelaxation Therapy in temporomandibular disorders. Adv Med Sci. 2015 ;60:6-12.
22. 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.
23. Tiidus PM. Manual massage and recovery of muscle function following exercise: A literature review. J Orthop Sports Phys Ther. 1997;27:203-210.
24. 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.
25. 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.
26. 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.
27. 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.
28. 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.

Tables:

Table1. Study groups

Groups	First Visit (T0-baseline)	Second Visit (T1-30 days)	Third Visit (T2-60 days)
Control (CG)	Kinesiographic assessment	Kinesiographic assessment + Education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions
Educational (EG)	Kinesiographic assessment + Education instructions	Kinesiographic assessment + Education and self-care instructions	Kinesiographic assessment + Review of education and self-care instructions
Education and self-Care (ESG)	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

Table 2. Mean values (±SD) of mandibular movement patterns during maximum mouth opening and chewing, before (T0) and after 30-days of treatments (T1).

			T0 (mm)	T1 (mm)	p-Value (t-test)
Scan 1	Control group (n=13)	MVO	35.1 ±5.0	36.0 ±2.9	0.418
		MAM	25.5 ±6.6	26.3 ±6.5	0.489
		LMD	13.8 ±8.5	15.2 ±11.2	0.720
		RMD	0.5 ±0.7	1.5 ±2.0	0.127
	Education group (n=16)	MVO	30.0 ±10.2	31.8 ±9.4	0.055
		MAM	17.7 ±10.0	18.6 ±8.3	0.496
		LMD	7.4 ±9.9	6.8 ±7.0	0.808
		RMD	5.3 ±6.7	3.7 ±4.5	0.363
	Self-care and education group (n=13)	MVO	30.5 ±6.0	35.6 ±6.4	0.000*
		MAM	18.1 ±8.9	25.6 ±9.5	0.016*
		LMD	6.1 ±5.5	19.7 ±13.8	0.003*
		RMD	0.8 ±1.1	0.61 ±0.5	0.529
Scan 8	Control group (n=13)	VER	16.2 ±2.0	16.3 ±1.7	0.854
		AP	5.7 ±2.5	5.7 ±2.1	0.985
		LAT	2.8 ±4.8	1.8 ±2.1	0.498
	Education group (n=16)	VER	14.7 ±2.0	15.0 ±2.8	0.496
		AP	3.6 ±1.9	4.0 ±2.5	0.511
		LAT	1.3 ±1.7	0.08 ±3.0	0.165
	Self-care and education group (n=13)	VER	16.0 ±1.4	17.4 ±1.7	0.023*
		AP	5.5 ±4.2	5.3 ±2.7	0.891
		LAT	1.8 ±3.9	2.0 ±2.6	0.842

*Statistically significant differences ($p<0.05$). MVO= maximum vertical opening; MAM= maximum anteroposterior movement; RMD= right maximum deviation; LMD= left maximum deviation; VER= vertical; AP= anteroposterior; LAT= lateral.

Table 3. Mean values (±SD) of mandibular movement pattern during maximum mouth opening, at T0 (baseline), T1 (30 days) and T2 (60 days), and comparison among the groups.

		Control group (mm)	Education group (mm)	Self-care and education group (mm)	p-Value (1-way ANOVA)
T0 (n=42)	MVO	35.1 ±5.0 A	30.0 ±10.2 A	30.5 ±6.0 A	0.171
	MAM	25.5 ±6,6 B	17.7 ±10.0 A	18.1 ±8.9 A	0.046*
	LMD	13.8 ±8.5 A	7.4 ±9.9 A	6.1 ±5.5 A	0.051
	RMD	0.5 ±0.7 A	5.3 ±6.7 B	0.8 ±1.1 A	0.006*
T1 (n=42)	MVO	36.0 ±2.9 A	31.8 ±9.4 A	35.6 ±6.4 A	0.215
	MAM	26.3 ±6.5 A	18.6 ±8.3 B	25.6 ±9.5 A	0.027*
	LMD	15.2 ±11.2 A	6.8 ±7.0 B	19.7 ±13.8 A	0.009*
	RMD	1.5 ±2.0 A	3.7 ±4.5 B	0.6 ±0.5 A	0.025*
T2 (n=35)	MVO	38.2 ±4.3 A	34.5 ±9.3 A	36.8 ±5.0 A	0.447
	MAM	27.6 ±7.9 A	22.7 ±9.9 A	23.8 ±7.7 A	0.408
	LMD	11.0 ±8.4 A	12.8 ±14.1 A	13.2 ±7.1 A	0.880
	RMD	6.2 ±9.9 A	2.6 ±4.8 A	1.4 ±3.2 A	0.204
ΔT1T0	MVO	0.9 ±3.8 A	1.8 ±3.5 A	5.1 ±3.4 B	0.012*
	MAM	0.8 ±4.4 A	0.8 ±5.0 A	7.4 ±9.5 B	0.019*
	LMD	1.4 ±14.3 A	-0.5 ±9.1 A	13.6 ±13.4 B	0.009*
	RMD	1.0 ±2.2 A	-1.6 ±6.3 A	-0.2 ±1.3 A	0.303

*Statistically significant differences ($p<0.05$). Different letters indicate statistically significant differences among the groups. MVO= maximum vertical opening; MAM= maximum anteroposterior movement; RMD= right maximum deviation; LMD= left maximum deviation.

Table 4. Mean values (±SD) of mandibular movement patterns during chewing, at T0 (baseline), T1 (30 days) and T2 (60 days), and comparison among the groups.

		Control group (mm)	Education group (mm)	Self-care and education group (mm)	p-Value (1-way ANOVA)
T0 (n=42)	VER	16.2 ±2.0 A	14.7 ±2.0 A	16.0 ±1.4 A	0.069
	AP	5.7 ±2.5 A	3.6 ±1.9 A	5.5 ±4.2 A	0.135
	LAT	2.8 ±4.8 A	1.3 ±1.7 A	1.8 ±3.9 A	0.546
T1 (n=42)	VER	16.3 ±1.7 AB	15.0 ±2.8 B	17.4 ±1.7 A	0.027*
	AP	5.7 ±2.1 A	4.0 ±2.5 A	5.3 ±2.7 A	0.179
	LAT	1.8 ±2.1 A	0.08 ±3.0 A	2.0 ±2.6 A	0.102
T2 (n=35)	VER	16.9 ±2.8 A	15.5 ±4.0 A	17.2 ±1.3 A	0.051
	AP	6.5 ±3.0 A	4.6 ±2.8 A	3.8 ±2.7 A	0.103
	LAT	2.3 ±3.4 A	0.7 ±4.0 A	1.8 ±3.8 A	0.583
ΔT1T0	VER	0.5 ±1.5 A	-0.3 ±1.7 A	1.4 ±1.1 A	0.065
	AP	0.05 ±2.4 A	-0.2 ±1.7 A	0.1 ±3.4 A	0.903
	LAT	-1.3 ±5.4 A	-1.5 ±3.3 A	-0.1 ±3.2 A	0.638

*Statistically significant differences ($p<0.05$). Different letters indicate statistically significant differences among the groups. VER= vertical; AP= anteroposterior; LAT= lateral.

Figures:

Figure 1. Common graphic patterns. A) Mandibular movement during maximum mouth opening (Scan 1) – MVO= inter-incisal maximum vertical opening; MAM= maximum anteroposterior movement from centric occlusion; RMD= right maximum deviation; LMD= left maximum deviation; COMO= centric occlusion to maximum opening. B) Mandibular movement during habitual chewing (scan 8) on the vertical (Ver), anteroposterior (AP) horizontal and lateral (Lat) axes.

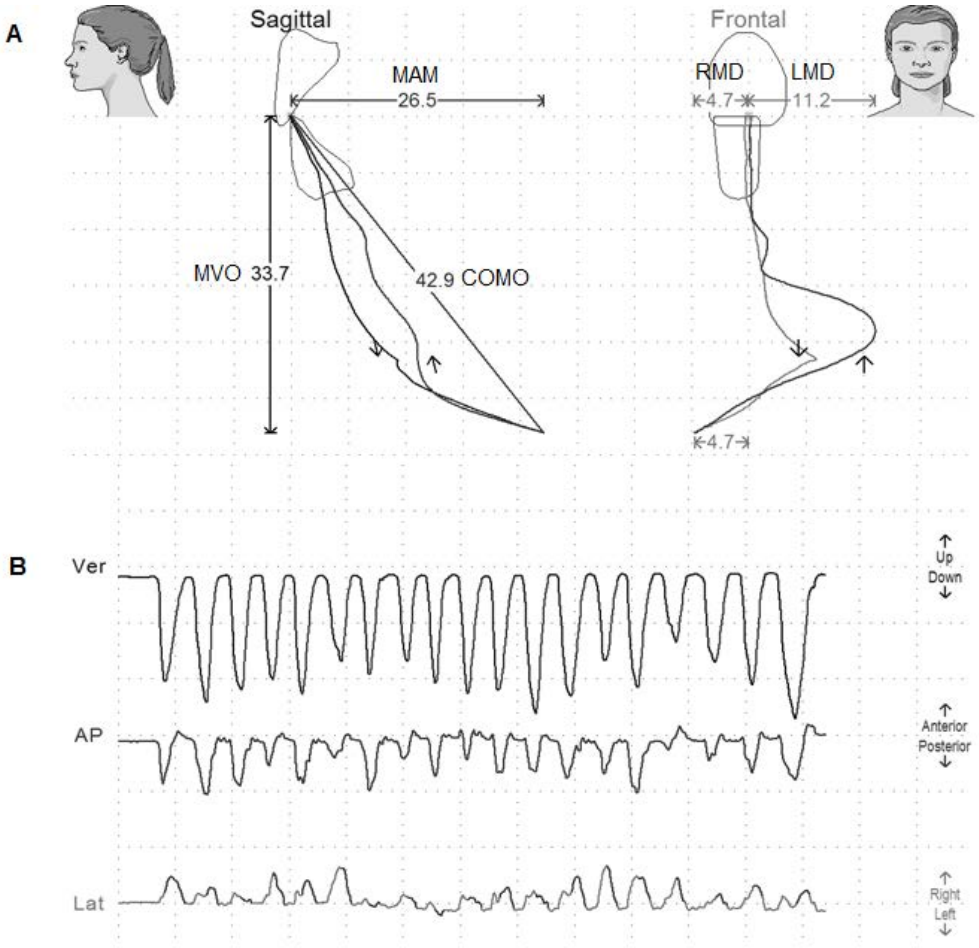
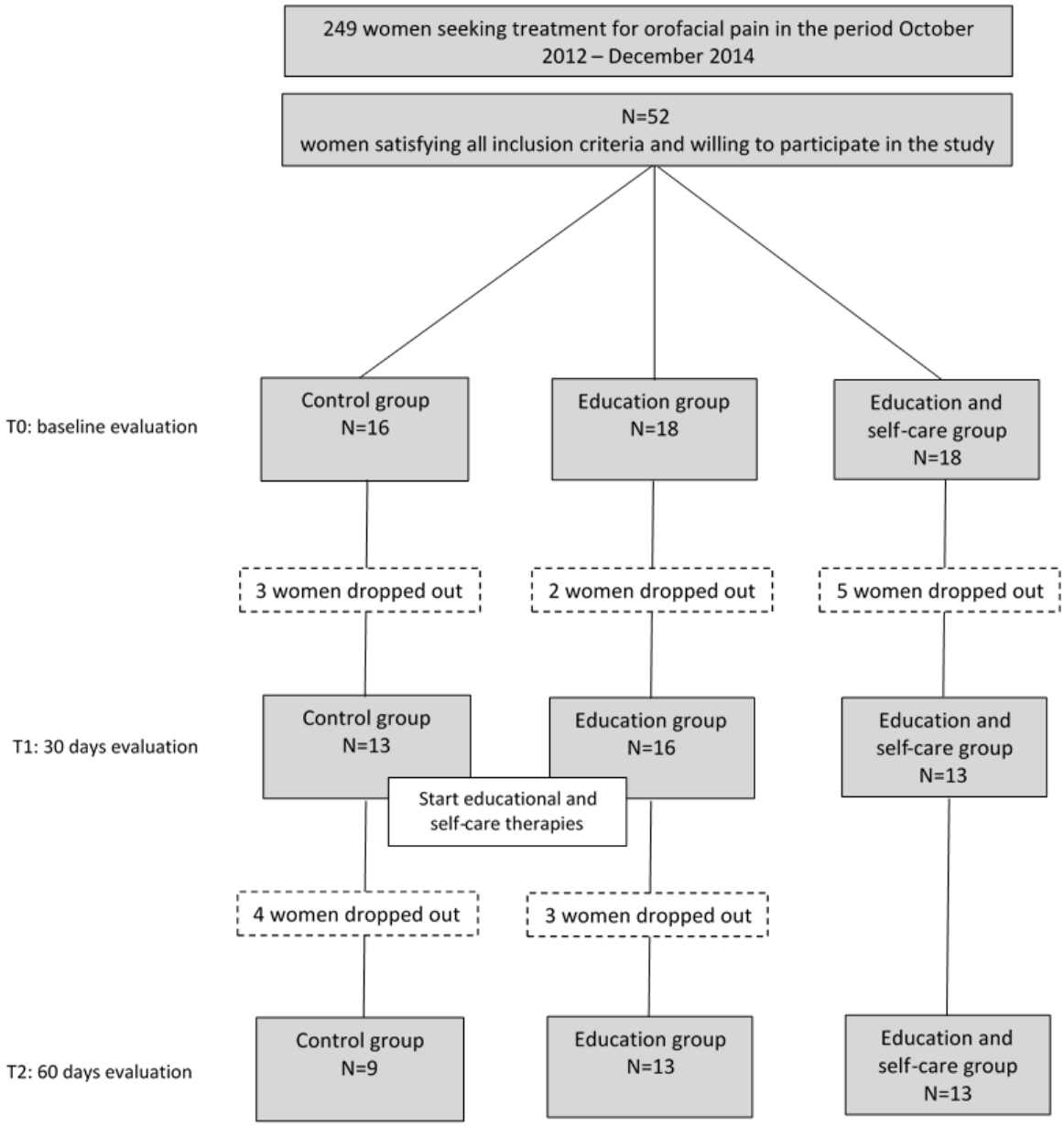


Figure 2. Flow diagram of participants.



3.2 Capítulo 2

Educational and self-care therapies for the treatment of chronic TMD women. Part II: masticatory performance

Running title: Masticatory performance of chronic TMD women

Article category: Original research

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Educational and self-care therapies for the treatment of chronic TMD women. Part II: masticatory performance

Summary

Background: Masticatory function can be impaired in temporomandibular disorders (TMD) individuals. Objective: the aim of this study was to investigate the impact of treatment with educational about TMD and self-care therapies on the masticatory performance of chronic painful TMD women. Methods: fifty-two women with diagnosis of muscle and joint TMD according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC-TMD), were selected and randomly divided into 3 independent groups, control (CG, n=16), education (EG, n=18), and education and self-care (ESG, n=18), according to the treatment sequence that they received. Outcome variable was the masticatory performance, evaluated by the sieves method. This analysis was performed at baseline (T0), 30-days (T1) and 60-days (T2). The paired sample t-test (α=0.05) was used to compare the masticatory performance before (T0) and after 30 days of follow-up (T1), for each group. Furthermore, a comparison among the groups was performed using the parametric test 1-way ANOVA (α=0.05). Results: no significant differences were found between the periods (T0 – T1), for all groups. After 30 and 60 days, the results were similar among the CG (55.0 ± 19.9; 52.4 ± 19.4), EG (50.8 ± 24.2; 52.7 ± 26.7) and ESG (61.1 ± 19.1; 56.9 ± 18.9). Conclusion: in the short-term, the masticatory performance of the patients with chronic painful TMD was not affected by the proposed treatment.

Keywords: mastication, temporomandibular joint disorders, temporomandibular joint, self-care, education, treatment outcome

Educational and self-care therapies for the treatment of chronic TMD women. Part II: masticatory performance

Background

Temporomandibular disorders (TMD) represent clusters of clinical problems involving the masticatory muscles and/or the temporomandibular joint (TMJ), as well as associated structures (1). They are mainly characterized by musculoskeletal pain, joint sounds, muscle fatigue and impairment of mandibular movement (1), and may cause functional limitations, such as difficulties in chewing, speaking, and other orofacial functions (2), negatively affecting sufferers' quality of life (3). Previous studies demonstrate that TMD are more prevalent in women, maybe due to the presence of estrogen receptors in the ATM or because they are more susceptible to psychosomatic stress than men (4).

The etiology of TMD has been considered complex and multifactorial, where several factors may contribute to its predisposition, initiation, and maintenance, making difficult to determine an effective treatment. Currently it is known that parafunctional habits and psychosocial factors (e.g., anxiety, depression and fatigue) play an important role in the development of TMD (5). Thus, treatments that approach only biomedical factors are considered insufficient to promote long-term improvement of TMD signs and symptoms (6).

Previous studies have shown that a biopsychosocial approach, that offers equal emphasis to the treatment of physiologics, psychological and social factors can result in substantial improvements in chronic TMD pain (7). With this purpose, approaches involving self-care strategies and behavioral therapies have been developed, and are highly recommended for painful TMD treatment. These approaches consist in an extensive education about the condition, associated with the use of heat packs, jaw exercises, strategies to reduce the parafunctional jaw activities and muscular relaxation techniques (8).

In addition, it has been suggested that counseling and self-care therapies help to relieve musculoskeletal pain and to restore mandibular functions by reducing inflammation, decrease in muscle tension and psychosocial changes (9). A recent systematic review concluded that these treatment approaches represent a conservative low-cost treatment and can be beneficial for relief and

control of TMD signs and symptoms by improving psychological domains and reducing harmful behaviors (8). However, more controlled and randomized clinical trials are needed to validate the effectiveness of this treatment modality (8).

The presence of TMD can influence the masticatory capacity due to the presence of pain, muscle dysfunction and limitations of mandibular movements[2]. Considering that the mastication is one of the main functions of the stomatognathic system, it is important to the assessment of the effect of counselling and self-care approaches in the masticatory performance of patients with chronic painful TMD.

Masticatory performance can be defined as the ability to grind certain food portions with a determined number of masticatory cycles (10). Several studies have assessed masticatory performance with different methods and foods (11). Among the methods stands out of the sieves, that can be performed with artificial or natural food. The food is crushed by the individual, collected from inside of their mouth, and is passed through sieves (10). The masticatory performance is considered better when more of what is masticated is found filtered through the smaller pore size sieve. This analysis provides an objective evaluation of masticatory function, and can be an important parameter for investigation of masticatory difficult of individuals with TMD (12).

The literature is still inconclusive regarding the masticatory performance of TMD patients treated with counseling and self-care therapies. Thus, the aim of the present study was to investigate the impact of these treatment modalities on the masticatory performance of women with chronic painful TMD. The null hypothesis was that the treatment with such therapies during the proposed period would not influence the masticatory performance of the participants.

Methods

Study Sample

Two hundred forty-nine women seeking treatment for orofacial pain in the TMD/Occlusion Clinic of the Araraquara Dental School (Univ Estadual Paulista), Brazil, over a 24-month period, were subjected to a preliminary interview to determine the main complaint, pain characteristics (quality, installation time, duration, aggravating and mitigating factors, frequency and intensity) and medical history. In addition, a calibrated researcher dentist (R1) performed the clinical and functional

examinations necessary to make the diagnosis and classification of the TMD according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC-TMD) Axis I and II - Portuguese version (13). Axis I allows the classification of TMD in 3 subgroups: Group I - masticatory muscle pain with/without limitation of mouth opening; Group II - disc displacement with or without reduction; Group III - arthralgia, osteoarthritis or osteoarthrosis. Axis II assess the severity of TMD, grade of depression and somatization, limitation of mandibular functions.

The inclusion criteria were: (1) woman with age range between 18 and 65 years; (2) presence of muscle and/or joint TMD as defined by RDC-TMD - Axis I, Groups I and II, with pain recurrent or constant for more than 3 months; (3) a self-report of an average jaw pain intensity on the assessment day of at least 3 on a visual analog scale (VAS) from 0 (no pain) to 10 (worst pain imaginable); (4) grade II or III of chronic pain according to RDC-TMD - Axis II; (5) not be in treatment for this painful condition; (6) not be starting any treatment for other painful condition such as fibromyalgia or rheumatoid arthritis; (7) presence of natural dentition or fixed prostheses with posterior occlusal stability. Individuals who had severe malocclusions or debilitating systemic diseases were excluded.

Fifty-two women met these criteria and were invited to participate in this study, which was approved by the institutional ethics committee (protocol number 10/11) and registered in the http://www.ensaiosclinicos.gov.br/database (trial: RBR-45yn9v). A written informed consent was obtained from each patient before enrollment.

Study Design

The present study was designed as a double-blind, short-term randomized clinical trial to evaluate the masticatory performance of women with chronic muscle and joint TMD, after treatment with educational and self-care therapies. Participants (n=52, mean age (SD): 36,4 ±8,8 years old) were randomly divided into three independent groups, control (n=16, mean age (SD): 37,4 ±7,3 years), education (n=18, mean age (SD): 34,8 ±6,7 years old) and education and self-care (n=18, mean age (SD): 36,6 ±10,6 years old), according to the sequence of treatment received, as described in Table 1.

The sample was randomized by age, which was performed by one researcher dentist (R2) using computer-generated numbers (BioEstat 5.0; Federal University of Pará). Outcome variable was the masticatory performance, evaluated by the sieves method. This evaluation was performed at T0,

T1 and T2, and conducted by the same examiner (G.G.), who was blind to the treatment group assignment. The interval between visits was 30 days, and at the end of 60 days follow-up, all participants had received full approach, including education about TMD and self-care therapies. A flow diagram of the participants throughout the course of the research is shown in Figure 1.

Treatment

The education instructions about TMD and self-care therapies were transmitted through a video, ensuring that the information had been passed in the same way to all study participants. One of the researchers (R2) were available to clarify any questions during the video sessions. In addition, women received a printed brochure containing the video information regarding the TMD education and the sequence of self-care procedures that should be made daily at home, during follow-up period of the study.

Education instruction video addressed general information about TMD, such as anatomical structures involved, possible etiologic factors and good prognosis of these disorders. Furthermore, the video explained about the overuse of the masticatory muscles, and how it could contribute to the signs and symptoms of TMD. The women were instructed to pay attention to their jaw muscle activity, to keep the jaw muscles relaxed with the mandible in its postural rest position (no contact between the teeth), and to avoid oral harmful habits and excessive mandibular movements.

Self-care video included instructions of procedures considered effective for the control of pain and dysfunction related to TMD, and recommended by the American Academy of Orofacial Pain (1):

a) Thermotherapy: the application of heat provides benefits such as relief pain, improved muscle tone and muscle relaxing. Thus, women were advised to apply moist heat pads over the face for 15 minutes, 3 times a day.

b) Mandibular exercises: controlled movements of the mandible collaborate for stretching and relaxation of muscles masticatory, improving muscle coordination and extent of mandibular movements. In order to stretch the muscle, the women were instructed to perform maximum mouth opening movement with the aid of the thumb and index fingers, to keep for 10 seconds and then slowly close the mouth. In addition, they should open and close the mouth keeping the tongue on the palate. Women were also instructed to do mouth opening with resistance, where they should place

one hand under their chin and force mandible up, hindering the opening movement. Coordination exercises consisted of opening and closing the mouth in front of the mirror, trying to make the jaw move straight. Thereafter, women should make movement of laterality and protrusion, without opening their mouth. The exercises should be repeated 6 times and performed 3 times a day.

c) Self-massage: massage promotes improvement of local blood circulation, decreases the pain and muscle tension. Hence, the women were carefully instructed to massage the masseter and temporal muscles with circular movements performed by index, middle, and ring fingers, 3 times a day.

In order to verify the adherence of the participants to treatment, a telephone interview was performed every 15 days, during follow-up period of the study. They were asked about compliance of the procedures prescribed, and the information were reinforced.

Outcome variable

The masticatory performance was evaluated by means of the sieves method, using almonds as the natural test food (14). The women were instructed to deliberately chew 5 almonds for 20 chewing strokes, while a single calibrated operator (R3) counted the cycles. Then, the chewed content was collected in a container. For standardization, after this collection, women gargle 50 ml of water to rinse and remove the remaining particles, which also were collected in the same container. This was then sealed and sent for laboratory analysis, where its contents were poured into a sieve (sieve 1-7 cm; Plasútil, ref. 1188, size 175x78x40 mm) adapted on a filter paper (no. 2; Melitta Brazil's Industry and Trade Ltd) to separate liquid and chewed material. At this time, 500 mL of water was poured over the sieve in order to eliminate any saliva present in the almonds and to reduce particle clumping.

The crushed almonds were desiccated in an electric oven (Fanem; Industry and Commerce Ltd) at a controlled temperature of 130o C for 40 minutes. The total content was weighed (Wt) on a precision scale (Electric and Electronic Industry and Trade Gehaka Ltd) and, then subjected to a 4-sieve system under constant vibration for 60 seconds in a gypsum vibrator (VH; Dental Products). The sieves used (Granutest; Telastem Screens for Analysis Ltd) were approved by the Brazilian Association of Technical Standards (ABNT) and had different hole sizes: 4.0 mm (ABNT 5), 2.8 mm (ABNT 7), 2.0 mm (ABNT 10), and 1.0 mm (ABNT 18). They were placed on top of each other, with the largest hole screen at the top and the smallest hole screen at the bottom, followed by a background collector to collect material that passed through the 4 sieves.

The particles retained in the sieves, including those that remained in the background collector, also were weighed (W1). Masticatory performance was calculated as the weight of comminuted material that passed through the 2.8-mm sieve. From these values, the masticatory performance was calculated based on the index proposed by Kapur and Soman (11): MP=W1x100/Wt, where MP was the masticatory performance (in percentage); W1 was the material weight sum in sieves 3, 4, and the background collector; and Wt the total material weight subjected to sieving.

Statistical analysis

All data collected were preliminarily analyzed by Shapiro-Wilk test to evaluate normal distribution. To test the impact of treatment, we compared the masticatory performance for each group (intragroup comparison), before (T0) and after 30 days of follow-up (T1), using the parametric paired sample t-test. Moreover, a comparison among the groups (CG, EG and ESG) was performed using the parametric test 1-way ANOVA. Statistical tests were conducted with the softwares PASW v19 and SPSS Inc, considering a significance level set at $\alpha=0.05$.

Results

During the follow-up, seventeen women (33%) dropped out of the study, 7 (13%) from the control group, 5 (10%) from the education group and 5 (10%) from the self-care and education group. The dropouts occurred at different times throughout the study, ten women (3 from the CG, 2 from the EG and 5 from the SEG) dropped out after the first evaluation (T0), and seven women (4 from the CG and 3 from the EG) dropped out after second evaluation (T1). Therefore, fifty-two women were evaluated at baseline (T0), forty-two were evaluated after 30 days of follow-up (T1) and thirty-five were evaluated after 60 days follow-up (T2). The reasons for dropouts included illness, impossibility to attend the appointments, and improvement of symptoms.

The results showed that the masticatory performance of the participants was not influenced by the proposed treatments (Table 2). At baseline (T0), no significant differences were found among the groups (P=0,604), demonstrating the sample homogeneity. Also, no significant differences among the groups were found after 30 days of treatment (T1), indicating that the masticatory performance of participants who did not receive treatment (control group) was similar to masticatory performance of participants who received educational and self-care therapies (education group and self-care and education group).

Considering that all participants received full treatment approaches in the second visit, including education about TMD and self-care instructions, the goal of the third visit was to evaluate whether the participants who had received total treatment for 60 days would show better results than the participants who had received full treatment for only 30 days. The results showed no significant differences between the volunteers treated with educational and self-care therapies for 30 days and the volunteers treated for 60 days (Table 1). Furthermore, as illustrated in Figure 2, the results were similar in T0 compared with T1 for all groups ($p>.05$).

Discussion

The null hypothesis of this study was accepted since the treatment with only educational instructions (EG) or educational associated with self-care therapies (ESG) had no impact on masticatory performance of women presenting chronic painful TMD during the proposed period. Their masticatory performance remained unaltered after 30 days of treatment, in both groups. Furthermore, there was also no improvement in masticatory performance on the 60 days follow-up.

Previous studies showed that individuals presenting TMD tend to exhibit a reduced masticatory performance compared with healthy individuals (15, 16). According to Campos et al (17), the presence of pain in the orofacial region and the limitation of mandibular movements directly impacts the masticatory function of TMD sufferers; therefore, the more severe these symptoms, the greater the masticatory difficulty, and the greater the change in eating habits. In addition, Pereira et al (9) found that TMD individuals reported limitations as limited choice of foods and changes in the meals preparation. Therefore, the improvement of masticatory function is one of the goals in the treatment of TMD (18)

Currently, educational and self-care therapies have been used as initial treatment of almost all DTM (19). The literature on these therapies shows that enforcing patient responsibilities, reducing harmful behaviors and the balance among physiological, psychological and social factors are a powerful tool for control and relief of TMD signals and symptoms (8, 20). Additionally, Craane et al. found significant improvement for quality of life ratings in patients treated with educational and self-care therapies.

Studies regarding the effect of educational and self-care therapies on masticatory performance of individuals with chronic painful TMD are relatively scarce in the literature. Michelotti et

al (19, 21) reported significant improvement of pain, impairment of mandibular movements and masticatory ability after treatment with these therapies. However, different methodologies were carried out in these studies, as the use of subjective measures, obtained from questionnaires and visual analogue scale, and a 3-month treatment period. The sieves method, used in the present study, is considered the most reliable masticatory analysis method (22), and it is important for simulate an everyday functional condition in the individual (12). Moreover, almond is the food test most commonly used, and has a convenient size and texture without being too difficult to chew (14).

Studies with long-term follow-up (1 year or more) showed that 50% to 90% of the TMD patients have few or no symptoms after conservative treatments (19, 23). Therefore, a follow-up period of only 60 days can be considered a limitation of this study. Another aspect that can be considered a limitation is that our sample was instructed to perform the physical therapy daily at home, without any supervision. It was observed by Craane et al (24) and Laat et al (25) that TMD individuals who performed the physical therapy, with the supervision of a physiotherapist, showed a significant improvement in the mandibular movement and masticatory ability. Additionally, we had a high dropout rate during the follow-up period. Thus, future studies should explore the effect of the educational and self-care therapies on masticatory performance in individuals with chronic painful TMD with long-term follow-up, and using bigger volunteers samples.

Conclusion

The findings of this study indicate that the treatment with educational and self-care therapies during a 60-day period had no impact on masticatory performance of women presenting chronic painful TMD.

Acknowledgments

This research was approved by the institutional ethics committee (protocol number 10/11) and registered in the http://www.ensaiosclinicos.gov.br/ database (trial: RBR-45yn9v). The authors declare no potential conflicts of interest with respect to the authorship and／or publication of this article.

References

1. de Leeuw, R., American Academy of Orofacial Pain Guidelines for Assessment Diagnosis, and Management. Fourth Edition ed. 2008, Carol Stream: Quintessence Publishing Company, Inc. 316 p.
2. Ferreira CL, Machado BC, Borges CG, Rodrigues Da Silva MA, Sforza C, De Felício CM. Impaired orofacial motor functions on chronic temporomandibular disorders. J Electromyogr Kinesiol. 2014;24:565-71.
3. Barros Vde M, Seraidarian PI, Côrtes MI, de Paula LV. The impact of orofacial pain on the quality of life of patients with temporomandibular disorder. J Orofac Pain. 2009;23:28–37
4. Phillips JM, Gatchel RJ, Wesley AL, Ellis III E. Clinical implications of sex in acute temporomandibular disorders. J Am Dent Assoc. 2001;132:49-56.
5. Mello VV, Barbosa AC, Morais MP, Gomes SG, Vasconcelos MM, Caldas Júnior Ade F. Temporomandibular disorders in a sample population of the Brazilian northeast. Braz Dent J. 2014;25:442-6.
6. Sherman JJ, Turk DC. Nonpharmacologic approaches to the management of myofascial temporomandibular disorders. Curr Pain Headache Rep. 2001;5:421–431.
7. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol Bull. 2007;133:581-624.
8. de Freitas RF, Ferreira MÂ, Barbosa GA, Calderon PS. Counseling and self-management therapies for temporomandibular disorders: a systematic review. J Oral Rehabil. 2013;40:864-74.
9. Pereira LJ, Steenks MH, Wiler AD, Speksnijder CM, Van Der Bilt A. Masticatory function in subacute TMD patients before and after treatment. J Oral Rehabil. 2009;36:391–402.
10. Eberhard L, Schindler HJ, Ellmann D, Schmitter M, Rammelsberg P, Giannakopoulos NN. Comparison of particle-size distributions determined by optical scanning and by sieving in the assessment of masticatory performance. J Oral Rehabil. 2012;39: 338-48.
11. Kapur KK, Soman SD. Masticatory performance and efficiency in denture wearers. 1964. J Prosthet Dent. 2006;95:407-11.
12. Boretti G, Bickel M, Geering AH. A review of masticatory ability and efficiency. J Prosthet Dent. 1995;74:400-403.

13. Pereira Jr FJ (editor), Huggins KH, Dworkin SF. Critérios de Diagnóstico para Pesquisa das Desordens Temporomandibulares RDC/DTM – Portuguese Translation [online]. Accessed May 02, 2015. http://www.rdctmdinternational.org/TMDAssessmentDiagnosis/RDCTMD/Translations/Portuguese(Brazil).aspx.
14. Al-Ali F, Heath MR, Wright PS. Simplified method of estimating masticatory performance. J Oral Rehabil. 1999;26:678-83.
15. Peroz I, Tai S. Masticatory performance in patients with anterior disk displacement without reduction in comparison with symptom-free volunteers. Eur J Oral Sci. 2002;110:341-4.
16. Henrikson T, Ekberg EC, Nilner M. Masticatory efficiency and ability in relation to occlusion and mandibular dysfunction in girls. Int J Prosthodont. 1998;11:125-32.
17. 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.
18. 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.
19. 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.
20. Feine JS, Lund JP. An assessment of the efficacy of physical modalities for the control of chronic musculoskeletal pain. Pain. 1997;71:5–23.
21. 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.
22. Mendonça DB, Prado MM, Mendes FA, Borges T de F, Mendonça G, do Prado CJ, et al. Comparison of masticatory function between subjects with three types of dentition. Int J Prosthodont. 2009;22:399-404.
23. Garafis P, Grigoriadou E, Zarafi A, Koidis PT. Effectiveness of conservative treatment for craniomandibular disorders: A 2-year longitudinal study. J Orofac Pain. 1994;8:309–314.

24. 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.

25. 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.

Tables:

Table 1. Study groups.

Groups	First Visit (T0-baseline)	Second Visit (T1-30 days)	Third Visit (T2-60 days)
Control (CG)	Masticatory performance assessment	Masticatory performance assessment + Education and self-care instructions	Masticatory performance assessment + Review of education and self-care instructions
Educational (EG)	Masticatory performance assessment + Education instructions	Masticatory performance assessment + Education and self-care instructions	Masticatory performance assessment + Review of education and self-care instructions
Education and Self-Care (ESG)	Masticatory performance assessment + Education and self-care instructions	Masticatory performance assessment + Review of education and self-care instructions	Masticatory performance assessment + Review of education and self-care instructions

Table 2. Mean values (± SD) of the masticatory performance at T0 (baseline), T1 (30 days) and T2 (60 days), and comparison among the groups.

	Control group (%)	Education group (%)	Education and self-care groups (%)	p-Value (1-way ANOVA)
T0 (n=42)	46.6 ±24.8 A	50.4 ±25.2 A	57.8 ±17.9 A	0.604
T1 (n=42)	55.0 ±19.9 A	50.8 ±24.2 A	61.1 ±19.1 A	0.450
T2 (n=35)	52.4 ±19.4 A	52.7 ±26.7 A	56.9 ±18.9 A	0.669
ΔT1T0*	5.34 ±17.0 A	0.4 ±9.9 A	3.3 ±17.5 A	0.676

*ΔT1T0, difference between the mean values of the masticatory performance recorded at T1 and T0; similar capital letters denotes no significant differences among the groups (p>.05).

Figures:

Figure 1. Flow diagram on women recruitment and dropouts during the study.

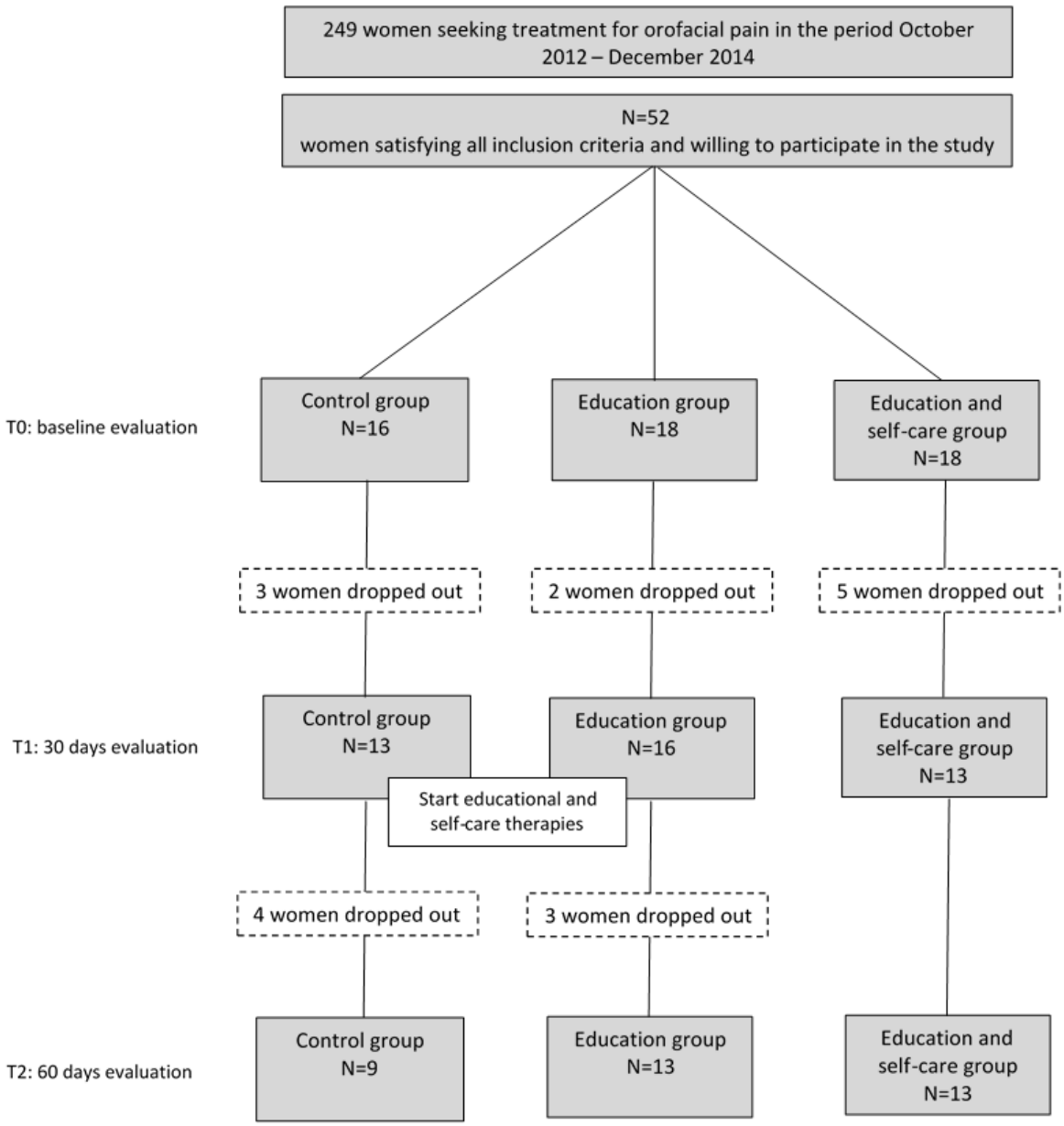
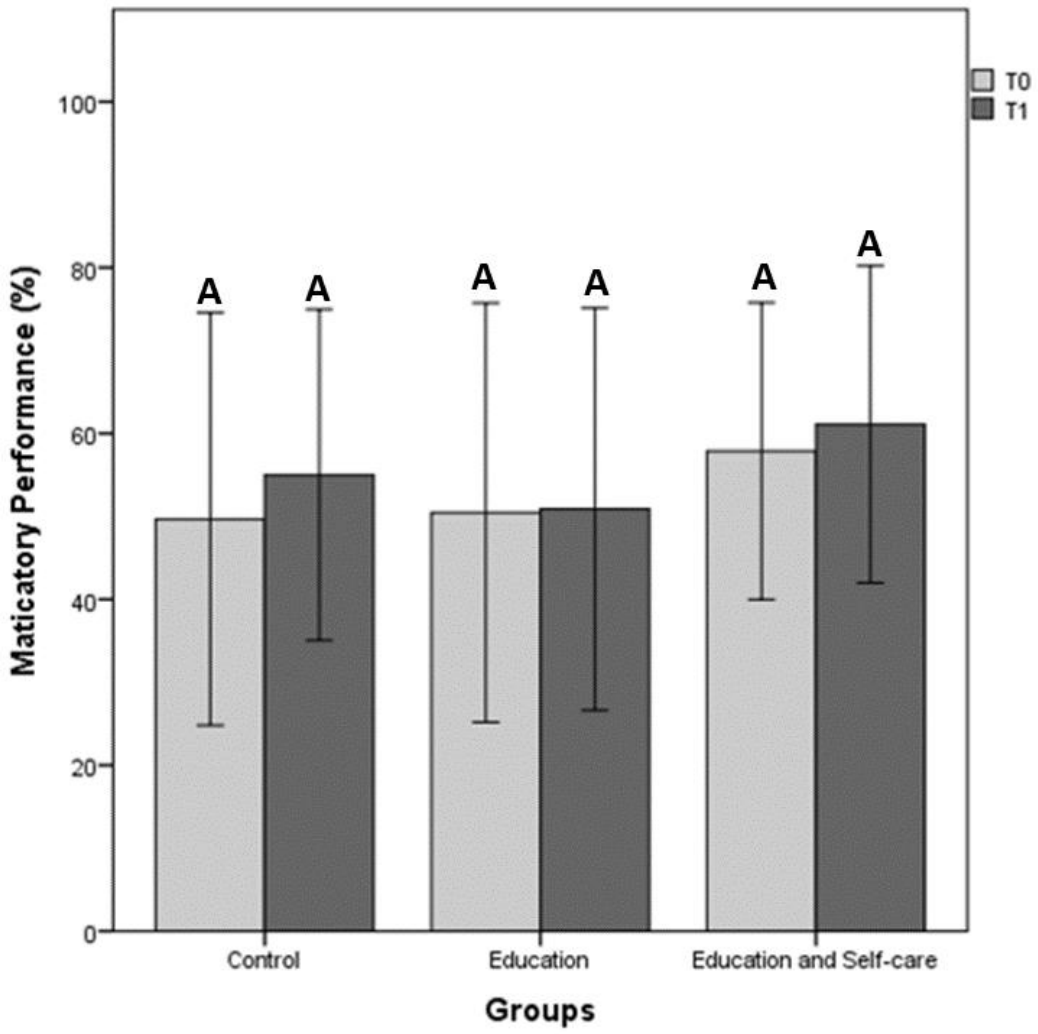


Figure 2. Comparison of the masticatory performance before (T0) and after 30 days of treatment (T1), for each group. Similar capital letters demonstrates no significant differences between periods (paired sample t-test, p> .05).



4 CONCLUSÃO

Diante do objetivo proposto, dos resultados obtidos e das limitações apresentadas, foi possível concluir que, em curto prazo, o tratamento com terapias educacionais e de autocuidados influenciou positivamente o padrão de movimento mandibular de mulheres com DTM crônica dolorosa. Entretanto, o desempenho mastigatório das pacientes permaneceu inalterado após 30 e 60 dias do tratamento proposto.

5 REFERÊNCIAS*

1. Al-Ali F, Heath MR, Wright PS. Simplified method of estimating masticatory performance. J Oral Rehabil. 1999; 26(8): 678-83.
2. Alencar F Jr, Becker A. Evaluation of different occlusal splints and counselling in the management of myofascial pain dysfunction. J Oral Rehabil. 2009; 36(2): 79-85.
3. Bagis B, Ayaz EA, Turgut S, Durkan R, Özcan M. Gender difference in prevalence of signs and symptoms of temporomandibular joint disorders: a retrospective study on 243 consecutive patients. Int J Med Sci. 2012; 9(7): 539-44.
4. Bonjardim LR, Lopes-Filho RJ, Amado G, Albuquerque Junior RLC, Gonçalves SRJ. Association between symptoms of temporomandibular disorders and gender, morphological occlusion, and psychological factors in a group of university students. Indian J Dent Res. 2009; 20(2): 190-4.
5. Boretti G, Bickel M, Geering AH. A review of masticatory ability and efficiency. J Prosthet Dent 1995; 74(4): 400-3.
6. 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(1): 47-55.
7. Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. J Orofac Pain. 1999; 13(4): 232-7.
8. Costa YM, Porporatti AL, Stuginski-Barbosa J, Bonjardim LR, Conti PC. Additional effect of occlusal splints on the improvement of psychological aspects in temporomandibular disorder subjects: A randomized controlled trial. Arch Oral Biol. 2015; 60(5): 738-44.
9. 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(11): 864-74.
10. de Leeuw, R. American Academy of Orofacial Pain Guidelines for Assessment, Diagnosis, and Management. 4th ed. Carol Stream: Quintessence; 2008.

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*De acordo com o Guia de Trabalhos Acadêmicos da FOAr/UNESP, adaptado das Normas Vancouver. Disponível no site da Biblioteca: http://www.foar.unesp.br/#biblioteca/manual.

11. Eberhard L, Schindler HJ, Ellmann D, Schmitter M, Rammelsberg P, Giannakopoulos NN. Comparison of particle-size distributions determined by optical scanning and by sieving in the assessment of masticatory performance. J Oral Rehabil. 2012; 39(5): 338-48.
12. Edlund J, Lamm CJ. Masticatory efficiency. J Oral Rehabil 1980; 7(2): 123-30.
13. Ferreira CL, Machado BC, Borges CG, Rodrigues Da Silva MA, Sforza C, De Felício CM . Impaired orofacial motor functions on chronic temporomandibular disorders. J Electromyogr Kinesiol. 2014; 24: 565-71.
14. Garofalo J, Gatchel RJ, Wesley AL, Ellis III E. Predicting chronicity in acute temporomandibular joint disorders using the research diagnostic criteria. J Am Dent Assoc. 1998; 129(4): 438-45.
15. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC.The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol Bull. 2007; 133(4): 581-624.
16. 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(3): 270-8.
17. Greene CS, Klasser GD, Epstein JB. Revision of American Association of Dental Research's Science Information Statement about Temporomandibular Disorders. J Can Dent Assoc. 2010; 76: a115.
18. Hayakawa I, Watanabe I, Hirano S, Nagao M, Seid T. A simple method for evaluating masticatory performance using a color-changeable chewing gum. Int J Prosthodont. 1998; 11(2): 173-6.
19. Henrikson T, Ekberg EC, Nilner M. Masticatory efficiency and ability in relation to occlusion and mandibular dysfunction in girls. Int J Prosthodont. 1998; 11(2): 125-32.
20. 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(2): 138-47.
21. Kapur KK, Soman SD. Masticatory performance and efficiency in denture wearers. 1964. J Prosthet Dent. 2006; 95(6): 407-11.
22. 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(3): 190-201.

23. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain. 2003; 106(3): 253-61.
24. LeResche L, Saunders K, Von Korff MR, Barlow W, Dworkin SF. Use of exogenous hormones and risk of temporomandibular disorder pain. Pain. 1997; 69(2): 153-60.
25. Licini F, Nojelli A, Segu M, Collesano V. Role of psychosocial factors in etiology of temporomandibular disorders: Relevance of a biaxial diagnosis. Minerva Stomatol. 2009; 58(11): 557-66.
26. Maísa Soares G, Rizzatti-Barbosa CM. Chronicity factors of temporomandibular disorders: a critical review of the literature. Braz Oral Res. 2015;29:18.
27. Manly RS, Braley LC. Masticatory performance and efficiency. J Dent Res. 1950; 29(18): 448-62.
28. Manfredini D, Guarda-Nardini L, Winocur E, Piccotti F, Ahlberg J, Lobbezoo F. Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011; 112(4): 453-62.
29. McNeill C. Management of temporomandibular disorders: concepts and controversies. J Prosthet Dent. 1997; 77(5): 510-22
30. Mello VV, Barbosa AC, Morais MP, Gomes SG, Vasconcelos MM, Caldas Júnior Ade F. Temporomandibular disorders in a sample population of the Brazilian northeast. Braz Dent J. 2014; 25(5): 442-6.
31. 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(1): 47-53.
32. 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(2): 114-25.
33. Mowlana F, Heath MR, Van der Bilt A, Van der Glas HW. Assessment of chewing efficiency: a comparison of particle size distribution determined using optical scanning and sieving of almonds. J Oral Rehabil. 1994; 21(5): 545-51.
34. Navrátil L, Navratil V, Hajkova S, Hlinakova P, Dostalova T, Vranová J. Comprehensive treatment of temporomandibular joint disorders. Cranio. 2014; 32(1): 24-30.

35. Nokubi T, Yasui S, Yoshimuta Y, Kida M, Kusunoki C, Ono T, et al. Fully automatic measuring system for assessing masticatory performance using b-carotene-containing gummy jelly. J Oral Rehabil. 2013; 40(2): 99-105.
36. Oliveira AS, Dias EM, Contato RG, Bérzin F. Prevalence study of signs and symptoms of temporomandibular disorder in Brazilian college students. Braz Oral Res. 2006; 20(1): 3-7.
37. Peroz I, Tai S. Masticatory performance in patients with anterior disk displacement without reduction in comparison with symptom-free volunteers. Eur J Oral Sci. 2002; 110(5): 341-4.
38. Poveda Roda R, Bagán JV, Diaz Fernández JM, Hernandez Bazán S, Jiménez Soriano Y. Review of temporomandibular joint pathology. Part I: Classification, epidemiology and risk factors. Med Oral Patol Oral Cir Bucal. 2007; 12(4): E292–8.
39. Santos CE, Freitas O, Spadaro ACC, Mestriner Junior W. Development of a colorimetric system for evaluation of the masticatory efficiency. Braz Dent J. 2006; 17(2): 95-9.
40. Sato S, Goto S, Takanezawa H, Kawamura H, Motegi K. Electromyographic and kinesiographic study in patients with nonreducing disk displacement of the temporomandibular joint. Oral Surgery. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1996; 81(5): 516-21.
41. 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(7): 708-13.
42. Sherman JJ, Turk DC. Nonpharmacologic approaches to the management of myofascial temporomandibular disorders. Curr Pain Headache Rep. 2001; 5(5): 421–31.
43. Toman M, Toksavul S, Saracoglu A, Cura C, Hatipoglu A. Masticatory performance and mandibular movement patterns of patients with natural dentitions, complete dentures, and implant-supported overdentures. Int J Prosthodont. 2012; 25(2): 135-7.
44. Wright EF, Domenech MA, Fischer JR Jr. Usefulness of posture training for patients with temporomandibular disorders. J Am Dent Assoc. 2000; 131(2): 202–10.

ANEXOS

Anexo 1 - Termo de Consentimento Livre e Esclarecido.

Termo de Consentimento Livre e Esclarecido

Projeto: Influência da educação e de autocuidados na dor e na função relacionada à disfunção temporomandibular crônica: estudo clínico, randomizado, duplo-cego, controlado.

Pesquisador Responsável: Daniela Aparecida de Godoi Gonçalves

Paciente: _____ Idade:_____

RG:_____ Prontuário Geral: _____ Telefone:_____

Endereço:_____

_____

A pesquisa para a qual a senhora está sendo convidada a participar tem como objetivo avaliar o quanto tratamentos simples feitos por si mesma em sua casa, podem ajudar a reduzir a dor no seu rosto e articulações perto dos ouvidos e também as dificuldades que possam estar acontecendo para mexer sua boca, falar ou mastigar. Por isso vamos lhe ensinar como realizar esses tratamentos em casa que incluem: compressas quentes no rosto, massagens que você mesma fará, exercícios para fazer com a boca. Esse tipo de tratamento é bem conhecido e usado para o tipo de dor facial que você apresenta chamada disfunção temporomandibular ou DTM. São considerados conservadores, não-invasivos, e não trazem riscos à sua saúde ou à sua vida, e não têm contra-indicação. Tais tratamentos não lhe trarão nenhum custo financeiro. Vamos avaliar se eles te ajudaram através dos exames clínicos nas consultas mensais onde mediremos o quanto você consegue abrir sua boca sem sentir dor, se você sente dor quando tocamos nos músculos do seu rosto, a nota que você dá para sua dor e ainda através de questionários que vão avaliar o quanto a dor está atrapalhando suas funções normais.

No início do tratamento você será avaliada por meio de exames clínicos e questionários. Depois assistirá a um vídeo com todas as informações que precisa para realizar o tratamento caseiro. Além disso, vamos lhe entregar um folheto com todas essas informações para que você possa ler na sua casa na hora de fazer os procedimentos. Todo o tratamento vai demorar 3 meses e você só terá que vir às consultas 1 vez por mês. Porém, durante todo o decorrer do acompanhamento você poderá falar conosco por telefone e agendamos uma consulta extra, caso seja necessário. Estaremos sempre à disposição para responder às suas dúvidas ou fazer qualquer esclarecimento que for necessário.

Protocolo CEP nº 10/11
Aprovado em reunião de 13/06/2011
Secretaria do CEP-FO/CAr

A qualquer momento você tem liberdade para desistir de participar da pesquisa sem que isso lhe cause qualquer problema ou prejuízo futuro. Isso quer dizer que se você decidir não participar da pesquisa, ou desistir de participar em qualquer momento, você tem a garantia de que receberá os tratamentos clínicos necessários para a DTM. Ao final dos 3 meses, outros tratamentos adicionais que forem necessários para dor serão realizados por nós como fisioterapia, placas de mordida para dormir, ou outros procedimentos.

Seu compromisso é de que enquanto participar da pesquisa seguirá nossas orientações e realizará os tratamentos em casa conforme lhe ensinaremos. Também, deverá nos fornecer as informações que necessitarmos sobre como está sua dor e condição geral, da forma mais precisa possível.

Garantimos que todos os dados que coletarmos durante essa pesquisa serão mantidos em sigilo e que seu nome, identidade ou qualquer outra informação pessoal não será divulgada em momento algum.

Caso tenha a necessidade de falar com algum dos dentistas envolvidos no seu tratamento, a senhora deve procurar a pesquisadora responsável no telefone: 16 - 3301-6412. Se tiver alguma reclamação ou precisar tirar alguma dúvida sobre seus direitos e deveres como paciente dessa pesquisa, pode ligar para a secretaria do Comitê de Ética em Pesquisa nos números: 16 - 3301-6432 ou 3301-6434.

Araraquara, ____ de _____ de 201_.

_____

Pesquisadora Responsável

Profa. Dra. Daniela A G Gonçalves

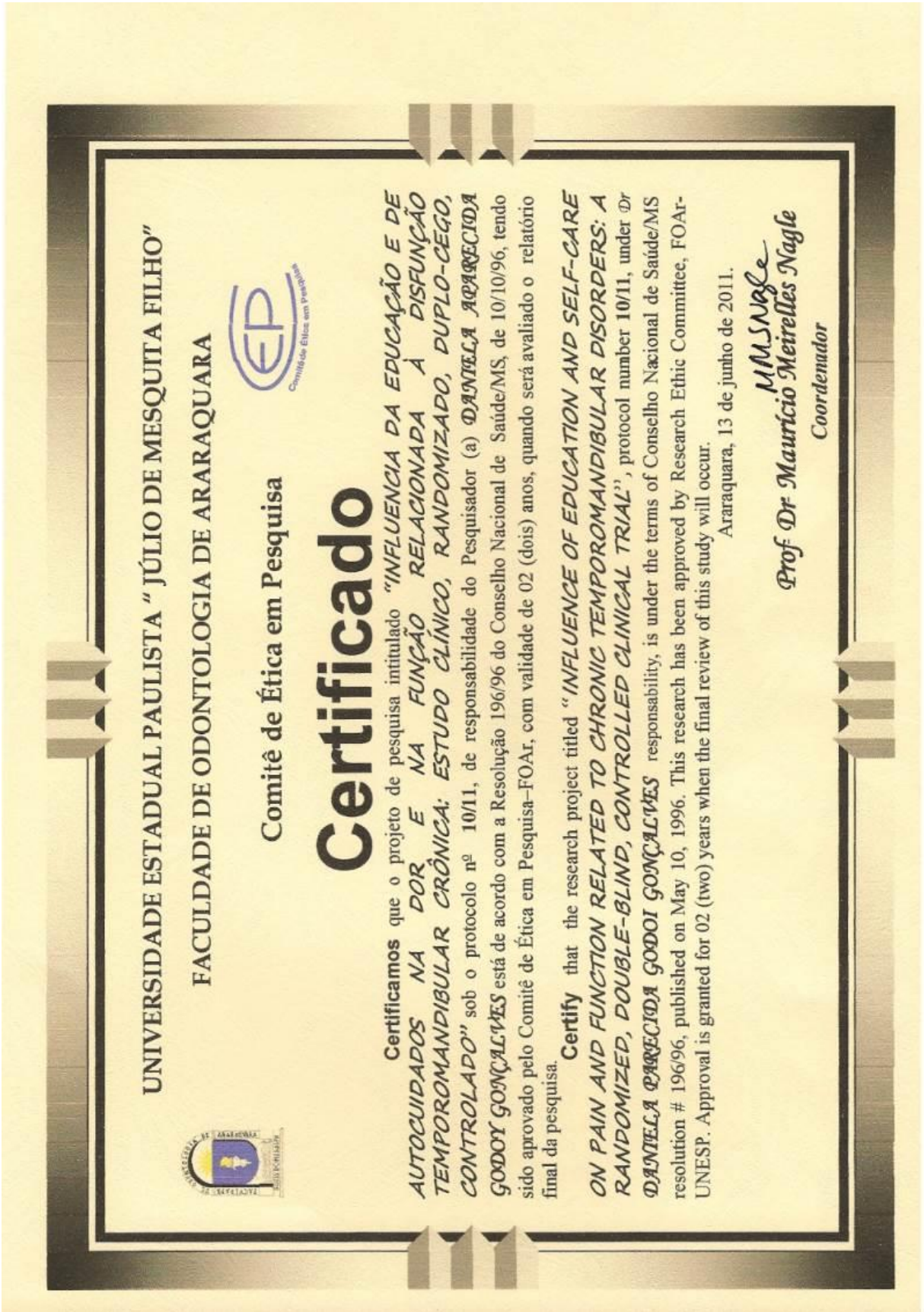
Entendi as informações acima e declaro que concordo em participar da pesquisa. Entendi que os tratamentos desse estudo não me trarão qualquer risco. Declaro também que compreendi que posso desistir de minha participação a qualquer momento, sem nenhum dano ou prejuízo para o tratamento de DTM na Faculdade de Odontologia de Araraquara-UNESP.

_____

Paciente

Protocolo CEP nº 10/11
Aprovado em reunião de
13/06/2011
Secretaria do CEP-FO/CAr

Anexo 2 – Certificados de aprovação pelo Comitê de Ética em Pesquisa – FOAr



UNIVERSIDADE ESTADUAL PAULISTA " JÚLIO DE MESQUITA FILHO"

FACULDADE DE ODONTOLOGIA DE ARARAQUARA

Comitê de Ética em Pesquisa

Certificado

Certificamos que o projeto de pesquisa intitulado *"INFLUENCIA DA EDUCAÇÃO E DE AUTOCUIDADOS NA DOR E NA FUNÇÃO RELACIONADA À DISFUNÇÃO TEMPOROMANDIBULAR CRÔNICA: ESTUDO CLÍNICO, RANDOMIZADO, DUPLO-CEGO, CONTROLADO"* sob o protocolo nº 10/11, de responsabilidade do Pesquisador (a) *DANIELA APARECIDA GODOY GONÇALVES* está de acordo com a Resolução 196/96 do Conselho Nacional de Saúde/MS, de 10/10/96, tendo sido aprovado pelo Comitê de Ética em Pesquisa–FOAr, com validade de 02 (dois) anos, quando será avaliado o relatório final da pesquisa.

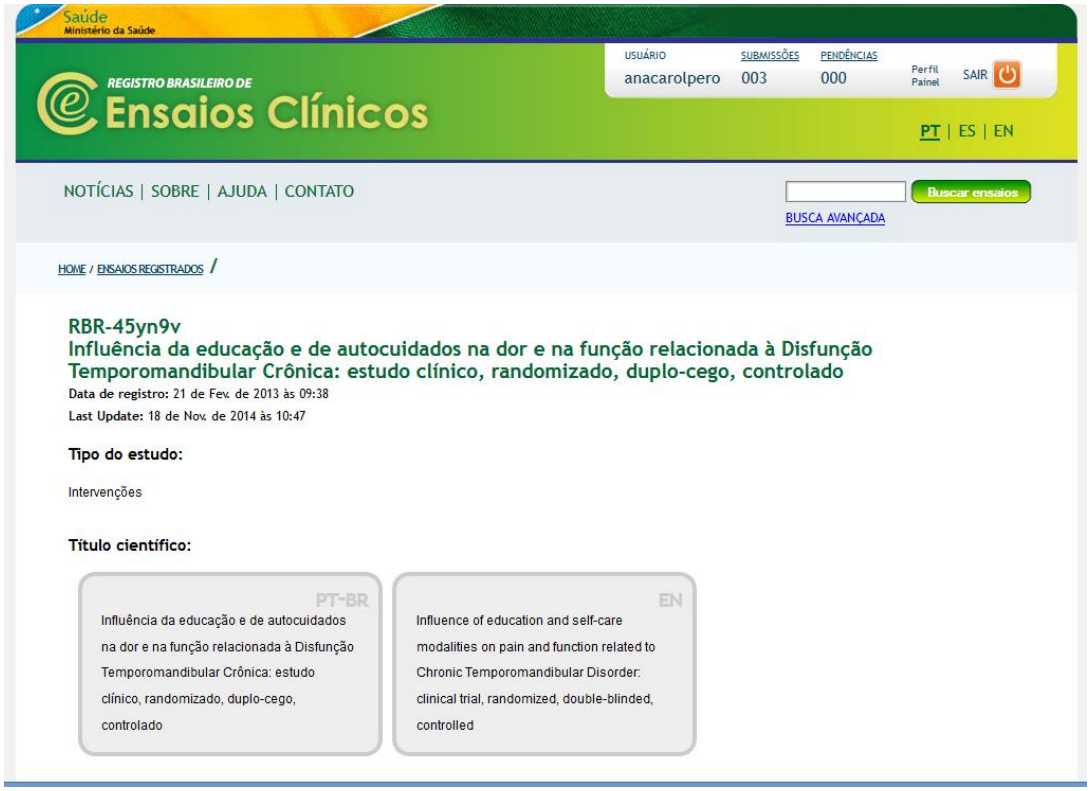
Certify that the research project titled *"INFLUENCE OF EDUCATION AND SELF-CARE ON PAIN AND FUNCTION RELATED TO CHRONIC TEMPOROMANDIBULAR DISORDERS: A RANDOMIZED, DOUBLE-BLIND, CONTROLLED CLINICAL TRIAL"*, protocol number 10/11, under *Dr DANIELA APARECIDA GODOI GONÇALVES* responsability, is under the terms of Conselho Nacional de Saúde/MS resolution # 196/96, published on May 10, 1996. This research has been approved by Research Ethic Committee, FOAr-UNESP. Approval is granted for 02 (two) years when the final review of this study will occur.

Araraquara, 13 de junho de 2011.

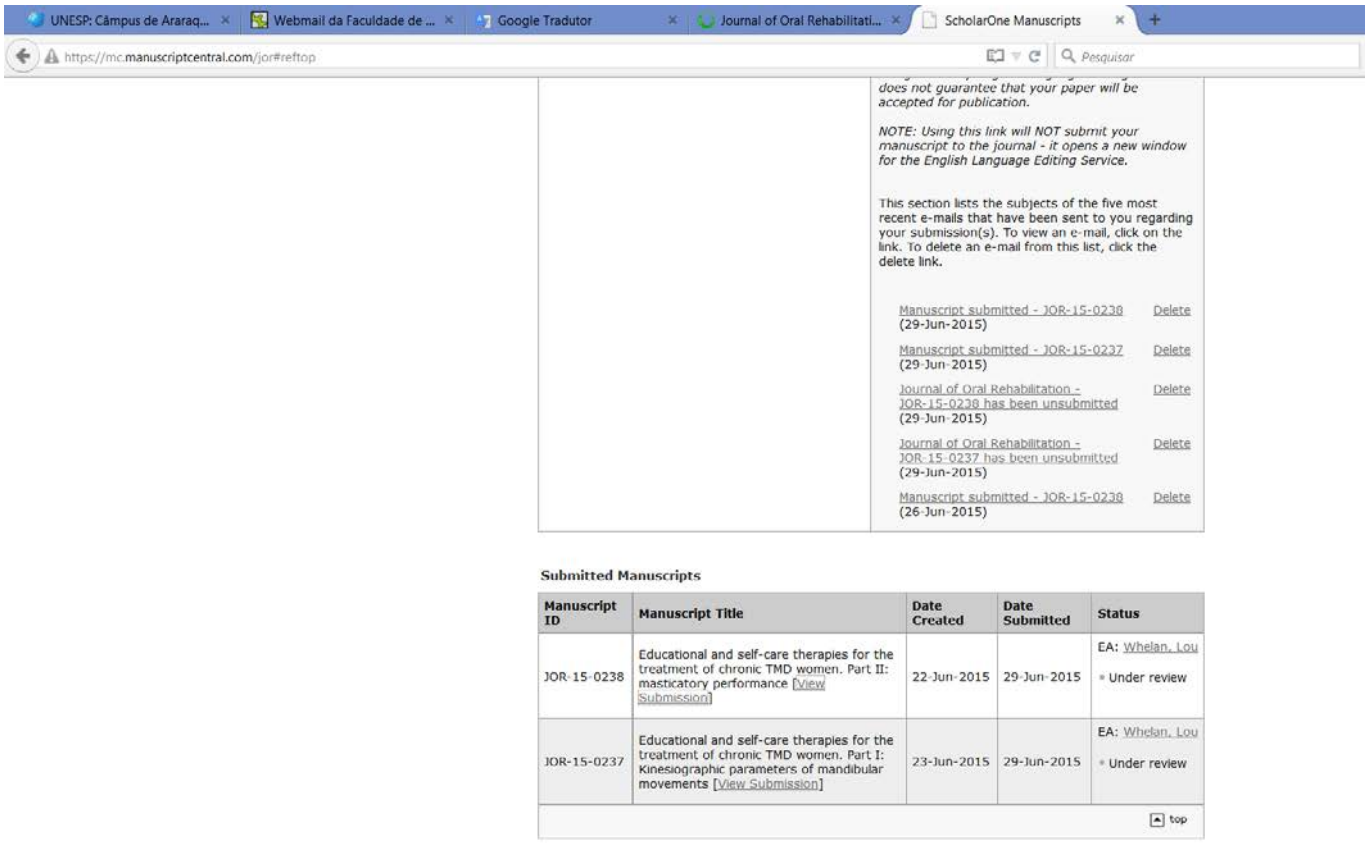
Prof Dr Maurício Meirelles Nagle

Coordenador

Anexo 3 – Registro do estudo na base de Registro Brasileiro de Ensaios Clínicos.



Anexo 4 – Situação dos artigos submetidos à revista Journal of Oral Rehabilitation.



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Manuscript submitted - JOR-15-0238 (29-Jun-2015) Delete

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Manuscript submitted - JOR-15-0238 (26-Jun-2015) Delete

Submitted Manuscripts

Manuscript ID	Manuscript Title	Date Created	Date Submitted	Status
JOR-15-0238	Educational and self-care therapies for the treatment of chronic TMD women. Part II: masticatory performance [View Submission]	22-Jun-2015	29-Jun-2015	EA: Whelan, Lou • Under review
JOR-15-0237	Educational and self-care therapies for the treatment of chronic TMD women. Part I: Kinesiographic parameters of mandibular movements [View Submission]	23-Jun-2015	29-Jun-2015	EA: Whelan, Lou • Under review

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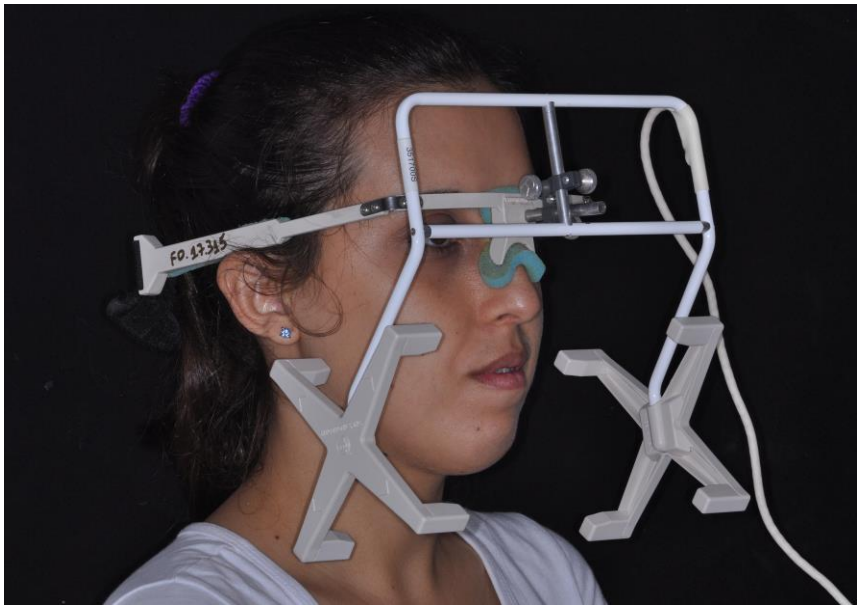
APÊNDICES

Apêndice 1 – Figuras relacionadas a análise cinesiográfica mandibular

Figura 1- Posicionamento do magneto na região vestibular dos incisivos centrais inferiores, coincidente com a linha média e sem interferir na oclusão.

Figura 2- Aparato para o registro dos movimentos mandibulares composto por sensores eletromagnéticos posicionados bilateralmente na face do paciente.



Apêndice 2 – Figuras relacionadas a análise do desempenho mastigatório

Figuras 3A e 3B- Sistema de Tamises utilizados no estudo.

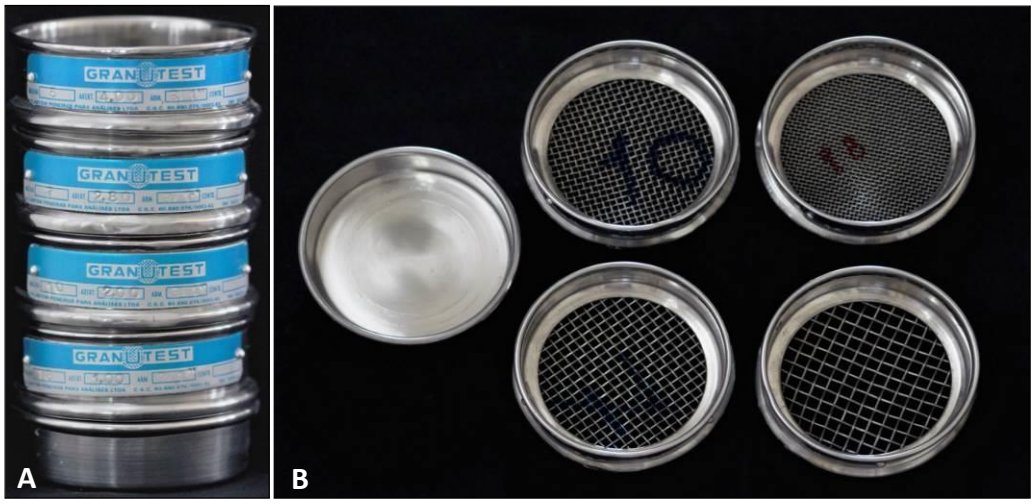
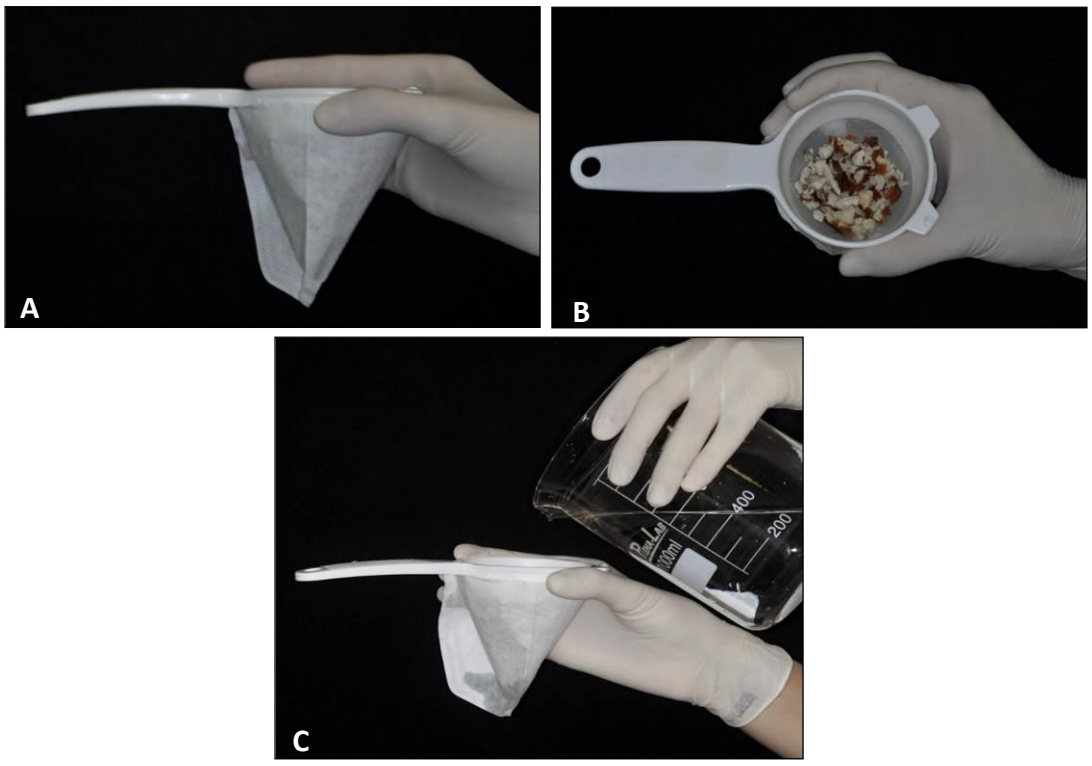


Figura 4A- Peneira adaptada sobre o filtro de papel. Figura 4B- Alimento teste triturado despejado sobre a peneira. Figura 4C- 500 ml de água despejados sobre o alimento teste triturado.



Figuras 5A e 5B- Exemplo de amêndoas trituradas e desidratadas.

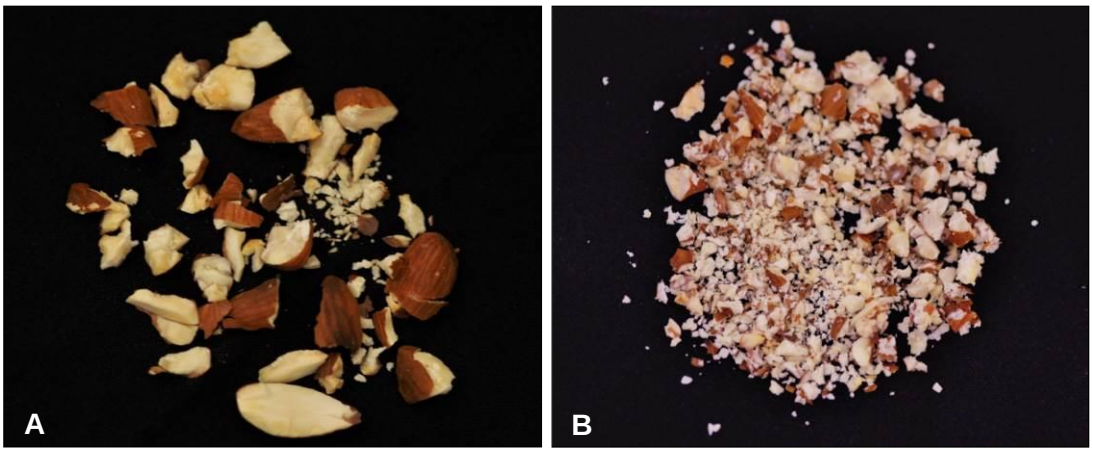
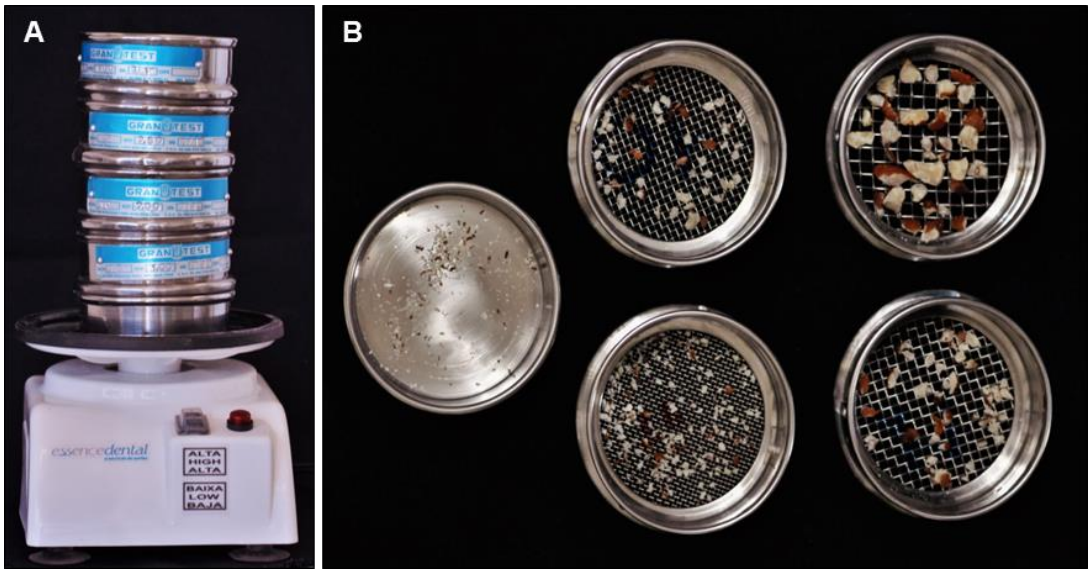


Figura 6A- Conjunto de Tamises sobre vibrador de gesso. Figura 6B- Partículas retidas nas diferentes malhas e fundo coletor, após tamisação.



Araraquara, 10 de setembro de 2015

GABRIELA GIRO