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ANA IZABELA SOBRAL DE OLIVEIRA SOUZA

EFETIVIDADE DE UM PROGRAMA DE EXERCÍCIOS CERVICAIS NA DOR E NA FUNCIONALIDADE DE PACIENTES COM DISFUNÇÃO TEMPOROMANDIBULAR: ESTUDO CLÍNICO CONTROLADO E RANDOMIZADO

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Tese de Doutorado apresentada ao Programa de Pós-graduação em Neuropsiquiatria e Ciências do Comportamento da Universidade Federal de Pernambuco como parte dos requisitos obrigatórios para obtenção do título de Doutor(a).

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Orientadora**:** Profª. Drª. Daniella Araújo de Oliveira

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RESUMO

Pacientes com disfunção temporomandibular (DTM) mista ou dor miofascial mastigatória apresentam comumente dor e incapacidade cervical. Apesar da literatura apresentar evidência de recomendação da fisioterapia e da relação entre a DTM e o déficit de controle motor da musculatura cervical, nenhum estudo avaliou a efetividade de exercícios específicos para a musculatura cervical na melhora da dor e da função orofacial de pacientes com DTM. Portanto o presente estudo objetivou verificar a efetividade de um programa de treinamento de controlo motor específico para os músculos cervicais na melhora da dor, função orofacial e qualidade de vida relacionada à saúde bucal (OHRQoL) de pacientes com DTM, assim como comparar estes resultados com um protocolo de tratamento fisioterapêutico convencional e placebo. Trata-se de um estudo clínico controlado randomizado cego. Foram incluídas 54 mulheres com idade entre 18 e 45 anos, com queixa de dor orofacial nos últimos seis meses, diagnosticadas com *Research Diagnostic Criteria* (RDC/DTM). Elas foram randomizadas igualmente em três grupos: treinamento cervical (GTC: treino de controle motor para os músculos cervicais), fisioterapia convencional (GTM: terapia manual) e grupo placebo (GP: placebo com ultrassom terapêutico desligado). As pacientes foram avaliadas em cinco momentos: antes da intervenção, após seis semanas do início da intervenção, ao final do tratamento, follow-up de um mês e três meses após o fim do tratamento. Foram avaliadas quanto: intensidade da dor orofacial; função mandibular; OHRQoL, amplitude de movimento (ADM) mandibular; índice de incapacidade cervical; escala de percepção global de mudança; escala Tampa de cinesiofobia; limiar de dor a pressão; teste de flexão crânio-cervical; ADM cervical; teste de flexão e rotação cervical (FRT). Os resultados estão apresentados em três estudos, com sua específica análise estatística. O estudo 1 apresenta os dados da revisão sistemática sobre as alterações musculoesqueléticas cervicais em pacientes com DTM. O estudo 2 (transversal) identificou os fatores que influenciavam a OHRQoL de pacientes com DTM. O estudo 3 apresenta os resultados do ensaio clínico. O estudo 3 identificou que o GTC foi melhor que o GP na intensidade da dor e na função mandibular ao final do tratamento, e após um e três meses de follow-up (Tamanho de Efeito (ES) >0.7). Na OHRQoL o GTC foi melhor que o GTM e o GP ao final do tratamento e no follow-up de 3 meses (ES>0,7). Ainda, o GTC foi melhor que

o GP no desfecho incapacidade cervical, FRT direito e esquerdo ao final do tratamento e no follow-up de três meses (ES >0,7). Na ADM cervical global o GTM foi melhor que o GP em quase todos os movimentos ao final do tratamento. Na avaliação do controle motor o CTG foi melhor que os outros dois grupos em todos as reavaliações (ES>0,8). Os exercícios de controle motor cervicais mostraram melhores resultados que o tratamento placebo para melhorar a dor orofacial, função mandibular, OHRQoL, incapacidade cervical, mobilidade cervical superior e o controle motor dos músculos cervicais, e melhor que a terapia manual no desfecho OHRQoL.

Palavras-chave: Transtornos da articulação temporomandibular. Doenças maxilomandibulares. Músculos do pescoço. Modalidades da fisioterapia. Terapia por exercício.

ABSTRACT

Patients with masticatory myofascial pain or mixed temporomandibular dysfunction (TMD) commonly present pain and neck disability. Despite the literature present evidence of recommendation for physiotherapy as well as evidence of the relationship between TMD and the deficit of neck muscles motor control, until now no study evaluated the effectiveness of a specific exercises for neck muscles in improving pain and orofacial function in patients with TMD. Thus, the present study aimed to verify the effectiveness of an 8-week training program consisting of specific and progressive exercises for neck muscles in reducing pain, improving orofacial function and quality of life related to oral health (OHRQoL) in patients with myogenic and mixed TMD, and to compare these results with a conventional physiotherapeutic treatment protocol and placebo. This is a blind randomized controlled clinical trial. Fifty-four women between 18 and 45 years old and complaining of orofacial pain in the last 6 months, diagnosed by Research Diagnostic Criteria (RDC/DTM), were included. They were randomized into three treatment groups: cervical training (NTG: specific and progressive motor control training for the neck muscles), conventional physiotherapy (MTG: manual therapy) and placebo group (PG: placebo with off therapeutic ultrasound). The patients were assessed at: before treatment, after six weeks of the beginning of treatment, at the end of treatment, and one- and three-months follow-up after the end of treatment. And they were evaluated for: orofacial pain intensity; mandibular function; OHRQoL, mandibular range of motion (ROM); neck disability index; global perception of change scale; Tampa kinesophobia scale; pressure pain threshold; cranio-cervical flexion test; cervical ROM; cervical flexion rotation test (FRT). The results of this doctoral thesis are presented in three studies, with their specific statistical analysis. Study 1 presents the data from the systematic review of cervical musculoskeletal changes in patients with TMD. Study 2 (cross-sectional) verified factors that influenced the OHRQoL of patients with TMD. Study 3 presents the clinical trial results. Study 3 showed that NTG was significantly better than PG group on pain and jaw function at the end of treatment, one- and three-months follow-up (Effect Size (ES) >0.7). For OHRQoL, NTG was significantly better than MTG and PG at the end of treatment and at three-months follow-up (ES>0.7). Also, this study showed that NTG was better than the PG in neck disability, in the right and left FRT at the end of treatment and with three-months follow-

up (ES>0.7). At global cervical ROM, MTG was better than PG in almost all movements at the end of treatment. In the motor control evaluation, the NTG was better than the other two groups in all reevaluations (ES>0.8). Neck motor control exercises presented better results than placebo treatment to improve orofacial pain, jaw function, OHRQoL, neck disability, upper cervical mobility and neck motor control and it was better than manual therapy to improve OHRQoL.

Keywords: Temporomandibular Joint Disorder. Jaw diseases. Neck muscles. Physical Therapy Modalities. Exercise therapy.

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1 INTRODUÇÃO

1.1 APRESENTAÇÃO

A presente tese está descrita baseada nos artigos científicos produzidos ao longo do processo de doutoramento da aluna. Quatro artigos originais diretamente relacionados ao projeto de doutorado foram produzidos. Assim como dois artigos desenvolvidos no período das disciplinas realizadas no Programa de Pós-graduação em Neurociências e Ciências do Comportamento, três artigos durante o período de doutorado sanduíche e três artigos em parceria com o grupo de pesquisa do Laboratório de Aprendizagem e Controle Motor (LACOM).

O primeiro artigo diretamente relacionado ao projeto de doutorado, teve como objetivo sintetizar todas as informações referentes as alterações musculoesqueléticas cervicais em pacientes com disfunção temporomandibular (população de interesse do presente projeto de doutorado). Para isso foi desenvolvida uma revisão sistemática intitulada: "*Cervical musculoskeletal disorders in patients with temporomandibular dysfunction: A systematic review and meta-analysis*" que se encontra publicada no *Journal of Bodywork & Movement Therapies* [2020, 24(4):84-101, doi: 10.1016/j.jbmt.2020.05.001], *CiteScore*: 2.0; *Highest percentile*: 77%; Fator de impacto:1.12; Qualis CAPES: A2; (Apêndice A).

Após a síntese das alterações musculoesqueléticas cervicais em pacientes com disfunção temporomandibular, percebeu-se a necessidade de elucidar quais aspectos demográficos e físicos realmente são fatores influenciadores da qualidade de vida relacionada á saúde bucal de pacientes com disfunção temporomandibular. Para responder essa pergunta o artigo intitulado *"Oral health quality of life is associated to jaw function and depression in patients with jaw pain* que se encontra publicada na revista *CRANIO: The Journal of Craniomandibular & Sleep Practice* [2021, 21:1-11 (online ahead of print) doi: 10.1080/08869634.2021.1885893] *CiteScore*: 1.5; *Highest percentile*: 44%; Fator de impacto:1.186; Qualis CAPES: B1, (Apêndice B).

Diante do fato de que pacientes com disfunção temporomandibular apresentam frequentes alterações musculoesqueléticas cervicais, como dor, incapacidade cervical

e alterações na função e comportamento muscular, foi percebido a necessidade de se testar um tratamento específico para o controle motor dos músculos cervicais de pacientes com disfunção temporomandibular. Com o objetivo de responder sobre a efetividade desse tratamento um ensaio clínico foi produzido ao longo do período de doutoramento, resultando em dois artigos científicos: O artigo "*Effectiveness of an 8-week neck exercise training on pain, jaw function and oral health-related quality of life in patients with jaw chronic pain: a randomized controlled trial*", encontra-se submetido na revista *Clinical Rehabilitation Journal*, (Apêndice C) e o artigo *"Effectiveness of an 8-week neck exercise training on neck disability and function of patients with jaw chronic pain: a randomized controlled trial"* que encontra-se em fase de escrita para ser submetido na revista *Brazilian Journal of Physical Therapy* (Apêndice D).

Durante o período de doutorado a aluna cumpriu a carga horária das disciplinas ofertadas pelo Programação de Pós-graduação em Neurociências e Ciências do Comportamento. E dentre duas das disciplinas ofertadas a aluna obteve duas produções científicas: "*Brain changes in subjects with catastrophic pain, as detected by magnetic resonance imaging: A systematic review*" (Apêndice E), artigo publicado na revista: *Neurology and Neurosurgery*; Qualis CAPES: B3 [DOI: 10.15761/NNS.1000117]; e "*Repercussions of smoking habit on Orofacial pain and temporomandibular dysfunction: integrative review*" (Apêndice F), artigo publicado na revista: *International Journal of Physiatry*; Qualis CAPES: B4 [DOI: 10.23937/2572-4215.1510016].

Também durante o período de doutoramento, a aluna realizou um ano de doutorado sanduíche na *University of Applied Sciences – Hochschule Osnabrück* (Alemanha) sob a supervisão da Prof. Dr. Susan Armijo-Olivo, onde também obteve produções científicas. O Artigo "*Tools to assess the Risk of bias and Reporting quality of randomized controlled trials in rehabilitation*" (Apêndice G), encontra-se submetido na revista: *Archives of Physical Medicine and Rehabilitation; CiteScore*: 4.9; *Highest percentile*: 96%; Fator de impacto: 2.697; Qualis CAPES: A1; o artigo: "*Attrition, Missing Data, and Compliance related biases in Randomized Controlled Trials of Rehabilitation Interventions: Towards improving reporting and conduct*" (Apêndice H) encontra-se publicado na revista: *European Journal of Physical and Rehabilitation Medicine; CiteScore*: 3.5; *Highest percentile*: 84%; Fator de Impacto: 2.246; Qualis CAPES: A2; e o artigo: "*What are the best parameters of low-level laser therapy to*

reduce pain intensity and improve mandibular function in orofacial pain? A systematic review and meta-analysis” (Apêndice I) encontra-se em fase de submissão na revista: *Journal of Physiotherapy*; *CiteScore*: 2.9; *Highest percentile*: 76%; Fator de Impacto: 1.117; Qualis CAPES: A2.

Além das produções referentes diretamente ao período de doutoramento, a aluna esteve envolvida ativamente com o seu grupo de pesquisa (Laboratório de Aprendizagem e Controle Motor - LACOM) onde os seguintes artigos foram produzidos: “*MRI in migraineurs: are there abnormalities in the area where the myofascial trigger points are palpable and in volume measurements*?” (Apêndice J), publicado na revista: *Journal of Bodywork & Movement Therapies; CiteScore:* 2.0; *Highest percentile*: 77%; Fator de impacto: 1.12; Qualis CAPES: A2 [DOI: 10.1016/j.jbmt.2020.02.025]; artigo: “Categorias da CIF comprometidas na migrânea” (Apêndice L) que se encontra publicado na revista: *Headache Medicine*; Qualis CAPES: C; e o artigo: “Alterações de funcionalidade de mulheres migranosas” (Apêndice M), que se encontra publicado na revista: *Headache Medicine*; Qualis CAPES: C.

1.2 INTRODUÇÃO

A articulação temporomandibular (ATM) é uma articulação complexa, que se localiza imediatamente anterior ao meato acústico externo, inferiormente ao osso temporal e superiormente a mandíbula, contém um disco intra-articular dentro da cápsula articular, e seus tecidos contráteis são os músculos da mastigação.(Shaffer, Brismee et al. 2014) O disco intra-articular é bicôncavo e divide o conjunto articular em superior (discotemporal) e inferior (discomandibular). Em circunstâncias normais, o côndilo mandibular pode ter formas variáveis e pode ser assimétrico de um lado para o outro.(Shaffer, Brismee et al. 2014) A ATM faz parte do sistema estomatognático, que é formado por maxila, mandíbula, arcada dentária, glândulas salivares e os músculos mastigatórios.(Cuccia 2011) Em particular, a ATM faz conexões musculares e ligamentares na região cervical, formando um complexo funcional chamado "sistema crânio-cervico-mandibular".

A disfunção temporomandibular (DTM) é uma desordem do sistema estomatognático caracterizada pela presença de dor na região preauricular, fadiga

muscular dos músculos mastigatórios, limitação ou desvios durante a movimentação da ATM e pode vir associada a ruídos durante abertura e fechamento da boca,(Bevilaqua-Grossi, Chaves et al. 2006, de Oliveira, Dias et al. 2006) além de afetar estruturas relacionadas, como pescoço e cabeça. Os sinais e sintomas da DTM na população em geral ocorrem duas vezes mais em mulheres do que em homens (2:1).(Schiffman, Ohrbach et al. 2014) Mais de 70% dos pacientes com DTM são mulheres, e a razão de afetados entre mulheres e homens de acordo com o diagnóstico foi de 2,4:1 para artralgia; 2,5:1 para osteoartrite; 3,4:1 para dor miofascial; e 5,1:1 para deslocamento de disco. (Kino, Sugisaki et al. 2005) Além disso, as mulheres apresentam mais cliques e dor na ATM, cefaleia e sensibilidade muscular do que os homens. (Riley and Gilbert 2001)

A DTM é considerada um grande problema de saúde pública, pois é a principal fonte de dor orofacial crônica e a categoria mais prevalente de dor crônica não dentária na região orofacial. (Fernandez-de-las-Penas, Galan-del-Rio et al. 2009) Há evidências que demonstram o grande impacto que a dor orofacial e, especificamente, a dor da DTM têm sobre a qualidade de vida das mulheres. (Maixner, Fillingim et al. 1998, Riley and Gilbert 2001) Elas interferem nas atividades diárias, diminuindo a capacidade de trabalho dos pacientes e a capacidade de interagir com seu meio social ou ambas. (Sarlani and Greenspan 2003) Além disso, a DTM tem sido considerada de grande impacto econômico devido ao atendimento direto, e segundo a classificação do impacto da condição clínica na vida dos pacientes, a DTM foi comparável à dor lombar e à cefaleia intensa. (Sarlani and Greenspan 2005)

Pacientes com DTM mista ou dor miofascial mastigatória frequentemente apresentam dor persistente, alodinia e hiperalgesia, às vezes estendendo-se a regiões distantes da face, demonstrando uma função anormal do sistema nervoso central semelhante a outras condições dolorosas crônicas.(Goldberg, Mock et al. 1996, Sarlani and Greenspan 2003, Fernandez-de-las-Penas, Galan-del-Rio et al. 2009) Uma das principais disfunções do tecido muscular que afetam pacientes com DTM é a mialgia. Os dois fatores precipitantes primários associados com a mialgia relacionados à DTM são hábitos parafuncionais e a formação de pontos-gatilho miofasciais sintomáticos.(Shaffer, Brismée et al. 2014)

Ainda há uma evidência forte de que pacientes com dor crônica, incluindo a DTM podem ter com um preditor para incapacidade a cinesiofobia.(Heuts, Vlaeyen et

al. 2004, López-de-Uralde-Villanueva, Beltran-Alacreu et al. 2015) Pacientes com DTM crônica que apresentam piores alterações funcionais na articulação temporomandibular sofrem de um maior grau de medo para realizar movimentos articulares. A presença da cinesiofobia pode então estar relacionada a problemas mecânicos da articulação.(Gil-Martínez, Grande-Alonso et al. 2016)

Além disso, os indivíduos com dor miofascial mastigatória tem maior prevalência de dor cervical, incapacidade cervical e também menores valores de limiar de dor a pressão dos músculos cervicais quando comparados a indivíduos saudáveis. Além disso, existe uma correlação positiva entre a DTM miogênica e a sensibilidade dos músculos mastigatórios e cervicais, ou seja, na presença da dor miofascial mastigatória os pacientes apresentaram aumento da sensibilidade dolorosa dos músculos mastigatórios. Ainda, uma correlação negativa entre a incapacidade cervical auto relatada e o limiar de dor a pressão dos músculos temporal anterior, esternocleidomastoídeo (ECOM) e trapézio superior também foi verificada em pacientes com DTM.(da Costa, de Lima Ferreira et al. 2015) Entretanto ainda é incerto se a gravidade da incapacidade cervical pode ter uma influência negativa sobre o desempenho muscular dos músculos cervicais.

Ainda, foi observada nessa população disfunção cognitiva (Sarlani and Greenspan 2005, Grossi, Goldberg et al. 2008) e motora, (Grossi, Goldberg et al. 2008, Armijo-Olivo, Silvestre et al. 2012) que pode estar relacionado à atividade anormal das regiões cerebrais associadas a essas funções. (Armijo-Olivo, Fuentes et al. 2010, Ichesco, Quintero et al. 2012) Essas alterações motoras podem ser percebidas pelas mudanças no comportamento e função muscular, com ativação reduzida dos músculos cervicais profundos, e aumento de atividade eletromiográfica (EMG) dos músculos cervicais superficiais (ECOM e escaleno anterior) para todas as condições do teste de flexão crânio-cervical (22, 24, 26, 28 e 30 níveis de pressão mmHg) em pacientes com DTM. Isso demonstra um padrão anormal de contração dos músculos cervicais profundos e superficiais. Este padrão anormal pode ocorrer devido a uma contração dos músculos flexores superficiais como forma compensatória da atividade dos músculos flexores cervicais profundos que se encontra reduzida ou prejudicada. (Falla, Jull et al. 2003, Armijo-Olivo and Magee 2013) Indivíduos com DTM também apresentaram menor resistência da musculatura flexora e extensora cervical em isometria.(Armijo-Olivo and Magee 2013)

Esta relação entre a DTM e as disfunções cervicais ocorrem devido a proximidade anatômica, as interconexões neuronais e as entradas de convergência entre as áreas cervical e trigeminal.(Arendt-Nielsen and Svensson 2001, da Costa, de Lima Ferreira et al. 2015) As alterações de controle motor nos músculos cervicais em pacientes com DTM podem ser explicadas por modelos que descrevem a relação entre a perda do controle motor na presença de dor em pacientes com desordens do sistema musculoesquelético.(da Costa, de Lima Ferreira et al. 2015) Semelhante ao "modelo de adaptação integrado da dor", o qual propõe que mudanças complexas ocorrem em todo o sistema sensório-motor na presença da dor, e essas mudanças são influenciadas por respostas individuais à dor e à complexidade do sistema sensório-motor. (Sessle 1999, Armijo-Olivo and Magee 2013)

A ativação anormal de áreas cerebrais em condições dolorosas crônicas, como a DTM, influencia os sistemas modulatórios descendentes da dor que perpetuam a transmissão anormal da dor aumentada.(Nebel, Folger et al. 2010) Esses achados são cruciais para a área de terapia do exercício, como a fisioterapia, já que os tratamentos atuais de reabilitação para condições patológicas não visam os mecanismos subjacentes de alterações corticais neuroplásticas que geram dor e disfunção. Isso pode resultar em uma restauração malsucedida da funcionalidade dos pacientes com essas condições. De acordo com esse novo paradigma, os esforços da reabilitação, incluindo exercícios que tentam direcionar as alterações neuroplásticas corticais, fornecem o maior potencial para o sucesso da reabilitação.(Salomons, Moayedi et al. 2012)

As alterações de controle motor juntamente com a capacidade reduzida de relaxar a musculatura cervical e com a atividade muscular prolongada com consecutivas contrações voluntárias, podem comprometer o controle motor da coluna cervical e, consequentemente, levar à dor e disfunção no segmento cervical nestes pacientes. Além disso, a perda da ativação seletiva, a inibição de certos músculos que realizam ação sinérgica, e a fraqueza muscular conduz ainda mais alterações nos padrões de ativação neuromuscular causando perda de estabilidade e fadiga precoce, que resulta na perda de controle motor do sistema cervical.(Armijo-Olivo and Magee 2013)

Assim, o controle neuromuscular anormal da coluna cervical pode contribuir para a irritação de estruturas sensíveis à dor no pescoço e contribuir para perpetuar

a dor nesta região. Devido à convergência entre a região orofacial e cervical no núcleo trigeminocervical,(Sessle 1999) a dor de qualquer uma das três articulações cervicais superiores e dos músculos inervados pelos nervos espinhais cervicais superiores pode ser percebida em quaisquer regiões inervadas pelo nervo trigêmeo. Portanto, o controle neuromuscular prejudicado na coluna cervical pode estar relacionado à sobrecarga do sistema craniocervical e, consequentemente, levar a dor nas estruturas relacionadas como a região orofacial.(Armijo-Olivo and Magee 2013)

Diante de todo esse panorama, a DTM têm sido reconhecida como uma doença complexa, assim o seu tratamento envolve uma equipe multidisciplinar, incluindo dentistas, médicos, fisioterapeutas, psicólogos, fonoaudiólogos, entre outros profissionais de saúde.(Armijo-Olivo and Magee 2013) A fisioterapia está entre os 10 mais comuns tratamentos utilizados para a DTM, e tem como principais objetivos aliviar a dor na ATM, nos músculos mastigatórios, nas articulações e músculos cervicais, com intuito de melhorar a amplitude de movimento mandibular e cervical, bem como melhorar a função dos sistemas mastigatórios e crânio-cervicais utilizando modalidades físicas, exercícios e técnicas de terapia manual, assim como a busca pelo equilíbrio muscular craniocervical.(Medlicott and Harris 2006, Armijo-Olivo and Magee 2013, Armijo-Olivo, Pitance et al. 2016)

O tratamento fisioterapêutico é reversível, não-invasivo, e provê um autoatendimento criando um ambiente em que o paciente tem responsabilidade com a sua saúde. As modalidades da fisioterapia incluem em geral a eletroterapia (micro-ondas, laser, TENS, corrente interferencial, biofeedback), termoterapia (ultrassom, crioterapia), acupuntura, exercício terapêutico e terapia manual, entre outros. (Armijo-Olivo, Pitance et al. 2016)

A terapia manual tem sido utilizada para restaurar a amplitude de movimento, reduzir isquemia, estimular propriocepção, diminuir a aderência fibrosa, estimular a produção do líquido sinovial, e reduzir dor. Na área da dor orofacial, algumas revisões de literatura têm relatado os benefícios do tratamento fisioterapêutico especialmente com a terapia manual e com exercícios terapêuticos.(Medlicott and Harris 2006, Armijo-Olivo, Pitance et al. 2016, Calixtre, Oliveira et al. 2019) A terapia manual isolada ou em combinação com exercícios tem apresentado efeitos promissores para pacientes com dor orofacial, especialmente quando realizada na coluna cervical com o objetivo de diminuir a dor, aumentar o limiar de dor à pressão e melhorar a amplitude

de movimento da boca em pessoas com DTM miogênica.(Craane, Dijkstra et al. 2012, Armijo-Olivo, Pitance et al. 2016, Calixtre, Oliveira et al. 2019) Resultados positivos foram verificados quando utilizado exercícios posturais, assim como os exercícios específicos para a ATM, no tratamento da DTM miogênica ou artrogênica.(Craane, Dijkstra et al. 2012, Guarda-Nardini, Stecco et al. 2012, Kalamir, Bonello et al. 2012)

Devido a DTM ser comumente associada a outras condições que afetam a região da cabeça e pescoço, tais como dor de cabeça, dor e disfunção muscular cervical, o tratamento fisioterapêutico tem se concentrado em melhorar o equilíbrio muscular crânio-cervical por meio do uso de exercícios direcionados para o pescoço.(Armijo-Olivo and Magee 2013) Intervenções incluindo exercícios de correção postural para cabeça e pescoço e exercícios terapêuticos para os músculos mastigatórios e/ou cervicais podem ser efetivos no alívio da dor musculoesquelética, melhora da função orofacial, da força, coordenação, resistência, mobilidade, estabilidade, controle motor e resistência do sistema muscular. (Wright, Domenech et al. 2000, Guarda-Nardini, Stecco et al. 2012, Armijo-Olivo, Pitance et al. 2016)

Ainda, evidências apontam que mudanças mal adaptativas no córtex motor podem ser melhoradas após treinamento físico específico utilizando exercícios de controle motor e habilidades a prática cognitiva, (Apkarian, Hashmi et al. 2011) treinamento de força e resistência (Straube, Schmidt et al. 2009, Kregel, Meeus et al. 2015) assim como o uso de feedback visual. (Lin 2014) De fato, um estudo prévio (Derbyshire, Nichols et al. 2002) foi o primeiro a destacar que o uso do exercício associado ao feedback visual pode induzir alterações corticais em indivíduos saudáveis. Assim, o feedback poderia ser usado como uma estratégia para direcionar mudanças corticais em indivíduos com condições musculoesqueléticas e sua eficácia deve ser mais investigada, especialmente nos estágios iniciais de reabilitação (2-8 semanas). (Lee, Smyser et al. 2013, Lin 2014)

Neste contexto, um programa de treinamento físico específico e progressivo de 8 semanas, que teve como objetivo melhorar o controle motor da coluna cervical, resultou em aprimoramentos imediatos na especificidade da atividade dos músculos cervicais e redução da dor em pacientes com dor cervical crônica. (Falla, Lindstrom et al. 2013) O protocolo de exercício selecionado no estudo de Jull *et al.*, 2009 (Jull, Falla et al. 2009) e Falla *et al.*, 2013, (Falla, Lindstrom et al. 2013) envolveu um programa de exercícios progressivos, que inicialmente (semanas 1-6) foi destinado a

restabelecer o controle motor dos músculos cervicais. Em indivíduos saudáveis, a formação da nova habilidade motora, em contraste com o exercício geral, tem-se associado com melhorias no desempenho da tarefa e maior representação da musculatura treinada no córtex motor primário. (Boudreau, Farina et al. 2010)

Vários exercícios para o pescoço têm sido utilizados para aliviar a dor e melhorar o controle motor dos músculos cervicais,(Jull, Trott et al. 2002, Falla, Lindstrom et al. 2013) especialmente o treinamento de controle motor da musculatura cervical profunda que tem sido associado com a facilitação da via de analgesia endógena por meio da ativação seletiva da musculatura. Como o exercício de flexão crânio-cervical, que foi projetado para enfatizar a ativação dos flexores cervicais profundos e minimizar a ativação dos flexores superficiais, e apresenta um efeito positivo no alívio da dor e melhora da função cervical de pacientes com cervicalgia crônica. (Jensen, Karoly et al. 1986, Jull, Falla et al. 2009, Schomacher, Erlenwein et al. 2015) Apesar de toda eficácia da fisioterapia convencional e de toda a relação entre a DTM e o déficit de controle motor da musculatura cervical, nenhum estudo avaliou a efetividade de um tratamento de exercícios específicos para a musculatura cervical na melhora da dor, da função orofacial e da qualidade de vida de pacientes com DTM.

1.3 OBJETIVO

1.3.1 Geral

O objetivo principal da presente tese de doutorado foi verificar a efetividade de um programa de treinamento de oito semanas composto por exercícios de controle motor específicos e progressivos para os músculos cervicais na redução da dor, na melhora da função orofacial e da qualidade de vida relacionada à saúde bucal em pacientes com DTM mista ou dor miofascial mastigatória, assim como comparar estes resultados com um protocolo de tratamento fisioterapêutico convencional e grupo controle (Artigo 3).

1.3.2 Específicos

- Identificar quais desordens musculoesqueléticas cervicais estão presentes em pacientes com DTM (Artigo 1).
- Determinar quais são os fatores (ex. dor orofacial, amplitude de movimento mandibular, função mandibular, sintomas depressivos, idade, ou duração da dor) que influenciam a Qualidade de Vida Relacionada à Saúde Bucal (OHRQoL) de pacientes com dor miofascial mastigatória crônica (Artigo 2).
- Determinar quais fatores melhor diferenciam entre OHRQoL boa/ruim em pessoas com dor miofascial mastigatória (Artigo 2).
- Determinar qual *cut-off* desses fatores (ex. dor orofacial, amplitude de movimento mandibular, função mandibular, sintomas depressivos, idade, ou duração da dor) podem predizer a OHRQoL boa/ruim em voluntários com dor miofascial mastigatória (Artigo 2).
- Verificar a efetividade de um programa de treinamento de oito semanas composto por exercícios de controle motor específicos e progressivos para os músculos cervicais nas funções (amplitude de movimento e controle motor cervical) e incapacidades cervicais em pacientes com DTM mista ou dor miofascial mastigatória, assim como comparar estes resultados com um protocolo de tratamento fisioterapêutico convencional e grupo controle (Artigo 4).

2 REFERENCIAL TEÓRICO

O referencial teórico será apresentado em formato de artigo científico de uma revisão sistemática. A revisão sistemática intitulada: "*Cervical musculoskeletal disorders in patients with temporomandibular dysfunction: A systematic review and meta-analysis*" foi publicada no *Journal of Bodywork & Movement Therapies* [2020, 24(4):84-101, DOI: 10.1016/j.jbmt.2020.05.001] (**Apêndice A**).

3 MÉTODO

As ferramentas e métodos utilizados pelos três artigos originais desenvolvidos nessa tese serão descritos conjuntamente nesta sessão de materiais e métodos. Entretanto, as análises estatísticas dos dados assim como as ferramentas utilizadas especificadamente em cada artigo científico serão descritas em sub tópicos ao fim dessa sessão.

Trata-se de um estudo clínico controlado randomizado cego, conforme as diretrizes do CONSORT, com objetivo de testar a efetividade de um programa de exercícios para a musculatura cervical em pacientes com DTM miogênica ou mista. O projeto foi aprovado pelo Comitê de Ética da Universidade Federal de Pernambuco sob o número CAAE: 68010717.8.0000.5208 (Anexo 1) e foi registrado no Registro Brasileiro de Ensaios Clínicos (ReBEC), sob o número: RBR-3fc62c (Anexo 2). Os voluntários foram triados do Departamento de Odontologia da Universidade Federal de Pernambuco e da comunidade da cidade do Recife. Os mesmos foram diagnosticados com auxílio do questionário *Research Diagnostic Criteria* (RDC/DTM), o qual tem sido o protocolo de diagnóstico mais amplamente utilizado para o diagnóstico da DTM em pesquisas clínicas.

3.1 AMOSTRA

Os pacientes foram incluídos no presente estudo de acordo com os seguintes critérios de inclusão: mulheres com idade entre 18 e 45 anos; queixa de dor na região orofacial nos últimos seis meses; diagnóstico de dor miofascial mastigatória determinada de acordo com os critérios estabelecidos pelo *Research Diagnostic Criteria* (RDC/DTM). Foram excluídas as pacientes que apresentaram: história de trauma facial ou cervical; procedimento cirúrgico prévio na coluna cervical e/ou no segmento craniofacial; algum tipo de alteração cognitiva ou desordem mental que a impedisse de responder a avaliação do presente estudo; doenças reumatológicas (ex. fibromialgia); doenças sistêmicas crônicas não controlada; que tenham realizado tratamento nos últimos seis meses para DTM; e/ou tratamento ortodôntico em andamento ou finalizado nos últimos 6 meses. Após aceitarem participar da pesquisa todos os participantes assinaram o termo de consentimento livre e esclarecido (TCLE).

O tamanho amostral resultou de um cálculo amostral, baseado em um estudo piloto com 10 voluntárias por grupo, onde foi estabelecido um nível de significância (α) de 0,05, um poder de 80%, considerando uma perda amostral de 30%, e o desfecho principal utilizado para o cálculo da amostra foi a avaliação da dor com o auxílio da Escala Visual Analógica (EVA 0-10 cm) e o questionário de qualidade de vida relacionado à saúde bucal (vide análise estatística, na seção de métodos). O número final de voluntárias necessárias para responder ao objetivo principal do estudo (intensidade da dor orofacial) foi estabelecido em 18 voluntárias por grupo.

3.2 TRIAGEM DOS VOLUNTÁRIOS

As voluntárias foram triadas da comunidade através da divulgação nas mídias sociais com auxílio de cartazes contendo os critérios de elegibilidade do estudo, assim como no Departamento de Odontologia da Universidade Federal de Pernambuco em colaboração com o Centro de Dor Orofacial, onde as voluntárias eram atendidas por profissionais dentistas. As voluntárias foram classificadas com DTM mista ou dor miofascial mastigatória com o auxílio do questionário RDC/TMD, previamente traduzido e validado para o português do Brasil. (Schiffman, Ohrbach et al. 2014)

O questionário RDC/DTM tem sido relatado como uma ferramenta diagnóstica bi-axial válida e confiável para a avaliação da DTM miogênica, artrogênica e mista, e é amplamente utilizado como critério diagnóstico na pesquisa clínica de pacientes com DTM.(Schiffman, Ohrbach et al. 2014) Este sistema de classificação é baseado no modelo biopsicossocial de dor, e é composto por dois eixos principais de avaliação. O eixo I é composto pela avaliação física que inclui avaliação da dor, amplitude de movimento da boca, presença ou ausência de ruídos, sintomas otológicos e sensibilidade dolorosa com a palpação muscular, utilizando critérios diagnósticos confiáveis e bem operacionalizados, os quais direcionam o clínico ou pesquisador a classificar o tipo de DTM do paciente. Enquanto o Eixo II engloba a avaliação do status psicossocial (ex. nível de depressão) e a incapacidade relacionada à dor crônica. A intenção principal dessa ferramenta diagnóstica é proporcionar, simultaneamente, um diagnóstico físico assim como identificar outras características relevantes para a história clínica do paciente, que poderiam ter influência na expressão da dor e,

portanto, no manejo da sua DTM. Nesta pesquisa ambos os eixos de avaliação foram aplicados em todos os pacientes incluídos.

3.3 RANDOMIZAÇÃO E SIGILO DE ALOCAÇÃO

Após a avaliação inicial, a paciente foi randomicamente alocada em um dos seguintes grupos: grupo treinamento cervical (GTC), grupo fisioterapia (terapia manual - GTM) ou grupo placebo (Placebo – GP). A randomização foi realizada por uma pessoa independente ao estudo com o auxílio do programa "*randomization.com"*. Com o intuito de manter o sigilo de alocação, foram utilizados envelopes opacos, numerados previamente e que continham o grupo de alocação da voluntária, esta alocação foi preparada previamente pelo mesmo pesquisador não envolvido na coleta de dados.

3.4 MASCARAMENTO DO ESTUDO

Trata-se de um ensaio clínico duplo cego, onde (1) os avaliadores foram cegos para a alocação dos grupos de tratamento, (2) o fisioterapeuta responsável pelo tratamento foi cego para os resultados das avaliações. Ainda os participantes foram cegos em relação a hipótese do estudo e orientados a não discutir o seu grupo de alocação com o avaliador.

3.5 DESFECHOS

Os desfechos estão apresentados separadamente de acordo com cada estudo.

3.5.1 Estudo 2: "Oral health quality of life is associated to jaw function and depression in patients with jaw pain."

Desfechos: Dor orofacial, qualidade de vida relacionada à saúde bucal, função mandibular, amplitude de movimento da boca.

3.5.2 Estudo 3: “Effectiveness of an 8-week neck exercise training on pain, jaw function and oral health-related quality of life in patients with jaw chronic pain: a randomized controlled trial.”

Desfechos primários: dor orofacial.

Desfechos secundários: função mandibular, amplitude de movimento da boca, qualidade de vida relacionada à saúde bucal, nível de incapacidade cervical, mobilidade cervical superior e global, controlo motor cervical e cinesiofobia.

3.6 INSTRUMENTOS DE AVALIAÇÃO

3.6.1 Intensidade da dor orofacial

A intensidade da dor orofacial foi medida pela escala visual analógica (EVA), que consiste em uma linha disposta em 10 centímetros, ancorada por descritores em cada extremidade, em que 0 significa "sem dor" na extremidade esquerda e 10 significa "pior dor imaginável" na extremidade direita. As voluntárias foram orientadas a marcar um traço perpendicular a linha vertical ao longo deste eixo, no ponto que melhor representasse a sua percepção da dor no momento da avaliação. A intensidade da dor foi descrita como o valor da distância encontrada entre o ponto marcado pela voluntária e a extremidade esquerda. (Jensen, Karoly et al. 1986, Conti, de Azevedo et al. 2001) As voluntárias responderam ao questionamento da dor em repouso. (Kalamir, Bonello et al. 2012)

3.6.2 Avaliação da função orofacial

Para a avaliação da função orofacial foi utilizado o Questionário de Limitação Funcional Mandibular (MFIQ), o qual permite a classificação da severidade da limitação funcional mandibular relacionada a DTM. O MFIQ tem sido bastante utilizado e seus scores apresentam uma forte associação com os valores encontrados na avaliação da dor, dos movimentos mandibulares limitados e nas mudanças

psicológicas. Estes resultados apontam que o presente questionário é uma ferramenta adicional confiável e válida para avaliar as limitações da função mandibular em pacientes com DTM. Este questionário foi traduzido e validado para o português do Brasil. (Stegenga, de Bont et al. 1993, Campos, Carrascosa et al. 2012)

O questionário é composto por de 17 questões divididas em duas dimensões: (D1) Capacidade funcional e (D2) Alimentação, as quais podem ser classificadas em 5 pontos que variam de 0 (nenhuma dificuldade) a 4 (muitíssima dificuldade ou impossível sem ajuda). A pontuação total é obtida somando-se os valores das respostas a cada questão, no entanto a graduação não é linear. É necessário realizar uma ponderação em que a pontuação é dividida pelo número de itens respondidos multiplicado por quatro (que é o valor máximo da resposta a cada questão). O coeficiente assim obtido ainda deve ser classificado dentro de determinadas condições do conjunto de respostas para se obter o grau de acometimento e a categoria de severidade. Se a pontuação total for menor do que 0,3, o grau de acometimento se classifica em 0 e 1 e a severidade é baixa, se a pontuação total for entre 0,3 e 0,6 o grau de acometimento se classifica entre 2 e 3 e a severidade é moderada e se a pontuação total for maior que 0,6 o grau de acometimento se classifica entre 4 e 5 a severidade é forte. O grau de acometimento da funcionalidade é classificado de acordo com a frequência das respostas. (Chaves, Oliveira et al. 2008)

3.6.3 Avaliação amplitude de movimento da boca

A avaliação da amplitude de movimento (ADM) mandibular foi avaliada para os seguintes movimentos: abertura funcional (a voluntária foi instruída a realizar a abertura ativa máxima da boca, sem a presença de dor); excursão lateral direita e esquerda (a voluntária foi instruída a mover a mandíbula na medida do possível para um lado sem desconforto); e protrusão (a voluntária foi instruída a mover a mandíbula para a frente tanto quanto possível, sem desconforto).

A ADM foi medida com o auxílio de um paquímetro universal (Paquímetro digital Caliper, 150 mm, São Paulo, SP, Brasil), considerando a distância entre a ponta do incisivo central superior, que exibir a melhor orientação vertical, e a extremidade vestibular do incisivo inferior correspondente. Na presença de trespasse vertical dos

incisivos centrais superiores, os valores que excederam foram adicionados aos da abertura da boca. No caso de desvio em relação à linha média dos incisivos centrais, os valores resultantes foram somados aos encontrados no lado contralateral ao desvio mandibular e subtraídos dos valores do lado ipsilateral, conforme recomendado pelo RDC/DTM.

3.6.4 Qualidade de vida relacionada à saúde bucal

Foi utilizado o questionário *Oral Health Impact Profile* - versão simplificada (OHIP-14). O questionário OHIP-14 é usado para avaliar a qualidade de vida relacionada à saúde bucal, analisando as limitações funcionais do paciente de acordo com os sintomas orais, limitações funcionais e seu bem-estar emocional e social. O OHIP-14 foi desenvolvido seguindo um modelo conceitual de saúde bucal e possui sete domínios: dor física, incapacidade psicológica, desconforto psicológico, limitação funcional, incapacidade física, incapacidade social e incapacidade. Possui 14 itens e suas respostas variam de 0 a 4 (0 = nunca; 1 = raramente; 2 = as vezes; 3 = constantemente; 4 = sempre). Sua pontuação total varia de 0 a 56 e é calculada com a soma dos 14 itens. Quanto maior a pontuação, pior a qualidade de vida relacionada à saúde bucal. (Afonso A 2017)

3.6.5 Índice de Incapacidade cervical

A incapacidade cervical foi avaliada pelo *Neck Disability Index* (NDI). O NDI é um questionário autoaplicável, traduzido e validado para o português do Brasil, o qual é composto por 10 perguntas relacionadas com a incapacidade e dor na região do pescoço. Cada item pode receber uma pontuação de 0 a 5 (0 = sem dor ou incapacidade e 5 = dor ou incapacidade total), e a soma das pontuações determina o grau de incapacidade. Mais especificamente, as pontuações mais altas implicam maior incapacidade. A interpretação de pontuação será: 0-4 = nenhuma incapacidade; 5-14 = incapacidade leve; 15-24 = incapacidade moderada; 25-34 = incapacidade grave; mais de 34 = incapacidade completa. (Ackelman and Lindgren 2002, Cook, Richardson et al. 2006)

3.6.6 Avaliação da amplitude de movimento cervical

A medida da mobilidade cervical foi avaliada pelo instrumento CROM®, que consiste em um instrumento de plástico colocado sobre a cabeça, por cima do nariz e orelhas, protegido por uma cinta de velcro. Possui dois inclinômetros acoplados independentes, um no plano frontal e outros no plano sagital, que determinam a posição da cabeça de acordo com a gravidade. Um terceiro inclinômetro é acoplado na linha horizontal, junto a um campo magnético colocado sobre o esterno da voluntária, quando for necessário medir o grau de rotação da cabeça. (Tousignant, Smeesters et al. 2006, Audette, Dumas et al. 2010)

O CROM® é um aparelho recomendado para uso clínico e de pesquisa, pois é muito simples de utilizar, capaz de medir todas as amplitudes de movimento cervical e possui confiabilidade e validade para uso clínico, com valores de CCI para todas as medições da amplitude cervical variando entre 0,73 (0,22 – 0,90) para flexão a 0,94 (0,87 – 0,97) para extensão. O erro padrão da medida (EPM) varia de 2° a 5° enquanto a mínima diferença detectável (MDD) varia 6° a 14° em voluntários saudáveis. As estatísticas da EPM e MDD são úteis para permitir a distinção de mudanças reais da amplitude de movimento do indivíduo pelo clínico. Além disso, o CROM® apresenta uma confiabilidade melhor do que o goniômetro e o inclinômetro convencionais. (Audette, Dumas et al. 2010)

Na avaliação da amplitude de movimento cervical com o instrumento CROM®, as voluntárias permaneceram sentadas com as articulações do quadril, joelhos e tornozelos em 90 graus e os membros superiores posicionados paralelos ao tronco. O instrumento CROM® foi posicionado na cabeça da voluntária de acordo com as instruções do fabricante. Foi solicitado a voluntária que realizasse os movimentos de flexão, extensão, inclinação lateral e rotação bilaterais, por três vezes com intervalo de 30 segundos entre cada uma das repetições. A ordem dos testes foi aleatorizada previamente a entrada da voluntária a sala de exame.

3.6.7 Avaliação do teste de flexão e rotação cervical

Para a medida da mobilidade de cervical superior, foi utilizado o *Flexion Rotation Test* (FRT) com o CROM® acoplado a cabeça da voluntária. O teste foi realizado com a finalidade de verificar a mobilidade da coluna cervical superior, com enfoque na mobilidade do segmento C1-C2. Foram considerados com limitação da mobilidade cervical superior aquelas voluntárias que obtiveram uma redução de 10° em relação ao valor de normalidade (44° de rotação para cada lado), portanto valores < 34°. O FRT é suficientemente sensível e preciso para monitorar pequenas mudanças de amplitude individual dos pacientes. A diferença mínima detectável importante é considerada quando ocorre uma alteração acima de 10° na medição. (Grondin, Hall et al. 2015)

Durante a avaliação da mobilidade com o FRT, a paciente foi posicionada em posição supina com a cabeça relaxada nas mãos do examinador, que realizou uma flexão passiva máxima da coluna cervical e em seguida um movimento de rotação passiva tanto para a direita como a esquerda. (Ogince, Hall et al. 2007, Smith, Hall et al. 2008, Hall, Briffa et al. 2010) O limite máximo de rotação foi dado quando o examinador encontrou uma resistência ao movimento ou a paciente relatou a sensação de dor na região próxima ao segmento C1/C2. A voluntária foi instruída a referir a palavra “dor” no momento inicial da sensação dolorosa. Durante a realização do teste, a voluntária estava com o instrumento CROM® acoplado à cabeça e foram realizadas três medidas com intervalo de 30 segundos entre elas e o valor final foi a média entre as três medidas. A ordem da realização dos movimentos foi aleatorizada previamente à entrada do paciente na sala do exame.

3.6.8 Avaliação do controle motor cervical

O desempenho dos músculos flexores cervicais profundos foi avaliado pelo teste de flexão crânio-cervical (CCFT). O CCFT é um teste de baixa carga, o qual é o método mais utilizado para avaliar o desempenho dos músculos cervicais profundos. O CCFT consiste em um movimento de flexão crânio-cervical (movimento de balançar a cabeça em sentido de “sim”), que combina a ação da flexão na articulação crânio-cervical realizada pelos músculos longos da cabeça bilateralmente, juntamente com o achatamento da lordose cervical, uma ação dos músculos longos do pescoço, bilateralmente. (Armijo-Olivo, Silvestre et al. 2011)

Durante o teste as participantes permaneceram em posição supina relaxada com os joelhos flexionados e a cabeça e o pescoço em uma posição intermediária (isto é, posição neutra, sem flexão ou extensão). A participante realizou o movimento de flexão crânio-cervical em 5 estágios progressivos de pressão crescente em 2 mmHg (22, 24, 26, 28, e 30 mmHg) com um dispositivo pressórico de feedback visual sob a base do osso occipital (Biofeedback Stabilizer Pressão; Chattanooga, Hixson, TN, EUA). As participantes foram instruídas a realizar o movimento de flexão crânio-cervical de forma lenta e controlada até atingir os níveis de pressão alvo solicitado. As participantes tiveram que manter uma pressão constante em cada nível alvo por uma duração de 10 segundos. Elas realizaram a contração mantida duas vezes em cada nível, com um período de descanso de 1 minuto entre as repetições para evitar os efeitos da fadiga.(Armijo-Olivo, Silvestre et al. 2011) O último nível que a paciente conseguiu manter a contração com sucesso foi anotado pelo avaliador.

3.6.9 Escala de cinesiofobia

O termo cinesiofobia é utilizado para definir o medo excessivo, irracional e debilitante do movimento e da atividade física, que resulta em sentimentos de vulnerabilidade à dor ou em medo de reincidência da lesão. Para a avaliação desta condição foi utilizada a escala Tampa de cinesiofobia, a qual consiste em um questionário autoaplicável, composto de 17 questões que abordam a dor e a intensidade dos sintomas. Os escores variam de um a quatro pontos, sendo que a resposta “discordo totalmente” equivale a um ponto, “discordo parcialmente”, a dois pontos, “concordo parcialmente, a três pontos e “concordo totalmente”, a quatro pontos. Para obtenção do escore total final é necessária a inversão dos escores das questões 4, 8, 12 e 16. O escore final pode ser de no mínimo 17 e, no máximo, 68 pontos, sendo que, quanto maior a pontuação, maior o grau de cinesiofobia.

3.6.10 Escala de Percepção Global de Mudança

O objetivo da Escala de Percepção Global de Mudança é a avaliação global da percepção do paciente acerca da sua melhoria e satisfação com o tratamento, possibilitando que este expresse de forma clara e concisa a sua percepção sobre os

componentes da sua experiência acerca da: dor, função física, aspectos emocionais, efeitos adversos, e conveniência dos cuidados realizados. Assim, os resultados obtidos por essa escala se referem a medição da avaliação global dos benefícios do tratamento, feita pelos próprios pacientes, refletindo assim a magnitude das mudanças nos resultados e a importância pessoal que a melhora clínica tem para os mesmos. (Hurst and Bolton 2004, Domingues and Cruz 2011)

A Escala de Percepção Global de Mudança é uma escala unidimensional, onde os indivíduos classificam a sua melhora numa escala de 7 itens que variam entre “1: sem alterações ou a condição pirou” a “7: Muito melhor, e com uma melhoria considerável que fez toda a diferença”. Esta escala tem sido utilizada em diversos estudos relativos à dor crônica, e disponibiliza informação facilmente interpretável acerca da importância clínica das mudanças do estado de saúde percebidas pelos indivíduos quando submetidos a algum tipo de tratamento.

3.6.11 Avaliação do limiar de dor a pressão

A avaliação do limiar de dor à pressão (LDP) foi realizada através de um dinamômetro digital (Kratos, Cotia, Brasil), o qual tem uma ponta plana circular (1 cm^2), utilizada para aplicar pressão sobre o músculo, que será aplicada com uma proporção de aplicação de 0,5 $kg/cm^2/s$. Para a avaliação do LDP os pacientes foram posicionados confortavelmente sentados em uma cadeira com apoio posterior e sem apoio para os braços, em um estado de relaxamento muscular. O dispositivo foi posicionado perpendicularmente ao local avaliado, enquanto a cabeça do participante era sustentada pela mão contralateral do examinador. Os participantes foram instruídos verbalmente a relatar a palavra “dor” no instante em que o aumento da pressão provocar uma sensação dolorosa. Foram avaliados bilateralmente os seguintes músculos: temporal anterior, masseter, ECOM, trapézio superior, escaleno e esplênio do pescoço. Os sítios musculares avaliados seguiram uma sequência aleatória sorteada previamente a entrada do voluntário a sala de avaliação. O valor final do LDP para cada local foi calculado com base na média de 2 repetições, de ambos os lados. Adicionalmente, cada medida foi realizada com intervalos de 30 segundos entre cada músculo avaliado.

3.7 INTERVENÇÕES

Este estudo contou com dois grupos de tratamento ativo e um grupo placebo. O protocolo de tratamento utilizado pelo grupo um do presente estudo foi baseado no protocolo proposto por Falla *et al* (2013),(Falla, Lindstrom et al. 2013) o qual consiste em exercícios específicos de controle motor e fortalecimento dos músculos flexores e extensores do pescoço. Enquanto o segundo grupo recebeu um protocolo de tratamento com terapia manual baseado na literatura prévia.(Medlicott and Harris 2006, Armijo-Olivo, Pitance et al. 2016, Laimi, Makila et al. 2018)

Todas as participantes receberam instruções e orientações de um fisioterapeuta referente ao tratamento ao qual as mesmas foram randomizadas, durante trinta minutos, uma vez na semana, no Laboratório de Aprendizado e Controle Motor (LACOM), localizado Departamento de Fisioterapia, da Universidade Federal de Pernambuco.

3.7.1 Grupo treinamento cervical

As participantes do grupo de treinamento cervical realizaram um programa de 8 semanas de exercícios específicos e progressivos para os músculos flexores e extensores cervicais. (Jull, Falla et al. 2009, Falla, Lindstrom et al. 2013) As pacientes receberam instruções individuais e supervisão por um fisioterapeuta durante 30 minutos, 1 vez por semana por um período de 8 semanas. Durante esse tempo o fisioterapeuta verificou como a paciente estava realizando os exercícios ensinados na semana anterior e progrediu a paciente quando apropriado. O programa de exercício consistiu em duas fases:

<u>Fase 1:</u>

A primeira fase teve duração de 6 semanas. O principal exercício realizado nesse período foi o de flexão cranial, que foi realizado com a voluntária posicionada em uma posição supina relaxada. Este exercício engloba os músculos estabilizadores profundos da cervical, longo da cabeça e longo do pescoço. (Falla, Lindstrom et al. 2013) As pacientes foram orientadas a realizar e manter posições, as quais foram progressivamente evoluídas durante a execução do movimento de flexão crânio-

cervical. Durante a tarefa, as pacientes foram orientadas a partir do feedback de uma unidade pressórica (*Biofeedback Stabilizer* Pressão; Chattanooga, Hixson, TN, EUA), colocado posteriormente a coluna cervical sob o osso occipital, com intuito de monitorar a redução da lordose cervical, o que ocorre com a contração do músculo longo do pescoço.

O treinamento iniciou com o aparelho inflado a uma pressão base de 20mmHg e foi solicitado a participante que realizasse um movimento curto de flexão de cabeça (movimento de concordância: “sim”), e deveria mantê-lo por 10 segundos com dez repetições com intervalo de 10 segundos entre elas, sendo considerado essa sequência como uma única repetição que dura 190 segundos. A partir daí a paciente deveria progredir o exercício durante cinco estágios de 2 mmHg cada, atingindo a pressão máxima de 30 mmHg. A participante deveria realizar as contrações de forma lenta e suave, não permitindo retração ou elevação da cabeça da maca, e evitando a contração simultânea de ECOM e escaleno (Figura 1).

Figura 1: treino de flexão cranial com auxílio do instrumento de unidade pressórica e feedback visual (instrumento *Stabilizer*)

Fonte: Do autor

Além disso, as pacientes realizaram os movimentos de extensão, flexão e a rotação crânio-cervical numa posição ventral apoiados nos cotovelos, onde as mesmas estavam posicionadas a 90º de flexão, e deveriam manter a coluna cervical numa posição neutra. O comando do exercício dado a paciente é que a mesma

realizasse os movimentos de “sim” e “não” com a cabeça. Este exercício tem como objetivo recrutar os músculos extensores profundos da coluna cervical.

Figura 2: treino dos músculos extensores profundos cervicais com apoio nos cotovelos.

Fonte: Do autor

Fase 2:

A segunda etapa do programa teve duração de 2 semanas e a participante realizou um exercício de fortalecimento da musculatura cervical utilizando o peso da cabeça como a carga. As pacientes foram posicionadas em decúbito dorsal e orientadas a realizar a flexão craniocervical seguida da flexão cervical apenas para levantar a cabeça da maca. Durante esta fase, as pacientes realizaram até 15 repetições com 3 segundos de duração. Este exercício tem o objetivo de fortalecer os músculos flexores cervicais superficiais.

Figura 3: treino dos músculos flexores superficiais cervicais.

Fonte: Do autor

Para o fortalecimento do grupo muscular extensor superficial, a paciente foi posicionada em decúbito ventral na posição de 4 apoios. As pacientes foram orientadas a manter a região craniocervical em uma posição intermediária, enquanto elas realizavam o movimento de extensão da coluna cervical inferior. Para os exercícios de fortalecimento, todas as repetições foram mantidas durante um período de 3 segundos sem descanso entre as repetições.

Figura 4: treino dos músculos extensores superficiais cervicais em quatro apoios.

Fonte: Do autor

As pacientes foram solicitadas a praticar o seu respectivo programa em domicílio, uma vez por dia durante as oito semanas. Os exercícios tinham em média uma duração de 10-20 min/dia e foram realizados sem qualquer provocação da dor no pescoço e/ou na ATM e músculos mastigatórios. Os pesquisadores não tinham controle sobre a pressão aplicada aos flexores profundos cervicais durante a realização do exercício domiciliar, e por essa razão a participante foi instruída a realizar o treinamento da musculatura flexora cervical profunda com o auxílio de um rolo de toalha posicionado na região posterior da coluna cervical, a fim de proporcionar um feedback sensorial e facilitar o controle dos ângulos de movimento da flexão cervical superior.

Assim, normalmente, as pacientes realizavam um exercício para os músculos flexores crânio-cervicais e um exercício para os músculos extensores crânio-cervicais na fase 1. Na fase 2, as pacientes foram orientadas a realizar um exercício de fortalecimento para o grupo muscular flexor superficial e profundo e um exercício para o grupo muscular extensor cervical superficial e profundo. Embora todas as pacientes tenham seguido o programa geral de exercícios, o nível e o número de repetições de cada exercício foram adaptados individualmente para cada paciente, garantindo que elas realizassem os exercícios livre de dor. No entanto, todas iniciavam com no mínimo 2 séries de 10 repetições. Foi solicitado que as pacientes se abstivessem de qualquer outra forma de intervenção específica para a DTM durante o período de treinamento. As participantes foram familiarizadas previamente ao início do treinamento com todos os exercícios.

3.7.2 Grupo fisioterapia convencional

O grupo fisioterapia convencional recebeu um tratamento previamente testado na literatura e que apresentou melhora na dor e na função dos pacientes com DTM. (Medlicott and Harris 2006, Armijo-Olivo, Pitance et al. 2016, Laimi, Makila et al. 2018) O tratamento envolveu exercícios domiciliares e terapia manual assistida. Durante o atendimento fisioterapêutico as pacientes foram tratadas com as seguintes técnicas:

- Mobilização da coluna cervical: liberação miofascial dos músculos trapézio superior, ECOM, escaleno anterior e suboccipitais (10 minutos) (Figura 5);

- Mobilização articular em póstero-anterior (PA central) grau I e II de Maitland, somente para alívio de dor, foram permitidos nessa fase a mobilização de até 4 segmentos, que se encontravam dolorosos no momento do tratamento (3 x 10 movimentos);
- Técnicas de alongamentos para os músculos cervicais, em inclinação, flexão, flexão com rotação e extensão (3 x 30 segundos) (Figura 6);

Foram recomendados os seguintes exercícios domiciliares:

- Técnicas de relaxamento: automassagem com movimento circulares nos músculos cervicais e uso de bolsa quente por no mínimo 20 minutos (Figura 7);
- Auto alongamento dos músculos cervicais em inclinação, flexão, flexão com rotação e extensão (mesmo número de repetições realizadas durante a sessão de tratamento com o fisioterapeuta) (Figura 8);

Figura 5: Mobilização da musculatura cervical

Fonte: Do autor

Figura 6: Alongamento da musculatura cervical

Fonte: Do autor

Figura 7: Automassagem nos músculos cervicais

Fonte: Do autor

Figura 8: Auto alongamento nos músculos cervicais

Fonte: Do autor

O tratamento do grupo fisioterapia foi administrado por um fisioterapeuta clinicamente experiente e treinado no tratamento para a DTM e que não estava envolvido no recrutamento das pacientes. Este grupo foi atendido uma vez por semana durante o período de oito semanas. Cada sessão de tratamento teve duração de aproximadamente 30 min e foi adaptada individualmente às necessidades de cada indivíduo.

3.7.3 Grupo placebo

As pacientes do grupo controle receberam tratamento placebo com ultrassom terapêutico – US (Quark®, *Pro Seven* 977), o qual se encontrava desligado durante o atendimento, sem que a paciente tivesse conhecimento. Foram aplicados dois minutos de ultrassom nos músculos masseter, ECOM, trapézio superior e esplênio, bilateralmente, com intervalo de 1 minuto entre cada aplicação, totalizando um tempo total de terapia de aproximadamente 25 minutos. As pacientes foram atendidas uma vez por semana, durante 8 semanas.

3.8 CO-INTERVENÇÃO

As participantes foram solicitadas a se abster de outros tipos de tratamentos para a dor orofacial durante esta fase de tratamento, incluindo medicação. Se a paciente recebesse outro tratamento, a mesma era orientada a relatar ao fisioterapeuta e então isto era registrado pelo pesquisador. Entretanto, neste estudo, nenhuma paciente referiu que ela recebeu outro tipo de tratamento durante o período de coleta.

3.9 SEGUIMENTO DO ESTUDO

Dois examinadores treinados, cegos para a alocação do grupo de tratamento, realizaram todas as medições tantos dos desfechos primários como secundários do estudo. As pacientes foram reavaliadas no decorrer do tratamento (6ª semana de intervenção – avaliação parcial), imediatamente após as oito semanas de tratamento (avaliação final), 1 mês (*follow up de 1 mês)* e 3 meses após o fim do tratamento (*follow up de 3 meses)*. O seguimento do estudo está disposto na figura 9.

Figura 9: Organograma do seguimento estudo.

Fonte: Do autor

3.10 ADERÊNCIA COM O TRATAMENTO

As participantes foram tratadas na clínica e foram motivadas a realizar exercícios em domicílio (GTC) ou a seguir as recomendações domiciliares (GTM). O cumprimento do tratamento na clínica foi avaliado com base no registro do comparecimento a cada sessão de tratamento. Para monitorar o cumprimento dos exercícios/recomendações em casa, as pacientes foram solicitadas a realizar os exercícios/recomendações que haviam feito em casa antes do início de cada sessão, para a então verificação de progressão dos exercícios pelo fisioterapeuta.

3.11 EFEITOS ADVERSOS

Todos os possíveis efeitos adversos foram monitoradores e registrados de acordo com o relato das pacientes.

3.12 ANÁLISE ESTATÍSTICA

3.12.1 Cálculo amostral

O cálculo amostral foi realizado no programa *Gpower*, baseado em um estudo piloto previamente realizado utilizando como base a melhora no nível da dor orofacial (medida com Escala Visual Analógica (EVA) – 0-10 cm) e de qualidade de vida relacionada à saúde bucal (medida com o Questionário de Qualidade de vida relacionada à saúde bucal – OHRQoL). Foram incluídas 30 pacientes distribuídas igualmente nos três grupos de tratamento. Baseado no tamanho de efeito (diferença média) de 2,6 (DP 0,83; ES = 1,4) entre os grupos ativos (GTC e GTM) quando comparado ao grupo controle na EVA, e um tamanho de efeito (diferença média) de 2,2 (DP 3,3; ES = 1.2) entre os grupos ativos (GTC e GTM) quando comparado ao grupo controle na OHRQoL, com um $\alpha = 0,05$ e $\beta = 80\%$, 54 voluntárias seriam necessárias no total, distribuídas igualmente em três grupos de 18 voluntárias.

A análise estatística está descrita com suas respectivas variáveis para cada estudo especificadamente:

3.12.2 Análise estatística - Artigo 2: “Oral health quality of life is associated to jaw function and depression in patients with jaw pain.”

O teste de normalidade Shapiro-Wilk foi realizado para verificar a distribuição dos dados com auxílio de um histograma, confirmando que os dados apresentaram distribuição normal. As variáveis de estudo como idade, tempo da doença, índice de massa corporal (IMC), dor orofacial, sintomas de depressão, amplitude de movimento

da mandíbula (ROM), e função da mandíbula foram descritos pela média e desvio padrão (DP).

A fim de determinar quais fatores influenciam significativamente a qualidade de vida das pessoas com DTM (objetivo 1), foi realizada uma análise em duas etapas. Inicialmente, foi feita uma regressão linear simples para analisar a relação entre a variável dependente (OHRQoL - baseada no questionário OHIP-14) com cada uma das variáveis independentes (idade, tempo da doença, IMC, dor orofacial, sintomas de depressão, amplitude de movimento mandibular e função mandibular). Variáveis significativas com $p \leq 0.20$ na análise univariada foram adicionadas a um modelo de regressão linear múltipla. Este valor de “p” foi sugerido previamente por alguns estudos como um critério conservador para envolver todas as variáveis potenciais que poderiam ser significativas em um modelo de regressão múltipla. Níveis alfa mais tradicionais podem falhar na identificação de variáveis que poderiam ser importantes.

As variáveis foram inseridas no modelo multivariado de forma hierárquica, com base no valor do R quadrado (R^2). O primeiro modelo nas análises multivariadas consistia em todas as variáveis com um valor R^2 significativo em $p<0,20$ e o modelo multivariado final incluía todas as variáveis que eram significativas em $p<0,05$.

Para verificar qual a combinação de variáveis que melhor diferencia entre boa e ruim qualidade de vida relacionada à saúde bucal (OHRQoL) (objetivo 2), a amostra foi dividida em dois grupos (variável dicotômica) com base na pontuação OHIP-14: boa OHRQoL (pontuação OHIP-14 < 17 pontos) e ruim OHRQoL (pontuação OHIP-14 < 17 pontos), com um tamanho de amostra igual de 27 pacientes por cada grupo. Estes valores foram escolhidos com base na mediana da amostra, uma vez que não há cortes estabelecidos para determinar o nível de deficiência na OHRQoL com base nos escores deste questionário e muitas vezes os autores escolheram certos pontos de corte para determinar a alteração da OHRQoL arbitrariamente. Depois disso, foi realizada uma regressão logística simples para verificar a associação entre OHRQoL (variável dicotômica) boa/ruim e cada uma das variáveis independentes (idade, tempo da doença, IMC, dor orofacial, sintomas de depressão, ADM e função mandibular). Variáveis significativas na análise univariada com $p<0,2$ foram adicionadas a um modelo de regressão logística múltipla. O modelo de regressão logística múltipla final incluiu todas as variáveis que eram significativas em $p<0,05$. Os resultados foram analisados com base na Odds Ratio (OR) seguindo os critérios: OR = 1, o evento é

provavelmente o mesmo nos dois grupos; OR > 1, o evento é mais provável no grupo de casos (OHRQoL ruim); e OR < 1, o evento é menos provável no grupo de casos (OHRQoL ruim).

Após a entrada das variáveis no modelo de regressão logística múltipla, foi realizada uma análise da curva característica do operador receptor (ROC) para determinar qual modelo, incluindo diferentes combinações de variáveis, poderia prever entre boa ou ruim OHRQoL. A área sob a curva (AUC) foi usada para determinar o melhor modelo e combinação de variáveis, usando os seguintes critérios de interpretação: excelente discriminação (AUC = 0,90-1,0); boa discriminação (AUC = 0,80-0,89); discriminação justa (AUC = 0,70-0,79); discriminação (AUC = 0,60-0,69); e nenhuma melhor discriminação do que o acaso (AUC < 0,50).

Para determinar o corte dos fatores para prever a boa/ruim OHRQoL (objetivo 3), dois avaliadores independentes escolheram o corte selecionado para cada fator, de forma que tanto a sensibilidade quanto a especificidade pudessem ser maximizadas (ou seja, valores altos); e assim, ambos os valores deveriam ser semelhantes. Além disso, o recorte escolhido deve também maximizar a porcentagem de pacientes corretamente classificados. De acordo com Cook et al., são buscados índices de probabilidade positiva (positive likelihood ratios (LR)) mais altos e valores negativos mais baixos para maximizar a discriminação. Valores superiores a 2 para LR positiva e inferiores a 0,5 para LR negativa são recomendados pela literatura. Um terceiro avaliador foi consultado quando houve desacordo entre os outros avaliadores principais, a fim de fornecer uma decisão final sobre o melhor valor de corte.

Todas as variáveis que foram incluídas nas análises foram previamente testadas para possíveis violações de linearidade e multicolinearidade. As estimativas são apresentadas com intervalos de confiança de 95% (IC95%). A estimativa foi estabelecida em 0,05. Todas as análises foram feitas no software SPSS, versão 20.0 e software STATA v.14, guiadas por um especialista em estatística.

3.12.3 Análise estatística – Estudo 3 (artigos 3 e 4): “Effectiveness of an 8-week neck exercise training on pain, jaw function and oral health-related quality of life in patients with jaw chronic pain: a randomized controlled trial.”

Para testar a distribuição de dados, foram aplicados os histogramas e o teste Kolmogorov-Smirnov. Os resultados primários e secundários foram normalmente distribuídos e foram descritos em termos de suas médias e desvios padrão (SD).

Para caracterizar a amostra, os dados demográficos e clínicos (idade, índice de massa corporal (IMC), dor orofacial e intensidade da cefaleia) foram comparados entre os grupos usando um teste ANOVA e um teste post-hoc de Bonferroni. Para analisar variáveis dicotômicas (presença de dor na ATM, dificuldade de alimentação e presença de cefaleia) foi usado o teste Qui-quadrado (X^2).

Para determinar se havia uma diferença entre grupos ao longo do tempo na intensidade da dor (resultado primário) e na função da mandíbula, ADM mandibular, OHRQoL, índice de incapacidade cervical (NDI), ADM cervical superior e global, CCFT e cinesiofobia (resultados secundários) foi realizada uma ANOVA mista com medidas repetidas. O fator interno foi o tempo (avaliação inicial, final (imediatamente após o término do tratamento), um mês de follow-up (quatro semanas após o término do tratamento), e três meses de follow-up (12 semanas após o término do tratamento), indicando a diferença no mesmo grupo ao longo do tempo, e o fator intermediário foi o tratamento (GTC, GTM, GP), indicando as diferenças entre os grupos ao longo do tempo. O pós-teste de Bonferroni foi aplicado após a ANOVA mista para verificar onde as diferenças ocorreram.

Todos os resultados foram realizados com base na análise de intenção de tratar (ITT). Neste caso, todos os sujeitos foram analisados de acordo com o grupo em que foram alocados (randomizados), incluindo todas as perdas. Para imputar os dados ausentes das variáveis contínuas, utilizamos uma imputação múltipla baseada em modelos plausíveis de dados, obtidos de uma distribuição projetada especificamente para cada ponto de dados ausente. O método de imputação múltipla selecionado leva um conjunto de preditores e retorna uma única imputação para cada entrada em falta na coluna incompleta. De modo que para imputar cada dado ausente, consulta-se todos os outros dados da planilha. Para isso foi utilizado o Pacote “MICE” do software R. Para determinar os tamanhos dos efeitos (ES) entre os grupos, o índice d de Cohen foi calculado para todos os resultados e interpretado de acordo com as diretrizes de Cohen: ES maior que 0,8: ES grande; ES maior que 0,5: ES moderado, e ES menor que 0,2: ES pequeno. Todas as análises de dados foram realizadas no software R.

4 RESULTADOS

Os métodos e resultados da presente tese estão apresentados em formato de artigos científicos, os quais foram produzidos durante o período do doutorado. A referida tese produziu quatro artigos diretamente relacionados ao projeto de doutorado, sendo uma revisão sistemática, um artigo original transversal e dois artigos originais do tipo ensaio clínico controlado randomizado. Os títulos dos artigos e suas respectivas informações de submissão/ publicação estão descritos abaixo (itens 4.1 a 4.4).

4.1 ARTIGO 1: CERVICAL MUSCULOSKELETAL DISORDERS IN PATIENTS WITH TEMPOROMANDIBULAR DYSFUNCTION: A SYSTEMATIC REVIEW AND META-ANALYSIS. (APÊNDICE A)

O referido artigo encontra-se publicado no *Journal of Bodywork & Movement Therapies* [2020, 24(4):84-101, DOI: 10.1016/j.jbmt.2020.05.001]. *CiteScore*: 2.0; *Highest percentile*: 77%; Fator de impacto: 1.12; Qualis CAPES: A2.

4.2 ARTIGO 2: ORAL HEALTH QUALITY OF LIFE IS ASSOCIATED TO JAW FUNCTION AND DEPRESSION IN PATIENTS WITH JAW PAIN. (APÊNDICE B)

O referido artigo encontra-se publicado na revista *CRANIO: The Journal of Craniomandibular & Sleep Practice*; *Practice* [2021, 21:1-11 (online ahead of print) doi: 10.1080/08869634.2021.1885893] *CiteScore*: 1.5; *Highest percentile*: 44%; Fator de impacto: 1.173; Qualis CAPES: B1.

4.3 ARTIGO 3: EFFECTIVENESS OF AN 8-WEEK NECK EXERCISE TRAINING ON PAIN, JAW FUNCTION AND ORAL HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH JAW CHRONIC PAIN: A RANDOMIZED CONTROLLED TRIAL. (APÊNDICE C)

O referido artigo encontra-se submetido na revista *Clinical Rehabilitation Journal*; *CiteScore*: 4.4; *Highest percentile*: 92%; Fator de impacto: 2.599; Qualis CAPES: A1.

4.4 ARTIGO 4: EFFECTIVENESS OF AN 8-WEEK NECK EXERCISE TRAINING ON NECK DISABILITY AND FUNCTION OF PATIENTS WITH JAW CHRONIC PAIN: A RANDOMIZED CONTROLLED TRIAL. (APÊNDICE D)

O referido artigo encontra-se em fase de escrita para ser submetido na revista *Brazilian Journal of Physical Therapy; CiteScore*: 3.6; *Highest percentile*: 86%; Fator de Impacto: 2.1; Qualis CAPES: A1.

5 CONCLUSÃO

Considerando as quatros produções relacionadas diretamente ao projeto de doutorado, quatro diferentes conclusões podem ser sumarizadas de acordo com cada tipo de estudo.

De acordo com a revisão sistemática e meta-análise foi possível verificar que há evidências moderadas a fortes de que indivíduos com DTM apresentam uma redução na resistência dos músculos extensores cervicais, pior incapacidade auto relatada do pescoço e hipomobilidade cervical global e superior, mas não apresentaram alterações na postura craniocervical em relação aos controles sem DTM. A qualidade metodológica dos estudos que avaliaram as disfunções cervicais em indivíduos com DTM variou de moderada a excelente.

Baseados nos resultados do estudo transversal que avaliou os fatores que influenciam a qualidade de vida relacionada à saúde bucal de pacientes com dor miofascial mastigatória, foi possível observar que os sintomas de depressão e o nível da função mandibular foram os fatores mais importantes que influenciaram a qualidade de vida relacionada à saúde bucal. Este estudo indica que pacientes com pior função mandibular e depressão têm pontuação mais alta no questionário OHIP-14, indicando pior qualidade de vida relacionada à saúde bucal. Diante disso, os clínicos que tratam pacientes com DTM devem observar tanto o domínio físico quanto o psicológico para controlar a dor orofacial e assim melhorar a qualidade de vida relacionada à saúde bucal desses pacientes.

Ainda, os resultados do ensaio clínico demonstraram que os exercícios de controle motor cervicais foram efetivos para melhorar a intensidade da dor, a função mandibular e a qualidade de vida relacionada à saúde bucal, mas não a ADM mandibular nas mulheres com dor miofascial mastigatória. Já que, os exercícios específicos cervicais foram significativamente melhores que o tratamento placebo para melhorar a dor, a função mandibular e a qualidade de vida relacionada à saúde bucal, e significativamente melhores que a terapia manual nos músculos cervicais para melhorar a qualidade de vida relacionada à saúde bucal.

Ainda em relação aos desfechos cervicais avaliados pelo presente ensaio clínico, os exercícios de controle motor cervicais foram também efetivos para melhorar a incapacidade cervical, a mobilidade cervical superior e o controle motor dos

músculos cervicais, mas não a ADM global do pescoço e a cinesiofobia das mulheres com DTM. Enquanto o tratamento de terapia manual somente apresentou melhores resultados na avaliação da ADM cervical em comparação com o tratamento placebo. Esses resultados fornecem evidências promissoras do uso de exercícios de controle motor do pescoço em pacientes com dor miofascial mastigatória.

Ainda é importante ressaltar que de acordo com a literatura prévia, este é o primeiro estudo que testou um protocolo específico de exercício de controle motor cervical isolado em um grupo de pacientes com DTM mista ou dor miofascial mastigatória. Este estudo mostrou que exercícios dirigidos ao pescoço (que requerem baixa supervisão terapêutica) podem ser úteis no manejo de pacientes com dor orofacial crônica. Este estudo optou por aplicar o protocolo de exercícios de controle motor de forma isolada, para esclarecer a efetividade deste tipo específico de tratamento e para garantir a validade interna do estudo. Este estudo seguiu os padrões metodológicos descritos para ensaios clínicos, utilizando um bom processo de aleatorização e ocultação de alocação. Embora a terapeuta não pudesse ser mascarada (devido à natureza das terapias), ela foi mascarada para as medidas de desfecho. Além disso, as pacientes estavam blindadas para as hipóteses do estudo, diminuindo a possibilidade de vieses de desempenho. Os avaliadores foram mascarados para o grupo de alocação, o que evitou os vieses de detecção. As co-intervenções foram controladas a fim de evitar o viés de contaminação. Além disso, foi utilizada a análise por intenção de tratar com imputação múltipla de dados faltantes, o que aumenta a confiança nos resultados encontrados.

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APÊNDICE A – ARTIGO 1: CERVICAL MUSCULOSKELETAL DISORDERS IN PATIENTS WITH TEMPOROMANDIBULAR DYSFUNCTION: A SYSTEMATIC REVIEW AND META-ANALYSIS. (ARTIGO PUBLICADO)

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Diagnostic Methods

Cervical musculoskeletal disorders in patients with temporomandibular dysfunction: A systematic review and meta-analysis

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ABSTRACT

Objective: To verify which are the neck musculoskeletal disorders presented by individuals with temporomandibular disorders (TMD).
Methods: It is a systematic review and meta-analysis that were included cohort, case-control and cross-section studies that analyzed the presence of cervical musculoskeletal disorders in individuals with TMD, with age between 18 and 55 years. The searches were carried out in the databases: Medline/PubMed, Cinahl, Web of Science, Cochrane, Lilacs and Scopus; and there was no linguistic or temporal restriction. The evidence quality was evaluated by GRADE system and methodological quality by *Newcastle-Ottawa Quality Assessment Scale* (NOS) and the risk of publication bias assessed by the funnel plot graph. The data was quantitatively analyzed by the meta-analysis using the mean differences (MD) as an effect measure.
Results: There were included 21 manuscripts in the synthesis, of theses 16 were evaluated by meta-analysis with methodological quality ranging from poor to excellent by NOS scale. Individuals with TMD present lower endurance of extensor neck muscle compared to TMD-free (MD = −194.66s [95%CI: 212.44;-176.88]), with moderate to excellent quality. As, upper neck hymobility on the right (MD = −8.59° (95%CI: −10.43°;-6.75°) and left (MD = −7.99° (95%CI: −9.63°;-6.35°), and in all global neck movements. Also, individuals with TMD presented worse self-reported neck disability (MD = 7.91 (95%CI: 7.39; 8.43)) compared to free-TMD.
Conclusion: There is moderate and strong evidence that patients with TMD present lower endurance of extensor neck muscle, global and upper neck hypomobility, worse self-reported neck disability, however, their cranio-cervical posture is similar to individuals without TMD, based on a moderate to excellent methodological quality.
Systematic review registration number: PROSPERO CRD42018103918.

1. Introduction

Temporomandibular disorders (TMD) is defined as a group of musculoskeletal conditions affecting the temporomandibular joint (TMJ), masticatory muscles and all others associated cranio-cervical structures(Durham, 2008; Greene, 2010). Among the orofacial pain conditions, the TMD are the most prevalent condition reaching around the 5–7% of these population, and it is more prevalent among young adults with 20–40 years old(Armijo-Olivo et al., 2016; Pain, 2019). Also, TMD are commonly associated with other symptoms affecting the head and neck region, as headache, oto-logic disturbances, cervical spine dysfunction and postural head and neck misalignment(Armijo-Olivo et al., 2016).

Individuals with TMD often present disorders on neck region, as neck pain, neck joint tenderness, restrict global and upper neck range of motion (ROM), and presence of sensitive points. Also, they show alterations on muscle function and behaviour (Armijo-Olivo et al., 2012), determined by loss of neck motor control and worse endurance of deep and superficial neck muscles. Thus, altered neuromuscular control of the cervical spine could contribute to the

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irritation of structures sensitive to neck pain and contribute to/or perpetuate pain in the cervical and orofacial regions (Armijo-Olivo et al., 2012).

These relation between cervical and orofacial disorders are due to anatomical proximity (Eriksson et al., 2000; Zafar et al., 2000), neuronal interconnections and convergence entries between the cervical and trigeminal areas in the trigeminocervical nucleus(Arendt-Nielsen and Svensson, 2001; da Costa et al., 2015; Mellick and Mellick, 2003; Mellick, 2005). This relationship is maintained through possible reflex connections between the nociceptors and mechanoreceptors of the TMJ and the cervical muscles system. These may be involved in the pathophysiological mechanisms responsible for sensorimotor disorders in the cervical region found in individuals with TMD.

Despite the vast evidence of anatomical and physiological correlation between temporomandibular and cervical disorders, there is no consensus about how these conditions are really associated with TMD. That is, there is still a lack of evidence about the force, endurance and motor control of the flexor and extensor neck muscles; cranio-cervical posture; upper and global neck mobility; and self-reported neck disability, in individuals with TMD. Clinically, this knowledge it will be helpful to guide the clinician to make evaluation and treatment decisions(Fougeront and Fleiter, 2018).

Based on the previous cross-sectional studies the hypothesis of this systematic review is that individuals with TMD present worse neck musculoskeletal disorders when compared to individuals without TMD. So, the objective of the present systematic review and meta-analysis was to verify which are the neck musculoskeletal disorders presented by individuals with TMD.

2. Methods

The present study was registered in the platform PROSPERO by the number: CRD42018103918. And followed the criteria describe above:

2.1. Criteria for inclusion of studies

2.1.1. Type of studies

Cohort, case-control, and cross-sectional studies were included. There was no linguistic or temporal restriction.

2.1.2. Participants

Studies that included individuals with myogenic or mixed TMD diagnosed by the Research Diagnostic Criteria (RDC/TMD) (Schiffman et al., 2014), with a history of pain for at least 6 months, both sexes, with age between 18 and 55 years old, and paired free-TMD participants. There were excluded studies in which the samples contained participants with primary and/or secondary headache, except when headache was diagnosed as due to TMD.

2.1.3. Outcomes

The outcomes considered in the present study were the musculoskeletal disorders: force, endurance and motor control of neck muscles; cranio-cervical neck posture; global and upper (C1–C2 vertebral segment) cervical range of motion; and self-reported neck disability.

2.1.3.1. Muscular force and endurance

2.1.3.1.1. Maximal isometric force test of cervical flexors. The participant should have undergone a test with the use of a load cell with visual feedback, where the individual was in the supine position. The result of the present test was described in mean and standard deviation (SD), and to indicate a clinically significant difference between the groups, the minimum important difference (MID) was 7.5 N between the means, calculated with an effect size of 0.5(Armijo-Olivo et al., 2011c).

2.1.3.1.2. Endurance test of cervical flexors. The study should have used the same test protocol described above, but with the contraction time measurement maintained at different strength levels (25%, 50% and 75% of the maximum voluntary contraction (MVC) force). The result was presented in mean and SD, to indicate a clinically significant difference between the groups, the MID should be 5.94 s, calculated with an effect size of 0.5(Armijo-Olivo et al., 2011c).

2.1.3.1.3. Endurance test of cervical extensors. The study should have used the same test protocol described above, but with the individual positioned in the prone position, the patient should maintain the cervical extension position for as long as he could, measured in seconds. The result was presented in mean and SD, to indicate a clinically significant difference between the groups, the MID should be 204 s, calculated with an effect size of 0.5(Armijo-Olivo et al., 2012).

2.1.3.1.4. Cervical muscle motor control. It was evaluated through the cranio-cervical flexion test (CCFT), which evaluated the level of test range (which is variable from 22 to 30 mmHg) and the electromyographic (EMG) activity of the cervical superficial musculature. The result for a good test performance should be at least 26 mmHg, and to indicate a clinically significant difference between the groups for EMG activity, the MID should range from 4.6 to 12% of the MVC, calculated with an effect size of 0.5 (Armijo-Olivo et al., 2011c).

2.1.3.2. Cranio-cervical posture evaluation.

We included studies that used in their methodology the evaluation of the angles: eye-tragus-horizontal; tragus-C7-horizontal; pognion-tragus-C7; Tragus-C7-shoulder; odontoid-base-occipital; odontoid process-C3/C4; atlas plane angle; craniovertebral angle (flexion/extension of the head to neck); cranio-cervical postural line (position of anteriorization of the head); atlas-occipital distance, evaluated by imaging or radiography software. Data were presented as mean and SD of the values in degrees. To indicate a clinically significant difference between the groups, the MID should be 2.7°, calculated with an effect size of 0.5(Armijo-Olivo et al., 2011a; Armijo-Olivo et al., 2011c; de Farias Neto et al., 2010; Faulin et al., 2015; Rakesh et al., 2014; Weber et al., 2012).

2.1.3.3. Cervical range of motion (ROM) evaluation

2.1.3.3.1. Global cervical ROM. The study should have used the cervical specific goniometer (CROM®), and perform flexion, extension, left and right lateral flexion, left and right rotation movements. The data were presented in mean and SD, the MID varies between 6° and 14° in healthy volunteers (von Piekartz et al., 2016).

2.1.3.3.2. Upper cervical ROM (C0–C2). The study should have used the flexion rotation test (FRT) with the CROM® coupled to the Participant's head, the results were presented in degrees, and values equal or less than 32° were considered upper cervical hypomobility (FRT positive). (Grandin et al., 2015).

2.1.3.4. Neck disability evaluation. The studies that applied the questionnaire Neck Disability Index was included. This questionnaire is a self-reported questionnaire related to pain and neck disability. The score is 0–4 = no disability; 5–14 = mild; 15–42 = moderate; 25–34 = severe; <34 = complete disability(Cook et al., 2006).

2.1.4. Research methods for the studies identification

2.1.4.1. Search strategy. The searches were conducted in June 2018 and updated on March 2020, by a trained personal in the following databases: Medline/PubMed, Cinahl, Web of Science, Cochrane,

Lilacs and Scopus. The searches included all relevant terms of subjects' headings and keywords for both concepts: temporomandibular disorder and cervical disorders, through the descriptors of the Medical Subject Headings (MeSH) and the Descriptors in Health Sciences (DeCS) for all databases. The Boolean operators "AND" or "OR" were used to cross the descriptors, defining the search strategy. The detailed search strategy is available in Table 1. The search was limited to cross-sectional studies, and animal studies, clinical trials and abstracts were removed. There was no time or language restriction. The reviewers had ability to read in Portuguese, English, and Spanish. When other languages were found, people with language skills were invited to help with the translation of the articles.

2.1.5. Data collection and analysis

2.1.5.1. Data screening. Two independent reviewers (AISOS and JKOF) participated in the data screening. Initially, articles were identified through the title and abstract based on the inclusion and exclusion criteria. If the article filled up the inclusion and exclusion criteria or if the information was unclear, the full text was obtained. And then, after the full text evaluation the articles were included in this systematic review. The agreement consensus was done and in the case of disagreements, the opinion of a third reviewer (DAO) was requested. The selection stages of the articles of this systematic review and meta-analyses are shown in the flowchart based on the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* – PRISMA (http://www.prisma-statement.org/).

2.1.5.2. Data extraction. The data were extracted and organized into the Excel file by one independent review, and a second reviewer check all data extracted. The following data were extracted: article information (i.e. year of publication, language, country, others); study information (i.e. objectives, design, diagnosis, others); outcomes and tools characteristics (description of the instruments used by the articles to evaluate the patients, specially regards to how they were measured). When the quantitative data were presented, it was extracting the mean, standard deviation, and 95% confidence interval. When the data were continuous, effects sized were presented as means differences or standardized. As described above in the case of disagreement, the opinion of a third reviewer was requested. When the data from the article was not well provided, the authors were contacted to provide more detailed information.

2.1.5.3. Risk of bias (quality assessment). The quality assessment (risk of bias) were assessed by Newcastle-Ottawa Quality Assessment Scale (NOS). For the NOS system, each component can receive from one to two points, already previously established. The final result can be classified on poor (<4 points); moderate (4–6 points); excellent (7–10 points).(GA Wells, 2014; Stang, 2010).

Overall evidence quality was performed by Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system(Atkins et al., 2004). For the GRADE system, the quality of evidence was graded in four levels: high, moderate, low or very low. The quality of evidence could be determined based on five factors: design, risk of bias, inconsistency, indirectness and imprecision.

In both evaluations, all discrepancies were resolved by a consensus between the reviewers, and when it was need, a third reviewer was invited to participate.

2.1.5.4. Strategy for data synthesis. The data were also analyzed quantitatively in a meta-analysis and presented in a forest plot chart. The results were analyzed based on the outcome, they were divided into flexor cervical muscular force and endurance, extensor cervical muscular force and endurance, alteration in the contraction pattern of deep and superficial neck muscles, cranio-cervical posture, global cervical range of motion, upper cervical range of motion by flexion rotation test, and neck disability index. The measure of effect used was the mean difference (MD), since the results were continuous variables. The effect model used was the Fixed Effect model, and the statistical method applied was that of inverse variance. The statistical program used for data analysis and graphing was the Review Manager (RevMan Computer program, version 5.3). The heterogeneity was analyzed by the mean values of the inconsistency test (I^2), that the values ranging from 0% to 100%, the cut-off values are: >25%: low heterogeneity; and <75% high heterogeneity. The publication risk of bias was analyzed with the funnel plot graph. The presence of asymmetry in the graph indicate the possible risk of bias(Gallin, 2017).

3. Results

A total of 4424 articles were evaluated, but only 38 were included for full reading, as described on flowchart (Fig. 1). Of these, 21 were included in the synthesis, with a methodological quality that ranged from poor (Khaled Rezaie, 2017) to excellent (Armijo-Olivo et al., 2011c; Ferreira et al., 2019) on the NOS Scale, determining moderate and excellent evidence for the outcomes by GRADE. A total of 2180 participants were evaluated, with 1577 participants with TMD and 603 free-TMD. In addition, 16 studies were included in the quantitative analysis by the meta-analysis.

3.1. Outcome evaluation

3.1.1. Muscle strength and endurance

Five articles evaluated the strength and endurance of cervical flexor and extensor muscles, with a methodological quality ranging from moderate (Greenbaum et al., 2017) (Greenbaum et al., 2017) to excellent (Armijo-Olivo et al., 2010a, 2010b, 2012) by NOS. (Table 2). A total of 226 free-TMD were evaluated; 221 participants with myogenic TMD and 216 with mixed TMD (Table 3).

It was verified that individuals with myogenic or mixed TMD presented lower endurance of neck extensor muscles when

Table 1
Strategies for searching.

MEDLINE/Pubmed/Scopus/Cinahl/Web of science	#1 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (muscle fatigue) #2 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (muscle strength) #3 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (muscle contraction) #4 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (neck pain) #5 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (musculoskeletal abnormalities) #6 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (joint range of motion) #7 (Temporomandibular joint disorders OR temporomandibular joint dysfunction syndrome) AND (Neck) AND (posture)

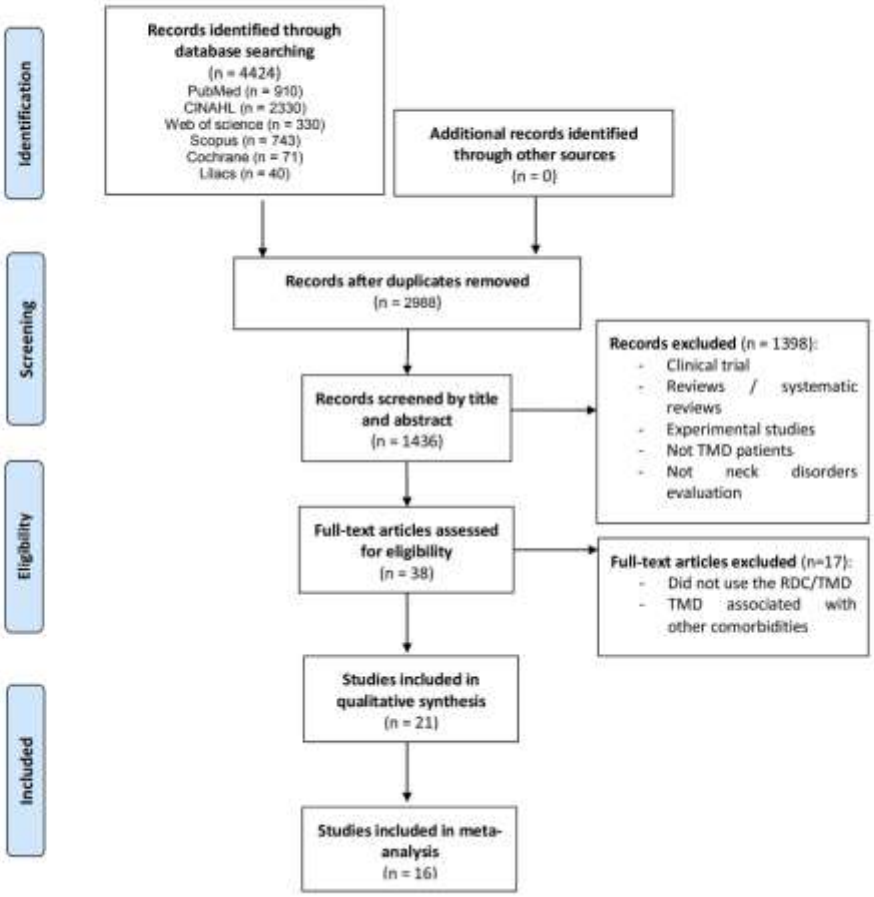

Fig. 1. Flowchart of the selection stages of the identified articles according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Table 2
Characterization of the articles included in the sample (n = 21).

Variables	Number of articles (%)
Publication year	
before 2010	0
2010–2015	11 (52.8%)
2015–2020	10 (47.6%)
Evaluation tools	
Flexor cervical muscular force and endurance	3 (7.7%)
Extensor cervical muscular force and endurance	2 (5.1%)
Alteration in the contraction pattern of deep and superficial cervical musculature	4 (10.3%)
Cranio-cervical Posture	6 (15.4%)
Global cervical range of motion	5 (12.8%)
Flexion Rotation Test	5 (12.8%)
Neck disability index	14 (35.9%)

compared to free-TMD, with a mean difference of −194.66 (95% CI: −212.44; −176.88) seconds (Table 3; Fig. 2 (A)). There is no publication risk of bias related to these results by the funnel plot graph (Fig. 2 (A)). When the neck flexor muscle endurance test was performed, with 25% CVM, this difference only remained in relation to individuals with mixed TMD. Where they presented −7.5 (95%

Table 3
Methodological quality evaluation of included studies according to New Castle - Ottawa quality assessment scale(cross section studies (NOS).

NOS assessment (10*)	Armijo-Olivo (2012)	Armijo-Olivo (2011)	Armijo-Olivo (2010)	Armijo-Olivo (2010)	Greenbaum 2017	Gil-Martinez 2016	Von Piekartz 2016	Carvalho 2016	Grondin (2015)	Costa 2015	Packer (2014)	Silveira et al., 2014	Weber et al., 2012	Armijo-Olivo 2011	Armijo-Olivo 2011	Farias Neto (2010)	Armijo-Olivo (2010)	Rezaie 2017	Faulin (2015)	Raketh (2014)	Ferreira 2019
SELECTION																					
Representativeness *	*	*	*	*	*	*	*	*	*	*	*	–	*	*	*	–	*	–	*	*	*
**Sample size ** **	*	*	*	*	–	*	*	*	–	*	–	*	–	*	*	–	*	–	–	*	*
Non-respondents *	*	*	*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	*
**Ascertainment of the exposure ** **	**	**	**	**	*	**	**	**	**	**	*	*	*	*	**	*	**	*	*	**	**
**Comparability ** **	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**	*	**	**	**	*	**
**Assessment of outcome ** **	**	*	**	**	**	**	**	**	**	**	**	**	*	*	*	*	**	*	*	*	**
Statistical test *	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	–	–	*	*
TOTAL	9	9	9	8	6	8	8	8	7	7	6	5	5	5	10	6	9	3	4	7	9

CI: −12.4; −2.7) seconds of resistance compared to free-TMD and presented a clinically relevant difference in relation to individuals with myogenic TMD (−7.1 (95%CI: −11.8; −2.4) seconds) (Table 3).

A single study found that individuals with TMD also presented lower strength of the cervical flexor muscles, however these data were not clinically relevant. Individuals with mixed TMD had a mean difference of −3 (95%CI: −10;-1.4) Newtons compared to free-TMD (ES = 0.3, MID = 9.5), while those with myogenic TMD presented −4.5 (95% CI: - 9.9; - 2.4) Newtons when compared to free-TMD (ES = 0.3; MID = 7.5) (Table 3). So, there is moderate evidence that individuals with TMD present worse endurance and strength of the neck flexors and extensors muscles when compared to individuals without TMD.

Four articles with methodological quality varying from moderate (Armijo-Olivo et al., 2011b) to excellent (Armijo-Olivo et al., 2011c; Ferreira et al., 2019) by NOS evaluated 343 participants with TMD and 155 free-TMD, regard to the neck motor control using CCFT (Table 5). It was found that only participants with moderate to severe TMD showed altered test response, however all participants had a higher recruitment of the superficial neck muscles during the test, indicating weakness of the deep neck flexor muscles (Table 4). So, there is moderate evidence that individuals with TMD present worst results on CCFT evaluation than individuals without TMD.

3.1.2. *Posture evaluation*

Six articles were included in the posture evaluation. They presented moderate (Faulin et al., 2015) to excellent (Armijo-Olivo et al., 2011c) methodological quality by NOS (Table 2). Overall, 403 participants with TMD and 171 free-TMD, of both sexes, were evaluated. Few studies showed differences between the individuals with and without TMD, however, the majority of studies (Armijo-Olivo et al., 2011a, 2011c; Faulin et al., 2015; Weber et al., 2012) did not present statistical or clinical significance differences (Table 5) (see Table 6).

Only the High Cervical Angle (HCA), which identifies the angle of head extension related to upper cervical spine, was included in the quantitative analysis. The results showed that there is no angular difference between individuals with TMD and free-TMD (MD = −0.40 (95%CI: 2.59; 1.79). There is no significant publication risk of bias, since the funnel plot graph showed no asymmetry (Fig. 2 (B)). So, there is moderate evidence that individulas with TMD present similar posture when compared to individuals without TMD.

3.1.3. *Evaluation of the global and upper cervical range of motion*

Cervical ROM and FRT were evaluated by four articles (Ferreira et al., 2019; Greenbaum et al., 2017; Grondin et al., 2015; von Piekartz et al., 2016) which included 193 individuals with TMD and 98 free-TMD. The methodological quality varied from moderate (Greenbaum et al., 2017) to excellent (Ferreira et al., 2019; von Piekartz et al., 2016) by NOS (Table 2).

According to the meta-analysis, individuals with TMD have a significant reduction in the right (DM = −8.59 [95%CI: −10.43;-6.75]) and left (DM = −7.99 (95%CI: −9.63; −6.35) FRT, and 90% of individuals with TMD present a positive result in the FRT (Fig. 3; Table 7). While for global ROM, it was found that individuals with TMD had lower values of cervical flexion-extension (DM = −9.77 [95%CI: −14.91;-0.85]), cervical lateral flexion (DM = −6.76 [95% CI: −11.08;- 2.44]), and cervical rotation (DM = - 7.59 [95% CI: −12.21; −2.96] movements compared to individuals without TMD (Fig. 4). Overall, there is moderate evidence that individuals with TMD presents lower upper and global neck mobility when compared to controls free-TMD (see Table 8).

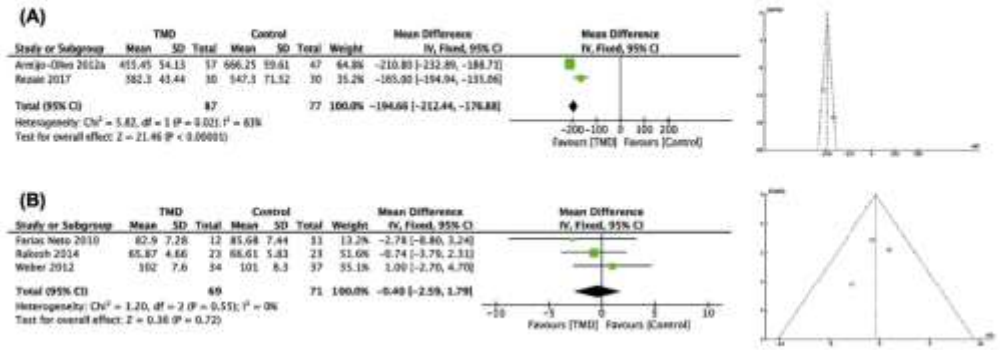

Fig. 2. (A) Forest plot and funnel plot of the mean difference for endurance of cervical extensor muscles in TMD patient's vs healthy control. (B) Forest plot and funnel plot of the mean difference for High Cervical Angle in TMD patient's vs healthy control.

3.1.4. Neck disability evaluation

Twelve articles evaluated the neck disability, with methodological quality ranging from moderate (Armijo-Olivo and Magee, 2007; Silveira et al., 2014) to excellent (Armijo-Olivo et al., 2010b, 2012; Ferreira et al., 2019; Gil-Martinez et al., 2016; Olivo et al., 2010) by NOS (Table 2). A total of 395 free-TMD, and 961 participants with TMD were evaluated. Some studies further classified the type of TMD, and then 420 individuals were diagnosed with myogenic TMD and 339 with mixed TMD (Table 7).

On average, 75% of the individuals with TMD presented self-reported neck pain in relation to 15% of participants free-TMD. Regarding the results found in the meta-analysis based on 11 studies, there is evidence that the level of neck disability in individuals with TMD is worse than the level of free-TMD, with a mean difference of 7.91 (95%CI: 7.39; 8.43) points in the NDI (Fig. 5). So, there is a strong evidence that individuals with TMD present more self-reported neck disability compared to individuals without TMD.

4. Discussion

With the quality of evidence mostly moderate to strong, the major issues of the present systematic review and meta-analysis were that the individuals with TMD presented lower endurance of neck extensor muscles, upper and global neck hypomobility, and worse level of self-reported neck disability, however do not show cranio-cervical postural differences in relation to individuals without TMD, based on a moderate to excellent methodological qualtiy by NOS. There remain limited cross-sectional studies of high quality that have investigated the muscle strength and endurance, in the opposite to neck disability evaluation, that have a lot of moderate and high-quality studies published.

4.1. Muscle strength and endurance

There is moderate evidence that individuals with TMD have less endurance of neck extensor muscles (Armijo-Olivo et al., 2010a, 2010b, 2012) when compared to free-TMD, which could indicate that the neck extensor muscles in these patients may present a different pattern of response to a sustained contraction, similar to a larger fatigue in some muscle groups(Armijo-Olivo et al., 2012). Despite this, no associations were found between neck disability, TMJ disability and clinical variables with the endurance test of the flexor and extensor neck muscles. These data are clinical important and useful, since the methodological quality of these studies was excellent (Armijo-Olivo et al., 2010a, 2010b, 2012). So, these results are pragmatic based on the methodological process followed by the studies.

Regard to neck motor control, evaluated by the CCFT, it is not fully established whether there is difference when comparing individuals with mild TMD to participants free-TMD. May be this difference is more apparent when the TMD is classified as moderate or severe. However, individuals with TMD in turn tend to have a greater activation of the superficial neck flexor muscles during the test, indicating the reduction activation of the deep flexor muscles(Armijo-Olivo et al., 2012; von Piekartz et al., 2016). It is important to note that a meta-analysis of these data was not possible due to the absence of the values reached in the studies included in the systematic review. This could be related to a publication bias, since the omission of data may be related to values considered non-significant by the authors. Or due to the lack of homogeneity between studies However, the included articles had a moderate to excellent methodological quality in their designs(Armijo-Olivo et al., 2011b; Armijo-Olivo et al., 2012; von Piekartz et al., 2016).

The neck motor control abnormalities are related to the fact that pain has an essentially motor component, and it is expected that people with pain usually develop abnormal movement patterns, since the muscle pain decreased the firing rates of active motor units during isometric contractions and caused alterations associated with motor production, such as increased activity or late onset in synergists and related antagonists(Armijo-Olivo and Magee, 2007; Farina et al., 2004).

4.2. Posture evaluation

In some studies (Armijo-Olivo et al., 2011a, 2011c; Faulin et al., 2015; Weber et al., 2012) postural alterations in individuals with TMD were not observed in relation to participants free-TMD (Durham, 2008; Faulin et al., 2015). However, these data are not consensual. Two other articles (de Farias Neto et al., 2010; Rakesh et al., 2014) with moderate methodological quality, found a greater position of head extension by analysis of the eye-tragus-horizontal angle in individuals with TMD, in addition to a tendency to flexion of the first cervical vertebra and a cervical spine hyperlordosis (C2–C7). However, these differences were small and were not considered clinically relevant. Also, the articles presented different methodologies to evaluate the posture and some of them

Table 4
Force and endurance of flexor and extensor cervical muscles.

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Armijo-Olivo et al. 2012	To determine if the patients with mix or myogenic TMD had more fatigue in the neck extensor muscles during the muscles resistance test (NEMRT) when compare to healthy control	Healthy (n = 47): 28.3 (7.5) years old; Myo TMD (n = 57): 31.1 (8.7) years old; Mix TMD (n = 47): 31.4 (8.4) years old; All females volunteer	Endurance test of cervical extensor muscles	**Extensor muscles endurance (seconds):** • Healthy: 666.21 (59.61) s • Myo TMD: 455.45 (54.13) s • Mix TMD: 459.70 (59.61) s Differences between groups in the endurance test (seconds): Healthy vs Myo TMD: 210.8 (80.1); P = 0.03; Healthy vs Mix TMD: 206.5 (84.1); p = 0.05.	Patients with TMD presented worse endurance of extensor neck muscles.
Armijo-Olivo et al. 2011	To Explore and analyze different evaluation methods of clinical relevance, using the crossectional studies like example	Myo TMD (n = 56); Healthy (n = 58); Mix TMD (n = 48);	Maximal cervical flexor strength Endurance test of the cervical flexor muscles Endurance test of the cervical extensor muscles	**Maximal cervical flexor strength:** Mix X Healthy → MD = −3 (−10.3; −1.4), ES = 0.3, MID = 7.5, NCR Myo X Healthy → MD = −4.3 (−9.9; −2.4), ES = 0.3, MID = 7.5, NCR **Endurance of the cervical flexor muscles (25%):** Mix X Healthy → MD = −7.5s (−12.6; −2.7), ES = 0.6, MID = 5.0, CI* Myo X Healthy → MD = 0.4 (−4.2; 5), ES = 0.34, MID = 5.9, NCR. Myo X Mix → MD = −7.1s (−11.8; −2.4), ES = 0.6, MID = 5.0, CI* **Endurance of the cervical extensor muscles during NEMRT:** Mix X Healthy → MD = 307 (16.8; 374.2), ES = 0.5, MID = 204, CI* Myo X Healthy → MD = 211 (31.8 −370.5), ES = 0.3, MID = 204, CI*	Patients with TMD presented worse maximal cervical flexor strength and endurance of extensor neck muscles. But, only Mix TMD presents worse endurance of flexor neck muscles
Armijo-Olivo et al. 2010	To determine whether patients with TMD had a reduced endurance of the cervical flexor muscles and maintained strength at any level of muscular contraction (25%, 50%, and 75% MVC) when compared to healthy subjects	Healthy (n = 49): 28.3 (7.3) years old Myo TMD (n = 54): 31.6 (9.1) years old; Mix TMD (n = 46): 31 (8) years old;	Endurance test of the cervical flexor muscles Maximal cervical flexor strength	**Cervical flexor endurance (sec):** **25% MVC:** Mix TMD: 20.5 (17.05; 24.05); **; Myo TMD: 27.3 (24.2; 30.5); Healthy: 28.1 (24.7; 31.4); **50% MVC:** Mix TMD: 17.5 (14.13; 20.97); Myo TMD: 20.7 (17.6; 23.8); Healthy: 18.7 (15.5; 22); **75% MVC:** Mix TMD: 12.3 (9.8; 14.8); Myo TMD: 14.4 (12.4; 16.7); Healthy: 14.4 (12; 16.8); **Cervical flexor strength (N):** **25%:** Mix TMD: 6.7 (5.3; 7.9); Myo TMD: 6.5 (5.5; 7.6); Healthy: 7.7 (6.5; 8.8); **50%:** Mix TMD: 12.9 (10.6; 15.2); Myo TMD: 12.9 (10.8; 14.8); Healthy: 14.4 (12.2; 16.6); **75%:** Mix TMD: 18.7 (15.4; 21.9); Myo TMD: 18.3 (15.3; 21.2); Healthy: 20.2 (17.1; 23.3);	There was a significant difference in holding time at 25% MVC between subjects with mixed TMD when compared with subjects with myogenous TMD and healthy subjects

					**: p < 0.05 with healthy and Myo TMD;
Armijo-Olivo et al. 2010	To determine whether there was a difference in maximal cervical flexor muscle strength in subjects with TMD (mixed and myogenous TMD) compared with healthy subjects;	Healthy (n = 50): 28.8 (7.3) years old; Myo TMD (n = 54): 31.6 (9.1) years old; Mix TMD (n = 45): 31.07 (8.1) years old;	Maximal cervical flexor strength	**Strength (N):** Mix TMD: 25.9 (21.4–30.4); Myo TMD: 6.5 (5.5–7.6); Healthy: 25.2 (21.2–29.2); Association between neck disability and maximal strength of the cervical flexors muscles was found: R = −0.1; T = −2.79; p = 0.006, IC = −0.17; −0.028)	Maximal strength of the cervical flexors muscles was found to be not significantly different among patients with mixed TMD, patients with myogenous TMD, and healthy subjects.
Rezaie et al. 2017	To investigate the association between TMDs and the endurance time of neck muscles and neck range of motion (flexion and extension).	TMD (n = 30): 26.06(1.33) years old; Healthy (n = 30): 22.8(1.6) years old;	Endurance test of the cervical extensor muscles	**Extensor muscles endurance (seconds):** • Healthy: 547.3 (71.52) s • TMD: 382.3 (43.44) s p < 0.001	The biggest difference is in the neck extensor muscles endurance in which neck extensor muscles endurance is significantly higher in healthy controls vs patients with TMD.

presented problems in the patients' selection. These data were confirmed by the meta-analysis, which showed that there is no difference between free-TMD participants and individuals with TMD in the evaluation of the HCA angle via radiological analysis, with moderate evidence, since the articles had problems with publication bias and selection bias.

It is important to note that subtle alterations in the craniocervical posture (approximately 4°) may reflect the poor muscular control of the deep neck flexor muscles, when sustained postures are evaluated in patients with pain in the upper quartiles(Falla et al., 2007). Thus, a more functional assessment, such as a dynamic assessment of posture, could contribute to the understanding of muscle impairment and to explain more accurately the symptomatology of individuals with TMD (Kraus, 2007), without necessarily subjecting the patient to an analysis by equipment that emits radiation.

4.3. Evaluation of the global and upper cervical range of motion

The individuals with TMD present approximately <8° in the FRT when compared to free-TMD participants, with a prevalence of 90% of positive FRT among them(Greenbaum et al., 2017; Grondin et al., 2015). However, the analysis by Funnel Plot showed a great asymmetry demonstrating a possible publication risk of bias in this data. Also, the studies that evaluated FRT were classified with a moderate methodological quality, since some did not present a sample size calculation, and problems with comparability between groups(Greenbaum et al., 2017; Grondin et al., 2015). But there was moderate evidence according to the GRADE.

In the same way, all global physiological movements of the cervical spine were reduced in individuals with TMD compared to free-TMD participants. These data were derived from studies with moderate methodological quality, especially because they present selection and publication risk of bias and, therefore, do not present a strong evidence. Spite of no correlation was found between TMD severity and cervical spine mobility (Greenbaum et al., 2017; von Piekartz et al., 2016), in a study with excellent methodological quality, stated that cervical disorders are more prevalent in individuals with more severe TMD levels, although individuals with mild and moderate TMD report more pain during the neck movements.

4.4. Neck disability evaluation

The prevalence of self-reported neck pain was quite high among individuals with TMD ranging from 75 to 87.8%, with a pain frequency of approximately 13 days per month. There is evidence that individuals with TMD have worse self-reported neck disability than healthy ones, with a mean difference of approximately 7.9 points on NDI (Armijo-Olivo et al., 2010a; Armijo-Olivo et al., 2012; Armijo-Olivo et al., 2010b; Carvalho et al., 2016; da Costa et al., 2015; Ferreira et al., 2019; Gil-Martinez et al., 2016; Silveira et al., 2014), with a strong evidence since all the studies that found these results had a lower heterogeneity and they showed a methodological quality of moderate (Armijo-Olivo et al., 2011b; Packer et al., 2014; Silveira et al., 2014) to excellent(Armijo-Olivo et al., 2010a; Armijo-Olivo et al., 2012; Armijo-Olivo et al., 2010b; Carvalho et al., 2016; da Costa et al., 2015; Ferreira et al., 2019; Gil-Martinez et al., 2016; Olivo et al., 2010; von Piekartz et al., 2016). The most common failure verified in these studies was the absence of a sample size calculation(Armijo-Olivo et al., 2011b; da Costa et al., 2015; Packer et al., 2014). Also, neck disability level showed a strong correlation with the disability of the TMJ (Olivo et al., 2010), where the higher the NDI score the greater the severity of TMD(von Piekartz et al., 2016). The individual with a high TMD related disability increases by around 19 points on the NDI score(Olivo et al., 2010).

Table 5
–Alteration in the motor control of deep and superficial neck muscles.

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Armijo-Olivo et al. 2011	To Explore and analyze different evaluation methods of clinical relevance, using the craniocervical studies like example	Myo TMD (n = 30); Mix TMD (n = 48); Healthy (n = 34);	EMG activity of the cervical flexor muscles during the craniocervical flexion test (CCFT); The EMG activity of the sternocleidomastoid and anterior scalenes (right and left) was collected during the CCFT. To obtain a measure of EMG amplitude, maximum root mean square (RMS) was calculated for 4s during the 10-s submaximal contractions for each muscle while doing the CCFT and was expressed a percentage of the 3s EMG activity obtained during the MVC normalization procedure.	**Right ECOM:** Mix vs Healthy (22 months) = 5.4 (1.7; 9.1), ES = 0.6, MID = 4.6, CR*. Mix vs Healthy (24 months) = 5.9 (1.8; 9.9), ES = 0.6, MID = 5, CR*. Mix vs Healthy (28 months) = 5.9 (0.8; 11.1), ES = 0.5, MID = 0.4, PCR*. Mix vs Healthy (30 months) = 6.3 (0.7; 1.2), ES = 0.5, MID = 7, CR*. **Left ECOM:** Myo vs Healthy (22 months) = 5.1 (0.7; 9.5), ES = 0.7, MID = 5.6, PCR*. Mix vs Healthy (22 months) = 5.8 (2.1; 9.5), ES = 0.6, MID = 4.0, CR*. Myo vs Healthy (24 months) = 4.9 (0.8; 9), ES = 0.5, MID = 5.2, PCR*. Mix vs Healthy (24 months) = 6.5 (2.5; 10.6), ES = 0.7, MID = 5, CR*. Mix vs Healthy (28 months) = 4.6 (0.3; 9), ES = 0.6, MID = 5.4, PCR*. Mix vs Healthy (30 months) = 5.2 (0.1; 10.3), ES = 0.6, MID = 6.3, PCR*. **Right Anterior Scalene:** Myo vs Healthy (22 months) = 6.4 (0.5; 12.3), ES = 0.4, MID = 7.5, PCR*. Myo vs Healthy (28 months) = 12.1 (1; 23.1), ES = 0.7, MID = 14, PCR*. Mix vs Healthy (30 months) = 8.2 (0.2; 16.3), ES = 0.4, MID = 10, PCR*. **Left Anterior Scalene:** Mix vs Healthy (22 months) = 4.4 (−1.2; 9.8), ES = 0.3, MID = 6.6, PCR*. Mix vs Healthy (24 months) = 5.4 (−1.1; 11.8), ES = 0.3, MID = 7.9, PCR*.	Patients with TMD present hyperactivity of the sternocleidomastoid and the anterior scalene muscles when evaluated by CCFT
Von Piekartz et al. 2016	To determine whether people with TMD, classified as either mild or moderate/severe TMD, have more cervical signs of dysfunction than healthy subjects	Mild TMD (n = 56): 33.21 (10.80) years old; Moderate/Severe TMD (n = 40): 37.25 (13.78) years old; without TMD (n = 41): 33 (8.71) years old;	CCFT	CCFT: Without TMD vs mild TMD: showed similar mean scores; Moderate/severe TMD: to have lower scores on the CCFT;	The CCFT were not impaired in people with mild TMD, only in moderate/severe TMD.
Armijo-Olivo et al. 2011	To determine whether patients with TMD had increased activity of the superficial cervical muscles when performing the Craniocervical flexion test (CCFT) compared with a control group of individuals who were healthy	Healthy (n:47): 28.3 (7.2) years old; Myo TMD (n = 54): 31.4 (9) years old; Mix TMD (n = 48): 33.3 (8.3) years old	CCFT + EMG → SCM, Anterior Scalene	**EMG:** There was no significant difference in EMG activity of the analyzed muscles among groups. **Right SCM:** – 22 months: myogenous X healthy (MD = 9.51*) – 24 months: myogenous X healthy (MD = 11.08*) – 28 months: myogenous X healthy (MD = 11.92*) – 30 months: myogenous X healthy (MD = 12.17*) **Left SCM:** – 22 months: myogenous X healthy (MD = 6.8*); mixed X healthy (MD = 9.54*) – 24 months: myogenous X healthy (MD = 7.32*); mixed X healthy (MD = 12.64*) – 24 months: mixed X healthy (MD = 10.88*) **Right Anterior Scalene:** – 22 months: myogenous X healthy (MD = 9.74*) **Left Anterior Scalene:** – 24 months: mixed X healthy (MD = 17.43*)	There were no differences in EMG activity in the SCM or the anterior scalene muscles in patients with mixed and myogenous TMD compared with healthy when performing the CCFT. However, the patients with TMD tended to have increased activity of the superficial cervical muscles compared with the control group.
Ferreira et al. (2019)	To evaluate, in female patients with TMDs with and without self-reported headache, the performance of the deep cervical flexors using CCFT.	Healthy (n = 17): 33.64 (11.64) years old TMD (n = 40): 37.5 (10.38) years old	CCFT	The TMD group with and without self-reported headaches showed significantly lower pressures (24 mm Hg) than the control group (28 mm Hg; P ≤ 0.001). It was finding a moderate correlation among patients with pain with regard to CCFT (P = 0.001; r = −.444) and also with NDI and CCFT (P = 0.004; r = −.383)	The results showed that the female patients with TMDs, regardless of self-reported headache had a worse performance of the deep cervical flexors than the controls. Also, the CCFT findings were associated with neck disability and temporomandibular pain intensity.

N = number of participants; TMD = temporomandibular dysfunction; Mix TMD = mixed temporomandibular dysfunction; Myo TMD = myogenic temporomandibular dysfunction; MD = minimal difference; ES = effect size; MID = minimal important difference; CR = clinical relevance; PCR = partial clinical relevance; CCFT: Cranio cervical flexion test; EMG: electromyography; SCM: sternocleidomastoid; * = statistical difference.

Table 6
–Posture evaluation of temporomandibular dysfunction patients.

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Armijo et al. 2011	To Explore and analyze different evaluation methods of clinical relevance, using the crossectional studies like example	Myo TMD (n = 56); Healthy (n = 50); Mix TMD (n = 48);	Posture evaluation of head and neck: Four angles were measured (degrees; Alcimagem software): - Eye-tragus-horizontal (A) - Tragus-C7-horizontal (B) - Pogonion-tragus-C7 (C) - Tragus-C7-shoulder (D)	**Postural assessment:** (A) DTM Mix X Healthy: MD = 1.5° (−0.7; 3.7), NCR; DTM Myo X Healthy: MD = 2.6° (0.5; 4.7)*, NCR; (B) : DTM Mix X Healthy: MD = −1.7° (−4.0; 0.5), NCR; DTM Myo X Healthy: MD = 0.6° (−1.5; 2.6), NCR; (C) : DTM Mix X Healthy: MD = 3.4° (0.6; 6.1)*, NCR; DTM Myo X Healthy: MD = 2° (−0.6; 4.6), NCR; (D) : DTM Mix X Healthy: MD = -4.9° (−10; 0.4), NCR; DTM Myo X Healthy: MD = −1.2° (−6.3; 6.9), NCR;	Patients with myogenic TMD presents difference with healthy only for eyes-tragus-horizontal angle but is not clinically relevant. Patients with mixed TMD presents difference with healthy only for Pogonion-tragus-C7 angle C, also with no relevant clinical difference.
Weber et al. 2012	To study the frequency of cervical spine dysfunction (CCD) signs and symptoms in subjects with and without TMD and to assess the craniocervical posture influence on TMD and CCD coexistence	TMD (n = 34): 23.4 (3.4) years old; Without TMD (n = 37): 23.8 (3.4) years;	Evaluation of craniocervical posture (radiographic) - Craniovertebral angle: flexion/extension of the head in relation to neck (CVA); - Craniocervical postural line: anterior head position (CPL);	The craniocervical posture was equal between the groups • TMD: - CPL (anterior head): 81° (4.9°) - CVA (craniocervical angle): 102° (7.6°) • Without TMD: - CPL (anterior head): 82° (5.1°) - CVA (craniocervical angle): 101° (8.3°)	In this study do not have any difference between patients with TMD and healthy in cranio-cervical posture
Armijo-Olivo et al. 2011	To determine whether patients with myogenous or mixed temporomandibular disorders (TMD) had different head and cervical posture measured through angles commonly used in clinical research settings when compared to healthy individuals	Healthy (n = 50); Myo TMD (n = 55); Mix TMD (n = 49);	A lateral photograph was taken with the head in the self-balanced position. Four angles were measured in the photographs (Alcimagem software): (1) Eye-Tragus-Horizontal; (2) Tragus-C7-Horizontal; (3) Pogonion-Tragus-C7; (4) Tragus-C7-Shoulder;	The only angle that reached statistical significance among groups was the Eye-Tragus-Horizontal (F = 3.03, P = 0.040); Myo TMD vs Healthy: MD = 3.3° (95% CI: 0.15; 6.41; p = 0.036).	Cranio-cervical posture measured using the Eye-Tragus-Horizontal angle was statistically significantly different between patients with myogenous TMD when compared to healthy subjects, but without clinically significant. This indicates a more extended position of the head in this group of patients.
Farias Neto et al. 2010	To compare the craniocervical angles and distances between temporomandibular dysfunction (TMD) and free TMD subjects	TMD (n = 12): 22.5 (4) years old; 5 men; 7 women; Free-TMD (n = 11): 22 (2.5) years old ; 4 men; 7 women;	To have a radiograph taken of the cervical spine. Measurements: Measurements three angles and two distances of craniocervical posture were measured: - High cervical angle (HCA) (odontoid–cranial base angle); - Low cervical angle (LCA) (odontoid angle – C3/C4); - Atlas plane angle (APA); - Anterior translation distance (C2–C7)	High cervical angle (HCA): - DTM = 82.90 (7.28); - F/DTM = 85.68 (7.44); - p = 0.378 Atla plane angle (APA): - DTM = 16.7 (1.63)); - F/DTM = 21.64 (1.24)); - p = 0.026 The anterior translation distance (C2–C7): - DTM = 28.7 (2.58); - F/DTM = 19.82 (3.29); - p = 0.045	It could be verified that individuals with TMD had a tendency to present flexion of the first cervical vertebra and an anteriorization (hyperlordosis) of the cervical spine (C2–C7)

Table 6 (continued)

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Faulin et al. 2015	To examine the possible correlation between the prevalence of temporomandibular disorders (TMD) and different head postures in the frontal and sagittal planes using photographs	TMD (n = 126): 75 women;	Craniovertebral angle; Interpupillary line: to measure head tilt in the frontal plane;	No statistically significant differences were found in craniovertebral angles.	No positive correlation was found between forward head posture or head tilt and a diagnosis of TMD.
N Rakesh et al. 2014	To assess the impact of abnormal head and neck posture on development of temporomandibular disorders (TMD); And to evaluate the possible correlation between cervical spine postural disorders and TMD by measuring craniocervical angles and distances in cervical spine radiographs of individuals with and without symptoms of temporomandibular joint dysfunction	TMD (n = 23): 30.52 (7.87) years old; 9 men and 14 women Healthy (n = 23): 29.91 (8.47) years old; 9 men and 14 women;	To have a radiograph taken of the cervical spine. Measurements: • The high cervical angle (HCA; odontoid–cranial base angle); • The low cervical angle (LCA; odontoid angle–C3/C4); • The atlas plane angle (APA) represented the plane of the atlas vertebra (C1). • The anterior translation distance (ATD; C2–C7) determined the mean value for the anterior transport of the head; • The occipital–atlas distance (OAD) has a normal value of 4 –9 mm.	High cervical angle (HCA): – DTM = 65.87 (4.66); – F/DTM = 66.61 (5.83); – p = 0.807; Atlas plane angle (APA): – TMD group: 20.96° (7.94°) – Healthy: 28.17° (10.39°) – p = 0.002; Anterior translation distance (ATD; Tz C2 –C7): – TMD group: 11.04 (5.270) mm – Healthy: 5.70 (3.535) mm – p = 0.001;	The present results suggest that head and body posture could be related to the initial onset, development, and perpetuation of TMD and that patients with TMD have a tendency to exhibit cervical spine hyperlordosis.

N = number of participants; TMD = temporomandibular disfunction; Mix TMD = mixed temporomandibular disfunction; Myo TMD = myogenic temporomandibular disfunction; MD = minimal difference; NCR = no clinical relevance.

4.5. Methodological elements and overall quality of the evidence affecting observed effect

The overall rating of the evidence for this review was moderate to excellent. The classification as moderate was due mainly to the risk of bias of the analyzed studies. The most common bias was related to absence of sample size calculation, non-respondents' volunteers data and differences in group comparisons. Also, some outcomes, such as neck motor control, strength and endurance, had small number of studies, so the results should be interpreted with caution and needs to be improved in the new researches.

4.6. Clinical and academic relevance

The main clinical relevance of this study is related to clinical decision making. Based on these results the evaluation and treatment of patients with TMD should be focused on the entire craniocervical-mandibular complex. Since individuals with TMD present lower endurance of neck extensor muscles, global and upper cervical hypomobility, and worse level of self-reported neck disability, based in a moderate to excellent methodological analysis. Adding these protocols on the clinical practice are simple and could potentially be beneficial for patients with TMD.

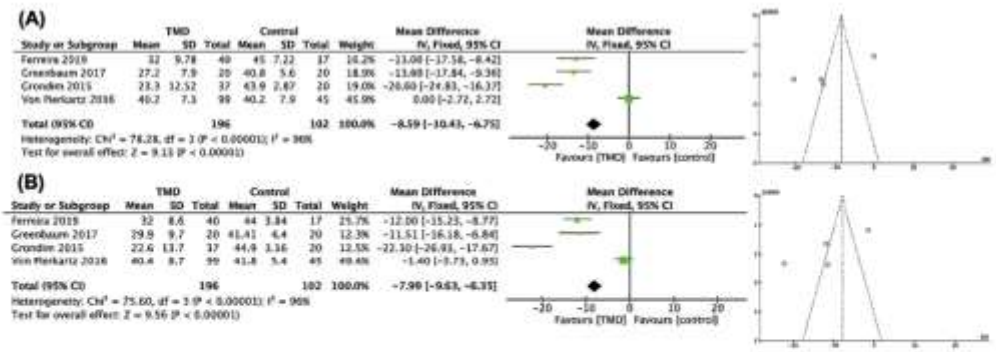

Fig. 3. (A) Forest plot and funnel plot of the mean difference for right Flexion Rotation Test (FRT) in TMD patient's vs healthy control. (B) Forest plot and funnel plot of the mean difference for left Flexion Rotation Test (FRT) in TMD patient's vs healthy control.

Table 7
–Global and upper (using Flexion Rotation Test) cervical range of motion evaluation.

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Greenbaum et al. 2017	To compare the 3-plane pure active physiological cervical movements and FRT in PWTMD (muscular origin) and healthy controls.	TMD (n = 20): 33 (9.2) years old; Controls (n = 20): 33.3 (8.55) years old; All female volunteer	FRT: with CROM® device; Cervical ROM with CROM® device: flexion, extension, right and left lateral flexion (LF) and right and left rotation	**FRT:** TMD: Right: 27.2° (7.9°); Left: 29.9° (9.7°); Control: Right: 40.8° (5.6°); left: 41.41° (4.4°); P < 0.000 Positive FRT: 18 (90%) subjects of the TMD vs 01 (5%) in healthy group. **Cervical ROM:** No difference was found between groups: TMD: Flex: 60.5 (10.8); Ext: 66.2° (66.2); Right LF: 41.7° (9.3); Left LF: 42.9° (9.9); Right rotation: 70.5° (7.7); Left rotation: 68.1° (9.6); Control: Flex: 58.75° (11.4); Ext: 72.4° (13.5); Right LF: 43.25° (6.8); Left LF: 44° (7.8); Right rotation: 71.7° (8.1); Left R: 73.8° (9.9);	A significant limitation in rotatory movement of the upper cervical was found among patients suffering from myogenic TMD and presenting with positive FRT (90%). On the other hand, pure cervical physiological movements in these patients did not differ from those recorded in healthy subjects.
Von Piekartz et al. 2016	To determine whether people with TMD, classified as either mild or moderate/severe TMD, have more cervical signs of dysfunction than healthy subjects.	Mild TMD (n = 56): 33.21 (10.80) years old; Moderate/ Severe TMD (n = 40): 37.25 (13.78) years old; Without TMD (n = 41): 33 (8.71) years old;	FRT: with CROM® device; Cervical ROM with CROM® device: flexion, extension, right and left lateral flexion (LF) and right and left rotation	**FRT:** No relevant difference between the groups was identified. **Cervical ROM:** Group NO TMD shows larger mean ROM than the groups with mild or moderate/severe TMD.	This study revealed that more cervical impairments are found in people with more severe levels of TMD in acute and sub-acute pain states. It was also demonstrated that people with mild and moderate TMD report more pain during cervical movements. In contrast, the FRT were not impaired in people with TMD
Grondin et al. 2015	To investigate whether patients with TMD pain (with or without headache) present with upper cervical spine impairment when compared with asymptomatic subjects.	TMD (n = 37) (TMDHA (n = 11); TMDNHA (n = 26)): 34.68 (12) years old; Control (n = 20): 30.6 (7.3) years old;	FRT: with CROM® device;	**FRT:** All subjects with TMD have a positive FRT. None control subject have a positive FRT. Control: Left FRT = 44.9° (3.16°); Right FRT = 43.9° (2.87°); TMD: Left TMD = 22.6° (13.07°); Right FRT = 23.3° (12.52°)	Mean ROM recorded during the FRT in subjects with TMD was significantly lower than asymptomatic subjects. And the FRT results was lower in individuals who reported headache
Ferreira et al. (2019)	To evaluate, in female patients with TMDs with and without self-reported headache, the active and passive ROMs of the cervical and upper cervical spine segment of C1–C2 using FRT.	Healthy (n = 17): 35.64 (11.64) years TMD (n = 40): 37.5 (10.38) years All females	FRT: with CROM® device; Cervical ROM with CROM® device: flexion, extension, right and left lateral flexion (LF) and right and left rotation	FRT: The FRT was significantly lower in the TMD group compared to control group. TMD: Right: 32 (9.78); Left: 32 (8.60); Control: Right: 45 (7.22) Left: 44 (3.84); P < 0.001 Cervical ROM: The TMD group demonstrated a significant decrease in flexion-extension ROM unlike the control group (P < 0.001; SD = 15.1) TMD: Flex + Ext: 122 (15.1); Rotation R-L: 133 (17.2); Lateral-flexion R-L: 83 (14.9) Control: Flex + Ext: 135 (14.0); Rotation R-L: 142 (16.1); Lateral-flexion R-L: 93 (12.4)	The results showed that the female patients with TMDs, regardless of self-reported headache, presented with reduced CROM and FRT findings. Moreover, the ROM and FRT and CCFT findings were associated with neck disability and temporomandibular pain intensity.

N – number of participants; TMD – temporomandibular disfunction; Mix TMD – mixed temporomandibular disfunction; Myo TMD – myogenic temporomandibular disfunction; TMDHA: temporomandibular disfunction with headache; TMDNHA: temporomandibular disfunction with no headache; LF: Lateral flexion; FRT: Flexion rotation test; CROM: cervical range of motion; R-L: right to left.

Table 8
Neck disability index assessment in temporomandibular dysfunction patients.

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
Armijo-Olivo et al. 2012	To determine if the patients with mix or myogenic TMD had more fatigue in the neck extensor muscles during the muscles resistance test (NEMET) when compare to healthy control	Healthy (n = 47): 28.3 (7.5) years old; Myo TMD (n = 57): 31.1 (8.7) years old; Mix TMD (n = 47): 31.4 (8.4) years old; All Females volunteer	Neck Disability Index (NDI);	**NDI:** Healthy = 1.62 (1.54) Myo TMD = 10.8 (6) * Mix TMD = 12.6 (6.9)* **Self-reported neck pain:** Myo TMD = 87.5% Mix TMD = 87.8%	Neck disability was worse in patients with TMD.
Armijo-Olivo et al. 2010	To determine if there was an association among the levels of chronic disability of TMD based on the RDC/TMD, clinical variables including pain intensity, and interference with activities of daily living using the RDC/TMD scales, and the endurance of the cervical flexor muscles.	Healthy (n = 49): 28.3 (7.3) years old; Mio TMD (n = 54): 31.6 (9.1) years old; Mix TMD (n = 46): 31 (8) years old;	Neck Disability Index (NDI);	**NDI:** Healthy: 1.71 (1.59); Mix TMD: 12.4 (6.2); Myo TMD: 10.8 (5.8); **Self-reported neck pain:** Mix TMD: 87.8%; Mio TMD: 87.5%;	Neck disability was worse in individuals with TMD. No significant associations between neck disability, jaw disability, and clinical variables were associated with neck flexor endurance test
Armijo-Olivo et al. 2010	To determine whether there was an association among maximal cervical flexor muscle strength, jaw disability, and neck disability.	Healthy (n = 50): 28.8 (7.3) years old; Mio TMD (n = 54): 31.6 (9.1) years old; Mix TMD (n = 45): 31.07 (8.1) years old;	Neck Disability Index (NDI);	**NDI:** Healthy: 1.72 (1.68); Mix TMD: 12.4 (6.2) *; Mio TMD: 10.8 (5.8) *;	Neck disability was worse in patients with TMD. A significant but weak association between neck disability and maximal neck flexors strength was found.
Gil-Martínez1 et al. 2016	To compare mandibular and neck disability and its association with craniofacial pain intensity, the impact of headache in daily life and fear of movement between subgroups of patients with chronic TMD	Chronic TMD with JP (n = 43): 55,8% women; Chronic TMD with MP (n = 59): 42,4% women Mixed chronic TMD (n = 52): 32,7% women; A total of 154 patients were recruited, of whom 57.11% were men, with an average age of 45.19 (12.75) years.	Neck disability index (NDI);	**NDI:** Statistically significant differences were observed in neck disability ($F = 39.84$; $p < 0.001$); Mean difference: MP vs JP = 3.06 (0·96-5.17)** MP vs Mixed = −4.92 (−6.96 to −2.89)** JP vs Mixed = −7.95 (−10.19 to −5.78)	Patients with mixed chronic pain diagnosis showed greater craniomandibular and neck disability than patients with a diagnosis of chronic JP or MP. Neck disability predicted a 37% variance of craniofacial pain and disability in MP. Neck disability and kinesiophobia predicted a 33% variance of craniofacial pain and disability for patients with mixed chronic pain
Von Piekartz et al. 2016	To determine whether people with TMD, classified as either mild or moderate/severe TMD, have more cervical signs of dysfunction than healthy subjects	Mild TMD (n = 56): 33.21 (10.80) years old; Moderate/Severe TMD (n = 40): 37.25 (13.78) years old; Without TMD (n = 41): 33 (8.71) years old;	Neck disability index (NDI);	**NDI:** Positive correlation between NDI and CAQ scores ($r = 0.55$, $p < 0.001$);	The correlation between NDI and CAQ scores indicates that the greater the cervical impairment the greater the degree of the TMD impairment
Carvalho et al. 2016	To assess the thermal pain threshold in patients with TMD and controls at cephalic and extra-cephalic areas, including the neck.	TMD (n = 20); Withou TMD (n = 20); All female volunteer	Neck disability index (NDI);	Report of Neck Pain: Healthy: 15% vs TMD: 75%; Frequency of neck pain (days/month): Healthy: 0.5 (0.1–1.1) vs TMD: 12.9 (7.4–18.5); Neck Disability Index: Healthy: 1 (0.1–2.2) vs TMD: 7.7 (5.3–10.2);	Patients with TMDs reported the presence of neck pain more often than controls, which led to disability
Costa et al. 2015	To compare neck disability in masticatory myofascial pain subjects versus asymptomatic controls, and to evaluate the correlation between neck disability and muscle pain	MMP (n = 27): 24.7 (3.7) years old; 88% women; Healthy (n = 28): 23.2 (3.8) years old; 61% women;	Neck Disability Index (NDI);	**NDI:** TMD = 11.8 (7) vs Healthy = 2.8 (2.4) ($p < 0.001$) Significant negative correlations with magnitudes from small to moderate were found between NDI and pressure pain threshold values for the anterior	Subjects with masticatory myofascial pain have greater neck disability than asymptomatic controls; Subjects with masticatory myofascial pain report greater neck disability, which, in turn, is correlated with regional muscle

(continued on next page)

Table 8 (continued)

Autor/Year	Aim	Sample	Tests	Outcomes	Conclusion
				temporalis (r = 0.4 (95% CI 0.6; 0.15), p = 0.002), SCM (r = 0.35 (95%CI 0.56; 0.09), p = 0.007) and upper trapezius (r = 0.3 (95%CI 0.58; 0.12), p = 0.005)	sensitivity, regardless of the presence of pain
Packer et al. 2014	To evaluate the relationship between neck disability and mandibular range of motion (ROM)	Healthy (n = 13): 21.30 (2.21) years old; TMD and neck disability (n = 13): 24.61 (3.05) years old; TMD and without neck disability (n = 13): 24.46 (4.38) years old; Neck disability and without TMD (n = 13): 22.84 (3.23) years old; All female volunteer	Neck Disability Index (NDI);	All volunteers with neck disability (Groups II and IV) were classified with mild disability. **NDI:** Healthy: 2.38 (1.19); TMD and neck disability: 9.61(3.22); TMD and without neck disability: 2.30 (1.43) Neck disability and without TMD: 6.53 (1.45) No significant association was found between the NDI and mouth ROM (p > 0.05)	There is no association between mandibular ROM and neck disability in university women
Silveira et al. 2014	To compare the masticatory and cervical muscle tenderness and pain sensitivity in the hand (remote region) between patients with temporomandibular disorders and health controls.	TMD (n = 20); 31.05(6.9) years old; Healthy (n = 20); 32.3 (7.17) years old;	Neck Disability Index (NDI);	**NDI:** TMD: 13.05 (6.98) Controls: 2.05 (1.28) Coefficient of variation was 0.82, approximately 82% of the mandibular disability was determined by the cervical disability.	Neck disability was worse in patients with TMD.
Armijo-Olivo et al. 2011	To determine whether patients with TMD had increased activity of the superficial cervical muscles when performing the Craniocervical flexion test (CCFT) compared with a control group of individuals who were healthy.	Healthy (n = 47): 28.3 (7,5) years old; Myo TMD (n = 54): 31.4 (9) years old; Mix TMD (n = 49): 31.3 (8.3) years old;	Neck Disability Index (NDI);	**NDI:** Healthy: 1.6 (1.6) Myogenous TMD: 10.5 (5.5) * Mixed TMD: 12.6 (6.8) *	Neck disability was worse in patients with TMD.
Armijo Olivo et al. 2010	To determine whether there was a relationship between neck disability measured using the NDI and jaw disability measured through the JFS	Healthy (n = 50): 28.8 (7.26) years old; Myo TMD (n = 56): 31.14 (8.94) years old; Mix TMD (n = 48): 31.48 (8.24) years old;	Neck disability index (NDI);	**NDI:** Healthy: 1.78 (1.65) Myogenous TMD: 10.87 (5.75) * Mixed TMD: 12.81 (6.94) * Subjects with TMD were significantly different from healthy subjects in NDI score. A strong relationship between neck disability and jaw disability was found (r = 0.82). A subject with a high level of TMD disability (grade IV) increased by about 19 points on the NDI when compared with a person without TMD disability.	In this population of subjects with mixed TMD, myogenous TMD and healthy subjects, people having more disability in the neck also have more jaw disability and vice versa
Ferreira et al. (2019)	To evaluate, in female patients with TMDs with and without self-reported headache, the active and passive ROMs of the cervical and upper cervical spine segment of C1–C2 using FRT.	Healthy (n = 17): 35.64 (11.64) years TMD (n = 40): 37.5 (10.38) years	Neck disability index (NDI);	NDI: Healthy: 0 (0) TMD: 5.60 (2.22)*	Neck disability was worse in TMD patients. The ROM and FRT and CCFT findings were associated with neck disability and temporomandibular pain intensity.

N = number of participants; TMD = temporomandibular disfunction; Mix TMD = mixed temporomandibular disfunction; Myo TMD = myogenic temporomandibular disfunction; JP: joint pain; MP: miofascial pain; MMP: masticatory miofascial pain; NDI: neck disability index.

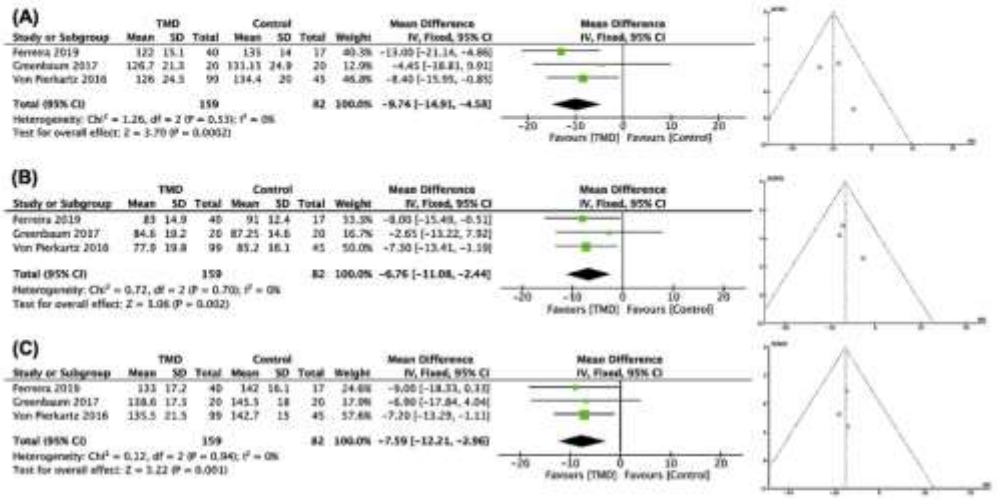

Fig. 4. (A) Forest plot and funnel plot of the mean difference for cervical flexion-extension in TMD patient's vs healthy control. (B) Forest plot and funnel plot of the mean difference for lateral flexion (right to left) in TMD patient's vs healthy control. (C) Forest plot and funnel plot of the mean difference for cervical rotation (right to left) in TMD patient's vs healthy control.

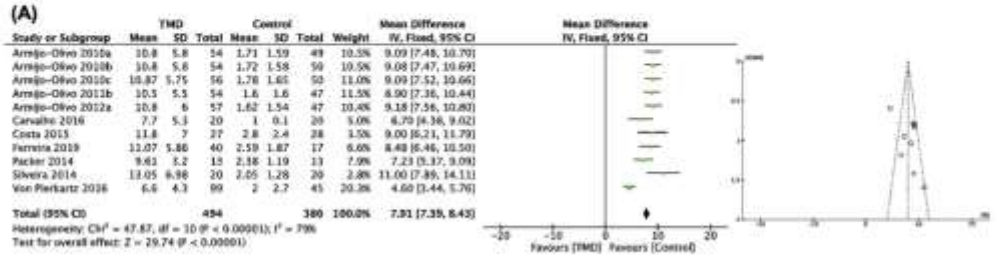

Fig. 5. (A) Forest plot and funnel plot of the mean difference for Neck Disability Index in TMD patient's vs healthy control.

Also, these findings can guide academic researchers to create treatment protocols focused on solve the general disorders presented by patients with TMD. So, for further research can explore targeted treatment protocols for neck region. Also, it is necessary to improve the researches about the motor control, strength and endurance of neck muscles in individuals with TMD.

4.7. Limitations

The results of this systematic review and meta-analysis are specific to neck disorders that affects individuals with TMD. To be direct and concise our team used a specific search strategy and included data-based and manual search. Due to the specific search strategy used, probably, there was a small proportion of studies that our team could not find. However, we believe that the most important studies regard to this subject were included in the final analysis.

Our team decided to fix the diagnoses based on the RDC/TMD, in order to standardize the patient's selection. Of course, this decision could influence in the numbers of articles included. But we took this decision because when the diagnoses criteria were standardized the results are more consistent, excluding problems with confusion and misunderstanding on the diagnoses.

5. Conclusion

In this systematic review and meta-analysis it was possible to verify that there is moderate to strong evidence that individuals with TMD present a reduction in the endurance of the neck extensor muscles, worse self-reported neck disability and global and upper cervical hypomobility, but did not present cranial-cervical posture alterations in relation to healthy controls. The methodological quality of studies evaluating cervical disorders in individuals with TMD ranged from moderate to excellent.

6. Clinical relevance

6.1. Bullet points

There is strong evidence that individuals with TMD have worse level of self-reported neck disability;

There is moderate evidence that individuals with TMD present lower endurance of deep neck extensor muscles and upper and global neck hypomobility;

There is moderate evidence that individuals with TMD have similar cranio-cervical postural in relation to individuals without TMD;

These results can guide academic and clinician to elaborate treatment protocols focused on solve the general neck disorders presented by individuals with TMD"

Systematic review registration number

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Declaration of competing interest

None.

N – number of participants; TMD – temporomandibular disfunction; Mix TMD – mixed temporomandibular disfunction; Myo TMD = myogenic temporomandibular disfunction; MD – minimal difference; ES – effect size; MID – minimal important difference; NCR – no clinical relevance; CR – clinical relevance; PCR – partial clinical relevance; NDI – neck disability index; MVC – maximal voluntary contraction;

CRediT authorship contribution statement

Ana Izabela S. de Oliveira-Souza: Conceptualization, Methodology, Resources, Investigation, Writing - original draft. **Josepha Karinne de O. Ferro:** Methodology, Resources, Investigation. **Manuella M.M.B. Barros:** Visualization, Investigation. **Daniella A. de Oliveira:** Supervision, Project administration, Writing - review & editing.

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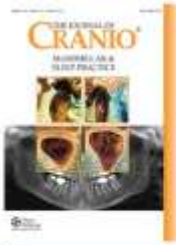
APÊNDICE B – ARTIGO 2: *ORAL HEALTH QUALITY OF LIFE IS ASSOCIATED TO JAW FUNCTION AND DEPRESSION IN PATIENTS WITH JAW PAIN*.
(ARTIGO PUBLICADO)



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Oral health quality of life is associated to jaw function and depression in patients with myogenous temporomandibular dysfunction

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ABSTRACT

Objective: To determine which factors influence and better differentiate between good and poor oral health-related quality of life (OHRQoL) in patients with myogenous TMD and which cut-off could predict a good/poor OHRQoL.

Methods: Fifty-eight women with myogenous TMD were included. Factors of interest were collected (i.e., demographic variables, depression symptoms (Symptom Checklist-90 R (RDC/TMD)), pain intensity (Visual Analog Scale), jaw function (Mandibular Functional Limitation Questionnaire), and OHRQoL (Oral Health Impact Profile-14). A multivariable regression model, logistic regression, and receiver operating curve (ROC) analyses were conducted.

Results: Depression symptoms (β = 0.139) and jaw function (β = 0.478) were significantly associated with OHRQoL in the multivariable model. The best model to discriminate between good/poor OHRQoL included only jaw function (AUC = 0.90), with the best cut-off of 17 points (sensitivity: 0.93; specificity: 0.79).

Conclusion: Depression symptoms and jaw function were significantly associated with OHRQoL. The best model and cut-off to discriminate good/poor OHRQoL included only jaw function.

KEYWORDS
Temporomandibular joint disorders; range of motion; articular; quality of life; facial pain

Introduction

Temporomandibular disorders (TMD) are a musculoskeletal pain condition involving the temporomandibular joint (TMJ), masticatory muscles, and other orofacial-related structures [1]. The symptoms of TMD can include pain in the TMJ, preauricular area, and masticatory muscles; deviation and limitation of mandibular movements; and joint noises during mandibular activity [2]. The TMD prevalence varies between 5 and 12% in the general population [3], with a peak age between 16 and 40 years [4]. TMDs are more prevalent in women than men [5], and women are more likely to seek treatment than men (at a ratio of 4.6:1) [6]. Comorbidities, such as headaches (e.g., migraine and tension type headache), neck pain, joint pain, and low back pain have been commonly seen in patients with TMD [7,8].

The cause of TMD is not fully understood. Patients with TMD are a heterogeneous group in terms of their physical signs and diagnoses, and probably in their psychosocial aspects [9]. Several associated symptoms have been related to TMD, such as chronic pain, muscle parafunction, traumatic injuries, hormonal influences, articular changes, loss of energy, daily life activity restriction, discomfort when eating, and general health problems [10,11]. Along with the somatic symptoms, patients with TMD can also present biopsychosocial problems [12] and often have anxiety, depression, and stress related-disorders, which could be considered perpetuating factors for TMD [13].

Occasionally, TMDs become chronic and interfere with patients' daily habits, including chewing and eating, and also diminishing patients' capacity of work and/or ability to interact with their social environment, directly impacting the quality of life of the patients [10,11,14]. In most cases, the resulting chronic pain from TMD and poor quality of life of the subjects cause them to seek treatment [9,11,13].

Particularly oral health-related quality of life (OHRQoL), which is described as the impact of a disease on the subject´s perceived oral health, could be considered

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an important issue for patients with TMD [9]. The prevalence of a poor OHRQoL has been reported to be 66.7% between patients with TMD, which is very high compared to 12% of the people without TMD. It is also more prevalent in women than in men [11].

Many tools are available to measure quality of life. These tools include items looking at biological, psychological, social, and cultural aspects of a patient's life. The 36-item Short Form Survey (SF-36) and the Sickness Impact Profile (SIP) questionnaires are commonly used in several areas of health to determine the quality of life of patients [9,10]. However, these questionnaires are not specific to oral health. Thus, the Oral Health Impact Profile (OHIP-14) [15] was created and is one of the most used tools to determine OHRQoL. This tool is valid and reliable and commonly used in the area of TMD [10,15–17]. It is a multidimensional measure that shows how an individual 's daily life is affected by orofacial diseases [18].

Many factors, such as gender, age, psychological aspects, chronicity, and duration of pain, have been analyzed in some cross-sectional studies as possible factors that interfere with quality of life in patients with TMD pain [11,19,20]. Nonetheless, gender, age, and general health have not been found to be significant predictors of OHRQoL evaluated by the OHIP questionnaire. On the other hand, chronicity of the disease was found to be an important factor for OHRQoL [11], as well as biopsychosocial factors and psychological illness, expressed as somatization and depression symptoms [9,11–13,18,20].

In addition, previous studies have shown that severity of OHRQoL in patients with TMD is generally higher among those who had higher pain chronicity and duration and is also associated with increasing levels of jaw disability [9,11,19]. However, the specific contribution of these biopsychosocial factors and psychological factors on OHRQoL of people with myogenous TMD is yet unknown. In addition, it is unclear whether physical factors, such as jaw range of motion or jaw functionality and demographic characteristics of patients with myogenous TMD, are important factors that influence OHRQoL.

Thus, the main objectives of the present study were as follows:

(1) To determine which are the main factors (i.e., myogenous pain, jaw range of motion (ROM), jaw function, depression symptoms, age, or pain duration) that influence oral health-related quality of life (OHRQoL) in patients with myogenous TMD;
(2) To determine which factors better differentiate between good and poor OHRQoL in subjects with myogenous TMD; and
(3) To determine which cut-off of these factors (i.e., measures) could predict a good/poor OHRQoL in these patients.

Materials and methods

Design

This was a cross-sectional study and followed the STROBE recommendations for reporting [21]. It was approved by the Ethics Committee of the local University (identification number: 2.131.546).

The study was performed in the Learning and Motor Control Laboratory (LACOM) in the Physiotherapy Department at the Federal University of Pernambuco (UFPE). The data were collected from August 2017 to February 2019. A convenience sample was recruited by referral from the dentists and through advertisement from the Orofacial Pain Clinic of the Dental Department of the same University and the community of the city of Recife.

Sample

Participants were enrolled in the present study according to the following inclusion criteria: women aged between 18 and 45 years (whereas the prevalence of myogenous TMD is higher between women within this age range) [4,5]; Body Mass Index (BMI) between 18.5 and 29.9; diagnosis of myogenous TMD (myofascial pain with or without limited opening) determined by the Research Diagnostic Criteria (RDC/DTM) [22]; and myogenous TMD pain in the last six months. All participants were recruited by convenience. This study involves a secondary analysis of a randomized controlled trial looking at the effectiveness of different physical therapy treatments.

The exclusion criteria were history of facial or neck injury; surgery on the craniofacial and/or in the cervical spine area; fibromyalgia; neurological disturbances; ongoing orthodontic treatment; chronic systemic diseases; and previous TMD treatments in the last six months. All participants signed a written informed consent.

Demographic and pain-disability measures were collected from all participants. Subjects were evaluated with the RDC/TMD criteria and were asked to provide their intensity of pain using the Visual Analog Scale (VAS). In addition, they were asked to provide data on their quality of life, jaw function, and depression through the Oral Health Impact Profile-simplified version Questionnaire (OHIP-14), Mandibular Functional Limitation Questionnaire (MFIQ), and the RDC/TMD

tools, respectively. All clinical examinations were performed by two trained therapists (40 hours of training).

Diagnosis with RDC/TMD

The RDC/TMD questionnaire is considered a valid and reliable bi-axial diagnostic instrument for the evaluation of TMD and is widely used as a diagnostic criterion in clinical research involving subjects with TMD [22]. This questionnaire has been recently replaced by the new Diagnostic Criteria for TMD (DC/TMD); however, it was not yet translated to Portuguese at the beginning of the study. Thus, the researchers followed the protocol established by the RDC/TMD Portuguese version [22] for evaluating the patients.

The bi-axial classification was based on the biopsychosocial pain model. Axis I is composed of a physical examination, including oral range of motion; pain intensity; presence of noises; otologic symptoms; and muscle palpation. The Axis II assesses the psychosocial status and disability related to pain, which contains specific items for the appraisal of subjective signs and symptoms for levels of depression. For depression evaluation, the Symptom Checklist 90R (SCL-90R) was used, which is composed of 20 items related to patient psychological well-being. The higher the score on these 20 items, the greater the degree of depression [22,23].

Pain intensity

The Visual Analog Scale (VAS) was used to evaluate the intensity of myogenous TMD and is composed of a line of 100 mm, where on the left side is written "no pain" and on the right side "worst pain imaginable." The pain intensity was recorded by each patient marking a point on the line between the two extremes. The pain intensity described was the distance between the left extreme and the individual's mark [24].

Jaw range of motion

The jaw range of motion was assessed using a universal caliper (Digital Caliper, 150 mm, São Paulo, Brazil), as recommended by the RDC/TMD. The jaw movements evaluated were jaw opening (active mouth opening without pain); right and left mandibular deviations; and protrusion. All these movements were measured in millimeters (mm).

Quality of life

The Oral Health Impact Profile–simplified version (OHIP-14) was used to determine the OHRQoL. The OHIP-14 questionnaire is used to evaluate the OHRQoL and to analyze the functional limitations based on oral symptoms, emotional, and social well-being [15]. The OHIP-14 was developed using a conceptual model of oral health and has seven domains: physical pain, psychological disability, psychological discomfort, functional limitation, physical disability, social disability, and overall disability. The questionnaire has 14 questions with five items ranging from 0 to 4 (0 = never; 1 = rarely; 2 = sometimes; 3 = constantly; 4 = always). The total score ranges from 0 to 56 and is calculated by determining the sum of the 14 questions. The higher the score, the worse the OHRQoL [1,25].

The OHIP questionnaire was developed and validated by Slade and Spencer in an extended version, including 49 questions [16]. This original version is statistically less robust than the short version of the OHIP. Thus, the use of the simplified OHIP-14 questionnaire is considered sufficient to evaluate the OHRQoL [13,26]. This tool has been translated and validated to the Brazilian Portuguese language [15].

Jaw function

Jaw function was evaluated by the Mandibular Functional Limitation Questionnaire (MFIQ), which allows classification of the severity of jaw function limitation. The MFIQ is a reliable and valid instrument used to evaluate the jaw function limitation in patients with myogenous TMD. This questionnaire has been translated into Portuguese [25]. The MFIQ consists of 17 questions and is divided into two dimensions: D1: functional capacity and D2: eating, which may be classified into five points ranging from 0 (no difficulties) to 4 (significantly difficult or impossible without help). The total score is obtained by adding the score of each answer. However, the scores do not have a linear graduation, and weighting is necessary by dividing the total score by the number of answered items multiplied by four (highest value of each question). The coefficient is classified according to the severity and degree of impairment. If the total score is: < 0.3, the degree of impairment is classified between 0 and 1 and indicates a low severity; 0.3–0.6, the degree of impairment is classified between 2 and 3 and indicates a moderate severity; >0.6, the degree of impairment is classified between 4 and 5 and indicates a strong severity.

Statistical analysis

The Shapiro-Wilk normality test was performed to verify the data distribution in addition to a histogram; this confirmed the normal data distribution. Age, time of the disease, body mass index (BMI), myogenous TMD pain,

depression symptoms, jaw range of motion (ROM), and jaw function were described by the mean and their standard deviation (SD).

In order to determine factors that significantly influenced the quality of life of people with myogenous TMD (objective 1), a two-stage analysis was conducted. First, a simple linear regression was done to analyze the relation between the dependent variable (OHRQoL, based on OHIP-14 questionnaire) with each of the independent variables (age, time of disease, BMI, myogenous TMD pain, depression symptoms, jaw ROM, and jaw function). Significant variables in the univariate analysis at $p \leq 0.20$ were added to a multiple linear regression model. This p-value has been suggested by some as a conservative criterion to involve all potential variables that could be significant in a multivariable regression model. More traditional alpha levels can fail in identifying variables that could be important [27].

Variables were entered into the multivariate model in a hierarchical fashion, based on the R-square value. The first model on the multivariate analyses consisted of all variables with a significant R-square, and the final multivariate model included all variables that were significant at $p < 0.05$.

To verify which combination of variables best differentiated between good and poor OHRQoL (objective 2), the sample was divided into two groups (dichotomic variable) based on the OHIP-14 score: good OHRQoL (OHIP-14 score < 17 points) and poor OHRQoL (OHIP-14 score ≥ 17 points), with an equal sample size of 27 patients for each group. These values were chosen based on the median of the sample since there are no established cut-offs to determine the level of impairment in the OHRQoL based on the scores of this questionnaire, and often, authors have chosen certain cut-off points to determine alteration of the OHRQoL arbitrarily [11,19]. After this, a simple logistic regression was done to check the association between good/poor OHRQoL (dichotomic variable) and each of the independent variables (age, time of disease, BMI, myogenous TMD pain, depression symptoms, jaw ROM, and jaw function). Significant variables in the univariate analysis at $p \leq 0.20$ were added to a multiple logistic regression model. The final multivariable logistic regression model included all variables that were significant at $p < 0.05$. The results were analyzed based on the Odds Ratio (OR) following the criteria: OR = 1, the event is probably the same in both groups; OR > 1, the event is more likely in the case group (poor OHRQoL); and OR < 1, the event is less likely in the case group (poor OHRQoL).

After the variables were entered into the multiple logistic regression model, a receiver operator characteristic curve (ROC) analysis was conducted to determine which model, including different combinations of variables, could predict between good or poor OHRQoL. The Area Under the Curve (AUC) was used to determine the best model and combination of variables, using the following interpretation criteria: excellent discrimination (AUC = 0.90–1.0); good discrimination (AUC = 0.80–0.89); fair discrimination (AUC = 0.70–0.79); discrimination (AUC = 0.60–0.69); and no better discrimination than chance (AUC < 0.50) [28].

To determine the cut-offs of the factors to predict good/poor OHRQoL (objective 3), two independent raters chose the selected cut-off for each factor in a way that both sensitivity and specificity could be maximized (i.e., high values); and thus, both values should be similar. In addition, the cut-off chosen should also maximize the percentage of correctly classified patients. According to Cook et al. [29], higher positive likelihood ratios (LR) and lower negative values are sought to maximize discrimination. Values higher than 2 for positive LR and lower than 0.5 for negative LR are recommended by the literature [29,30]. A third rater was consulted when there were disagreements between the other raters, in order to provide a final decision on the best cut-off value.

All variables that were included in the analyses were tested for possible violations of linearity and multicollinearity. The estimates are presented with 95% confidence intervals. The α was set up at 0.05. All analyses were done with the SPSS software, version 20.0 and STATA software v.14, guided by a statistical expert.

Results

Sample characterization

Fifty-eight patients with myogenous TMD participated in the study. The mean age was 29.5 (SD 10.2) years, with a BMI of 23.2 (SD 4.3), and a mean of myogenous TMD pain intensity of 6.6 cm (SD 2) on the VAS. All demographic and clinical characteristics are described in Table 1.

Factors associated with OHRQoL

Simple and multiple linear regression analyses results

The variables that presented a significant association with OHRQoL in the univariate analyses were as follows: age ($R^2 = 0.204$, $F = 14.332$, $p < 0.001$), BMI ($R^2 = 0.156$, $F = 10.365$, $p = 0.002$), myogenous TMD pain ($R^2 = 0.140$, $F = 9.116$, $p = 0.04$), depression symptoms ($R^2 = 0.248$, $F = 1.047$, $p < 0.001$), jaw function ($R^2 = 0.377$; $F = 33.889$, $p < 0.001$), and right lateral excursion ($R^2 = 0.044$; $F = 2.588$, $p = 0.113$). In the final

Table 1. Sample characterization.

Outcomes (N = 58)	Mean	SD
Age (years)	29.5	10.2
BMI (Kg/m²)	23.2	4.3
Myogenous TMD Pain (VAS)	6.6	2
Myogenous TMD Pain duration (months)	71.1	74.7
Depression (SCL-90R)	38.4	28.2
Jaw function (MFIQ)	20.2	11.4
Jaw opening (mm)	31.7	9.2
Right lateral excursion (mm)	8.2	2.4
Left lateral excursion (mm)	8.5	2.4
Protrusion (mm)	4.1	1.6

SD: standard deviation; BMI: body mass index; VAS: visual analog scale; MFIQ: Mandibular Functional Limitation Questionnaire; SCL-90 R: Symptom Checklist 90 R (RDC/TMD); mm: millimeters.

multivariate model, only depression symptoms and jaw function were found to be significant at $p < 0.05$ and were included. Based on the β coefficient, for each increase of 1 point on the depression symptoms scale, there was an increase of 0.2 points in the OHIP-14 score. In addition, for each increase of 1 point on the jaw function questionnaire (MFIQ score), there was an increase of 0.5 points in the OHIP-14 score (Table 2).

Factors associated with good/poor OHRQoL

Simple and multiple logistic regression analyses results

The variables that were significantly associated to OHRQoL (good/poor) in the univariate analysis were the following: age, BMI, myogenous TMD pain, depression symptoms, jaw function, jaw opening, right lateral excursion, and left lateral excursion. The time of disease and protrusion were not significant ($p > 0.20$) so were not included in the multiple logistic regression model. Two multiple logistic regression models were performed: the first model included all variables that had $p < 0.20$ in the univariate logistic model, and the second model included only the variables that were significant (at $p < 0.05$) in the first multivariate analysis. These variables were jaw function and right lateral excursion (Table 3). Based on the above results, the most parsimonious model that could discriminate between good and poor OHRQoL included only jaw function, with an AUC = 0.90.

Based on the previous literature, depression and pain intensity could be factors that influence quality of life and thus, in an exploratory analysis, a model was tested that included these two variables as well. The AUC of this model, including jaw function + right lateral excursion + depression symptoms + pain intensity was 0.92. Although this model provided a larger AUC than the model only including the jaw function, the difference between the two models to differentiate between good and poor OHRQoL was not statistically significant (Figure 1) and, thus, then the simplest model, having only jaw function, was chosen as the best model.

Cut-offs to determine good and poor OHRQoL

The cut-off points of all variables analyzed in this study are described in Table 4. The only variable that presented a good discrimination was jaw function (sensitivity: 0.93; specificity: 0.79; AUC: 0.87), with a cut-off of 17 points in the MFIQ to discriminate between good/poor OHRQoL. The variables that were included in the second model to determine a poor OHRQoL are highlighted in Table 4.

Discussion

The results highlight that, although demographic factors such as age and BMI as well as myogenous TMD pain, depression, jaw function, and right lateral excursion were related to OHRQoL in the univariate analyses,

Table 2. Univariate and multivariate analysis to show the relation between the demographic variables myogenous TMD pain, depression symptoms, and jaw function with oral health-related quality of life.

	Univariate analysis				Multivariate analysis					
					First			Final		
Outcomes (N = 58)	Coef. (B)	95% CI	p-value	Included in multivariate model	Coef. (B)	95% CI	p-value	Coef. (B)	95% CI	p-value
Age	0.55	0.26, 0.85	<0.001	Yes	0.17	−0.10, 0.44	0.209	-	-	-
BMI	1.15	0.44, 1.87	0.002	Yes	0.24	−0.43, 0.91	0.471	-	-	-
Myogenous TMD Pain (VAS)	2.39	0.80, 3.98	0.004	Yes	0.55	−0.81, 1.90	0.420	-	-	-
Myogenous TMD Pain duration (months)	0.02	−0.02, 0.07	0.310	No	-	-	-	-	-	-
Depression (SCL-90R)	0.22	0.12, 0.32	<0.001	Yes	0.14	0.05, 0.23	0.004	0.17	0.08, 0.25	<0.001
Jaw function (MFIQ)	0.67	0.44, 0.91	<0.001	Yes	0.48	0.25, 0.71	<0.001	0.58	0.37, 0.79	<0.001
Jaw opening	−0.22	−0.58, 0.14	0.220	No	-	-	-	-	-	-
Right lateral excursion	−1.09	−2.45, 0.27	0.113	Yes	−0.18	−1.26, 0.90	0.745	-	-	-
Left lateral excursion	−0.87	−2.25, 0.51	0.212	No	-	-	-	-	-	-
Protrusion	−0.14	−2.29, 2.01	0.897	No	-	-	-	-	-	-

Coef: coefficient B; CI: confidence interval; BMI: body mass index; VAS: Visual analog scale; MFIQ: Mandibular Functional Limitation Questionnaire; SCL-90 R: Symptom Checklist 90 R (RDC/TMD).

Table 3. Univariate and multivariate logistic regression analysis results to predict good or poor oral health-related quality of life (OHRQoL).

	Univariate analysis				Multivariate analysis							
					All variables model			First model			Second model	
Outcomes (N = 58)	OR	95% CI	p-value	Included in multivariate model	OR	95% CI	p- value	OR	95% CI	p- value	OR	95%CI	p- value
Age	1.08	1.01, 1.14	0.014	Yes	1.01	0.91, 1.13	0.806	-	-	-	-	-	-
BMI	1.22	1.05, 1.41	0.008	Yes	1.17	0.89, 1.53	0.253	-	-	-	-	-	-
Myogenous TMD Pain (VAS)	1.42	01.05, 1.93	0.023	Yes	1.04	0.63, 1.72	0.881	-	-	-	1.07	0.69, 1.66	0.744
Myogenous TMD Pain duration (months)	1.00	0.10, 1.01	0.271	No	-	-	-	-	-	-	-	-	-
Depression (SCL-90R)	1.03	1.01, 1.05	0.011	Yes	1.02	0.98, 1.37	0.339	-	-	-	1.02	0.99, 1.05	0.127
Jaw function (MFIQ)	1.19	1.09, 1.30	<0.001	Yes	1.21	1.07, 1.37	0.003	1.19	1.09, 1.30	<0.001	1.23	1.09, 1.38	0.001
Jaw opening	0.95	0.89, 1.00	0.074	Yes	0.91	0.80, 1.04	0.174	-	-	-	-	-	-
Right lateral excursion	0.78	0.61, 0.99	0.040	Yes	0.53	0.29, 1.00	0.049	-	-	-	0.66	0.44, 0.99	0.043
Left lateral excursion	0.85	0.68, 1.07	0.159	Yes	1.15	0.71, 1.87	0.558	-	-	-	-	-	-
Protrusion	0.97	0.70, 1.36	0.883	No	-	-	-	-	-	-	-	-	-

OR: odds ratio; CI: confidence interval; BMI: body mass index; VAS: Visual analog scale; MFIQ: Mandibular Functional Limitation Questionnaire; SCL-90 R: Symptom Checklist 90 R (RDC/TMD); OR >1 = Poor OHRQoL.

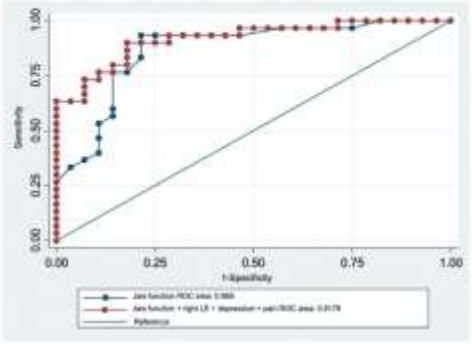

Figure 1. ROC curve analysis (area under the curve) model to predict good or poor oral health-related quality of life. ROC area: area under the curve; LE: lateral excursion.

only depression symptoms and jaw function were significantly related to OHRQoL in the multivariable analysis. In addition, jaw function was found to be the most important predictor to differentiate between good and poor OHRQoL in subjects with myogenous TMD. Furthermore, this study found cut-offs of the analyzed variables that could help discriminate between good and poor OHRQoL. For example, a score of 6.5 cm or higher on the VAS at baseline, 50 points on the SCL-90R (RDC/TMD) questionnaire related to depression symptoms, 17 points on the MFIQ, and 9.1 mm or less of right lateral excursion would be indicative of a poor OHRQoL in patients with myogenous TMD. Although the cut-offs were determined, these values should be used with caution and might have limited usefulness since their discriminative ability (AUC and sensitivities and specificities) was mostly between poor and moderate discrimination. The variable that had the best discriminative ability was "jaw function" measured with the MFIQ. These results show that clinicians treating subjects with myogenous TMD should pay attention to jaw function and its cut-off values when making decisions about management; these values could potentially help guide some possible strategies to manage poor OHRQoL in these subjects.

Factors influencing OHRQoL in subjects with TMD

Demographic Factors

Age

When analyzed in isolation (univariate analysis), age was able to explain around 20% of the OHRQoL score; however, when included in the multivariable

Table 4. Cut-off and area under the curve (AUC) (ROC analysis) to predict good or poor oral health-related quality of life (OHRQoL).

Variables included in the second model	Outcomes (N = 58)	Cut-off	Sensitivity	Specificity	Correctly Classified (%)	AUC
-	Age	29	0.57	0.82	68	0.6351
-	BMI	23.3	0.67	0.82	74.1	0.7167
Yes	Myogenous TMD Pain (VAS)	6.5	0.63	0.54	58.6	0.6792
-	Myogenous TMD Pain duration (months)	16	0.87	0.43	65.5	0.6208
Yes	Depression (SCL-90R)	50	0.48	0.93	69.0	0.7083
Yes	Jaw function (MFIQ)	17	0.93	0.79	86.2	0.8690
-	Jaw opening (mm)	26.5	0.57	0.32	44.8	0.6560
Yes	Right lateral excursion (mm)	9.1	0.33	0.46	39.7	0.6673
-	Left lateral excursion (mm)	9.6	0.30	0.64	44.5	0.6143
-	Protrusion (mm)	3.9	0.60	0.43	51.7	0.5179

VAS: Visual analog scale; MFIQ: Mandibular Functional Limitation Questionnaire; SCL90R: Symptom Checklist 90 R (RDC/TMD); mm: millimeter.

model, it was no longer significantly related to OHRQoL. These results agree with those found by Zucoloto et al. [31] and Wettstein et al. [32], who found that age does not significantly contribute to quality of life. In addition, these results are in line with those of Bayat et al. [11], who found no differences in prevalence and severity of OHIP scores when they divided the sample into two groups based on a cut-off of 30 years of age [11], even when the OHRQoL was stratified into three groups of severity (mild, moderate, and severe) [33]. On the contrary, two other studies found that older patients have higher OHRQoL scores than younger subjects; however, both studies used an older population (ages between 18 and 80), and the dichotomization was done with a cut-off of 40 years of age, which is higher than the present and other studies, which could explain, in part, the differences in results [9,34]. Therefore, it seems that age would be related to OHRQoL only when subjects are over 40 years old.

BMI

Body mass index (BMI) was not found to be significantly associated to OHRQoL and, likewise, could not discriminate between poor/good OHRQoL. These results are difficult to compare with others since no study was found evaluating the relationship between BMI (or related variables) and OHRQoL in patients with myogenous TMD. Only one study showed that subjects identified as being underweight (BMI <20) had more dental diseases, such as dental caries and dentition defects, than subjects with normal weight [35]. However, these dental disorders might not necessarily be related to OHRQoL. Based on the analysis of the cut-offs of BMI, people with myogenous TMD who have equal or more than 23.3 on BMI (which could be related to being overweight), have a poor OHRQoL. Since no other study looked at this information before, these results should be interpreted with caution and need to be further explored.

Clinical factors

Myogenous TMD intensity

In this study, myogenous TMD pain intensity was not found to be significantly associated with OHRQoL. This result is not in agreement with several other studies looking at the relationship between pain intensity and QoL [9–11,13,19,36]. For example, Trize et al. [36] documented that patients with TMD had their systemic health and quality of life affected by the presence of orofacial pain [36]. It is well accepted that pain compromises daily professional and/or social activities, social functions, affective and cognitive equilibrium, sleep, and physical activities [10]. It has been found that women with severe orofacial pain had a statistically significantly higher mean value for an OHIP-5 score (which indicates a worse OHRQoL) than women without orofacial pain [19]. Similarly, Blanco-Aguilera et al. [13] found that individuals with more intense pain had a statistically worse self-perceived quality of life [13]. Furthermore, Back et al. [19] revealed a significant association between the OHIP-5 score with severe orofacial pain. Also, pain duration has been shown to be related to psychosocial impairment, pain-related disability [37], and severity of the OHIP-14 score [11]. Pain duration in this study was not considered an important factor to explain the OHRQoL variability or to discriminate between good and poor OHRQoL.

Similar to these results, Lame et al. [38] found that pain intensity and demographic variables were not strongly associated with quality of life; however, they found that pain catastrophizing was an important predictor of quality of life [38]. These findings could be

explained through considering quality of life as a complex construct and is not always related to illness or impairment. Factors such as pain beliefs, cognitive-emotional aspects, social support, activities, ability to cope, mood, future orientation, vitality, religiosity, and spirituality have been reported to be potential stressors that could potentially influence the quality of life, reducing the relative importance of pain intensity or duration on quality of life domains [39,40]. Unfortunately, this study did not collect these variables and, thus, future research should explore the influence of these factors on OHRQoL in patients with TMD.

Jaw ROM

Based on the literature, jaw range of motion (ROM) does not appear to be strongly associated with OHRQoL [20]. Despite the high prevalence of mandibular hypomobility and biomechanical deficits in jaw movements in patients with TMD, no significant association between TMD severity and jaw ROM has been reported [41,42]. This present study found that jaw ROM restriction was not able to discriminate between poor and good OHRQoL, with the exception of right lateral excursion; however, these values should be taken with caution since the sensitivity and specificity for this analysis is poor. The differences found between sides in jaw lateral excursion could be related to the pain side or to unilateral chewing habits; unfortunately, these factors were not evaluated in this study, so it is not possible to specify which of these, in part, could explain the results.

It is important to highlight that this weak association between jaw ROM and OHRQoL could be attributed in part to the OHIP-14 tool, which is a generic instrument that is not TMD-specific, and could include irrelevant items, such as change in sense of taste, and exclude some important TMD-related disabilities, such as difficulty in mouth opening/closing [20].

Jaw function

Jaw function was considered one of the most important factors that influenced the OHRQoL scores in the present study. In agreement with these findings, Blanco-Aguilera et al. [13] found that depression and jaw function were the most important variables for explaining the OHIP-14 score variance [13]. In their model, depression symptoms explained 37.15% of the OHIP-14 score variance (model's R2), and jaw function explained 33.22%, similar to the model created in this study, where the jaw function explained 37%. Also, patients who had jaw disability presented around 16.3 points higher on the OHIP-14 questionnaire (worse OHRQoL) than people who did not report jaw pain or disability [13].

Based on the findings of the present study, jaw function alone evaluated by the MFIQ could be considered a good variable to discriminate between good and poor OHRQoL. Seventeen points on the MFIQ was the cut-off value found to be able to discriminate best between good and poor OHRQoL. Although studies have already studied the relationship between jaw function and OHRQoL, none of them have described a cut-off value, and thus, the present results provide novel evidence and provide further validity evidence for the MFIQ questionnaire.

Psychosocial factors

Psychosocial factors, such as pain somatization, distress, catastrophizing, and depression, are frequent comorbid clinical conditions in patients with TMD [37]. In the present study, depression symptoms were significantly associated with OHRQoL scores (OHIP-14 score). This result is in line with the literature since patients with TMD had worse OHIP-14 scores, higher depression, anxiety, and stress scores than those without TMD [20,43]. It has been shown that psychosocial status can influence the perception of OHRQoL of patients with chronic myogenous TMD since depressive symptoms might affect how the person perceives pain and its associated disability, as depression is associated with negative cognitive patterns [19].

In addition, patients who have higher degrees of somatization and depression symptoms and more jaw disability had worse OHIP-14 scores [13,44,45]. Psychosocial impairments have shown to be significant factors associated with poor OHRQoL, especially depression symptoms, in patients with TMD [13,36]. These findings are in agreement with this study; depression symptoms were included in the best model to discriminate between poor and good OHRQoL in this study. The cut-off point to discriminate between good and poor OHRQoL for the depression symptoms questionnaire (from RDC/TMD) was found to be 50 points (moderate discriminative ability). This means that patients who have at least this score on depression symptoms might be predisposed to a worse self-perceived quality of life [22].

Strengths and limitations

One of the strengths of the present study is that it explores a topic that has not been explored before, especially looking at variables that could influence OHRQoL

and, thus, provides novel evidence. The results of this study reinforce the importance of the interaction between functional and psychological impairments in this group of patients, especially jaw function and depression symptoms. This study tried to clarify factors that could discriminate between good and poor OHRQoL in patients with myogenous TMD and presented cut-off values to help identify patients at risk of poor OHRQoL. This information could be used to guide clinical decision-making and look for appropriated treatment strategies to improve not only physical impairments but also psychosocial aspects that could affect OHRQoL.

This study has some limitations. This study is a secondary analysis from a randomized controlled trial and, thus, it might not have been powered to answer all questions that could explain, in part, the lack of significance of some of the variables. In addition, it analyzed only variables that were available in the original dataset. It might be possible that other variables and factors known to influence quality of life (e.g., socioeconomic status, marital status, variables related to the job, pain beliefs, cognitive-emotional aspects, social support, activities, ability to cope, mood, future orientation, vitality, religiosity, and spirituality) but that were not analyzed in this current study, could have an influence in the OHRQoL. Future research should explore these factors and determine their influence specifically on OHRQoL in patients with myogenous TMD.

Implications for clinical practice and future studies

Physical and mental health are aspects that determine a good quality of life. For clinicians, to understand the factors that interfere with quality of life of patients with myogenous TMD is essential to elaborate better anamnesis, evaluation, and management strategies. In this respect, this study clarified that psychological (particularly depression symptoms) and functional aspects, such as jaw function based on the MFIQ questionnaire, were the most important factors that could influence OHRQoL in this sample. These two factors deserve special attention in clinical practice. In addition, the cut-off values provided for these factors could be useful for clinicians as a guide in their clinical decision when looking at improving OHRQoL as a goal.

Conclusion

The present study found that depression symptoms and jaw function were the most important factors influencing OHRQoL. This study indicates that patients with worse jaw function and depression have higher scores on the OHIP-14 questionnaire, indicating worse OHRQoL. Clinicians treating patients with myogenous TMD should look at both physical and psychological domains for managing jaw pain and, thus, improve OHRQoL in these patients.

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APÊNDICE C – ARTIGO 3: *EFFECTIVENESS OF AN 8-WEEK NECK EXERCISE TRAINING ON PAIN, JAW FUNCTION AND ORAL HEALTH-RELATED QUALITY OF LIFE IN PATIENTS WITH JAW CHRONIC PAIN: A RANDOMIZED CONTROLLED TRIAL*. (ARTIGO SUBMETIDO)

Clinical Rehabilitation

Effectiveness of an 8-week neck exercise training on pain, jaw function and oral health-related quality of life in patients with chronic temporomandibular disorders: a randomized controlled trial.

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Keywords:	Temporomandibular Joint Disorder, Jaw diseases, Neck muscles, Physical Therapy Modalities, Exercise therapy

Effectiveness of an 8-week neck exercise training on pain, jaw function and oral health-related quality of life in patients with chronic temporomandibular disorders: a randomized controlled trial.

Abstract

Background: despite the close relationship between jaw pain and cervical dysfunctions, no study has tested the effectiveness of an isolated neck training program to manage temporomandibular disorders (TMD).

Objective: to test the effectiveness of an 8-week exercise program targeted to the neck muscles compared to manual therapy, and placebo treatments on orofacial pain intensity, jaw function, oral health related quality of life (OHRQoL), and jaw range of motion (ROM) in patients with TMD.

Methods: This is a randomized controlled trial. Fifty-four women with 18-45 years old with diagnosis of myofascial or mixed TMD according to the Research Diagnostic Criteria for TMD (RDC/TMD) were included. All patients were evaluated with the Visual Analog Scale, Mandibular Function Impairment Questionnaire, Oral Health Impact Profile – 14, and jaw Range of Motion (ROM) at baseline, immediately after treatment, one-month and three-months follow-up. Participants were equally randomized into three groups: Neck motor control training (NTG), Manual Therapy Group (MTG), and Placebo Group (PG). For all outcomes, a mixed ANOVA with repeated measures was conducted with a Bonferroni post hoc test.

Results: NTG was significantly better than PG group on pain and jaw function at the end of treatment, one- and three-months follow-up (Effect Size (ES) >0.7). For OHRQoL, NTG was significantly better than MTG and PG at the end of treatment and at three-months follow-up (ES>0.7).

Conclusion: Neck motor control training was significantly better than placebo treatment to improve pain, jaw function, and OHRQoL, and better than manual therapy to improve OHRQoL.

Keywords: Temporomandibular Joint Disorder, Jaw diseases, Neck muscles, Physical Therapy Modalities, Exercise therapy.

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Keywords: Temporomandibular Joint Disorder, Jaw diseases, Neck muscles, Physical Therapy Modalities, Exercise therapy.

Bullet points

(1) Neck motor control training is effective to improve orofacial pain.
(2) Neck motor control training is better than manual therapy to improve quality of life in patients with TMD.
(3) Neck motor control training is better than placebo therapy to improve orofacial symptoms.

1. Introduction

Temporomandibular disorders (TMD) are a group of conditions affecting the stomatognathic system characterized by the presence of preauricular pain, restriction, deviation or noises during jaw movements, and fatigue and pain of the masticatory muscles. In addition, TMD are also commonly associated with other symptoms affecting the head and neck.(1, 2) TMD signs and symptoms occurs twice more often in women than in men (2:1),(3-6) and over 70% of patients with TMD are women. Additionally, women are more severely affected by TMD than men and generally seek treatment more often.(7)

TMD is considered an important public health problem, as it is the main source of chronic orofacial pain having a big impact on quality of life of women with TMD.(7-11) TMD has been shown to interfere with daily activities, reducing the capacity of work and/or social interaction of individuals suffering this condition,(12) having a big economic impact.(13)

Patients with myogenic or mixed TMD presents persistent pain, allodynia and hyperalgesia, showing an abnormal function of the central nervous system similar to other chronic pain conditions.(10, 12, 14) They usually present motor dysfunction,(12, 15, 16) expressing changes in the muscle behavior and function.(17, 18) Specifically, it has been demonstrated that subjects with TMD present with lower neck flexor and extensor muscles endurance and force, in isometric tasks.(19) In addition, subjects with TMD present impaired performance of the deep cervical flexor muscles while conducting the craniocervical flexion test (CCFT).(18, 19)

There is abundant evidence showing that neck muscles and structures, and neck functionality are impaired in subjects with TMD.(15, 18-21) For example, people with jaw pain have worst neck disability and lower values on pressure pain threshold (PPT) of neck muscles than people without jaw pain.(9) In addition, subjects with myogenic TMD diagnoses are more likely to present masticatory and cervical muscle sensitivity, self-reported neck disability and lower PPT of temporal anterior, sternocleidomastoid (SCOM), and upper trapezius muscles.(9)

The association between TMD and neck disorders is thought to occur due to the anatomic proximity and the convergence between the cervical and trigeminal areas in the trigeminocervical nucleus.(9, 22) Due to the convergence between orofacial and cervical areas in the trigeminocervical nucleus,(23) the pain in each of three upper cervical joints and on muscles innervated by the upper cervical spinal nerves could be perceived at any

area innervated by the trigeminal nerve. So, impairments in the neuromuscular motor control in the neck may be related to the overload of the cranio-cervical system and consequently lead to pain in related structures such as the orofacial region.(19)

Due to the complexity of TMD and also due to their common association with headache, neck pain, and disability, the physiotherapeutic approach in clinical settings has been concentrated in improving the cranio-cervical functioning through exercises targeted to the neck.(19) Treatments including neck and head postural exercises, and therapeutic exercises to masticatory muscles and/or neck muscles have been shown to be effective to reduce musculoskeletal pain, improve jaw function, force, coordination, endurance, mobility, stability, and motor control of the muscle system in these patients.(24-26) In the same way, manual therapy treatment has been used to improve range of motion, proprioception, stimulate synovial fluid production, and reduce pain in different conditions. In subjects with TMD, manual therapy applied to neck area has shown to reduce pain, improve PPT and range of motion of masticatory and neck muscles.(24, 27-29)

Different neck exercises, especially endurance training of the deep neck muscles, have been used to reduce pain and improve neck motor control in patients with neck pain related disorders and cervicogenic headache.(30-32) Several trials have tested the effectiveness of neck motor control in different conditions involving the neck such as neck pain, cervicogenic headache, whiplash among others and all of them have shown positive results. However, limited numbers of trials have tested the effectiveness of manual therapy directed to the neck in subjects with TMD.

To our knowledge none of the previous studies have evaluated in isolation the effectiveness of a specific exercise treatment for neck muscles in improving pain, orofacial function, and quality of life in patients with TMD. Therefore, this study provides preliminary and novel evidence regarding the potential use of these exercises for this condition. Thus, the following objectives of this study were 1) to determine the effectiveness of an 8-week exercise program targeted to the neck muscles compared to manual therapy, and placebo treatments **on orofacial pain intensity (primary outcome)**, jaw function, oral health related quality of life (OHRQoL), and jaw range of motion (ROM) (secondaries outcomes) in patients with TMD **immediately after the end of treatment (final evaluation; primary time point)**, one-month follow-up (four weeks after the end of treatment) and three-months follow-up (12 weeks after the end of treatment).

It was hypothesized that, after eight weeks of treatment, individuals receiving neck motor control training would significantly reduce their orofacial pain, and would significantly improve their jaw function, OHRQoL and jaw ROM when compared to a placebo treatment. It was hypothesized that neck motor control training would have similar results than manual therapy treatment.

2. Methods

2.1 Study design

This study was a parallel randomized controlled trial. The assessor (who measured the clinician-assessed outcomes) did not know the group allocation, the therapist did not know the results of the measured data, and the patients were unaware of the study hypothesis. In addition, patients were instructed to not discuss their allocation group with the other participants, to avoid biases. The randomization process was performed by using a website (www.randomization.com) which provide the random sequence. The randomization sequence was generated by a research assistant not involved in the trial recruitment. To ensure the concealment of allocation, an external researcher, not involved in the study phases, prepared opaque envelopes (sealed and numbered) with the randomization. Participants were equally randomized into three groups: Neck Motor Control Training Group (NTG), Manual Therapy Group (MTG), and Placebo Group (PG).

This trial was approved by the Ethics Committee of the local University prior to data collection (number: 2.131.546), and it was registered in the Brazilian Clinical Trials Register (number: RBR-3fc62c). This trial was reported according to the CONSORT guidelines and the Template for Intervention Description and Replication (TIDieR) checklist and guide.(33, 34)

2.2 Subjects

Participants were recruited from the Department of Dentistry of the Federal University of Pernambuco and the community through announcements by advertisements placed in the University's centers and social media between October 2017 to September 2019. Patients were included based on the following inclusion criteria: women; aged between 18 to 45 years old; orofacial pain for at least six months; and diagnosis of masticatory myofascial pain or mixed TMD according to the Research Diagnostic Criteria for TMD (RDC/TMD).(35) Patients were excluded if they had 1) history of neck or facial trauma; 2) history of cervical spine and/or craniofacial surgery; 3) diagnosis of

fibromyalgia or rheumatic or neurologic or chronic systemic issues; 4) mental illness; 5) orthodontic treatment ongoing or completed in less than six months; or 6) participants who had been using occlusal splints or regular medication or treated by a physiotherapist for less than six months. An experienced clinician determined the eligibility of the subjects and used the standardized forms from the RDC/TMD to evaluate the patients.

The diagnosis was made with the old RDC/TMD criteria version since the new version of the RDC/TMD criteria was not available in the Portuguese language during the project data collection. The complete standardized RDC/TMD criteria examination was applied for all patients.

Sample size calculation: The Sample size was determined using the Gpower software, based on the primary outcome of this trial, which was orofacial pain intensity (measured by a 0-10 cm Visual Analog Scale (VAS)). This calculation was based on a pilot study conducted by our team. Based on the estimates of the effect size (mean difference) of 2.6 (SD 0.83; ES = 1.4) mm between active groups (NTG and MTG) when compared to PG on VAS, an $\alpha = 0.05$; and $\beta = 80\%$, 54 participants were needed in total, being 18 patients per group.

Procedures: Demographic data including age, weight, and height, body mass index (BMI), TMJ pain, difficulty to feeding, and headache pain intensity (VAS) was collected for all subjects. In addition, the following outcomes were collected:

2.3 Outcome measures

All clinician-assessed outcomes (when the outcomes were not self-reported, i.e. jaw ROM) were collected by two assessors who were blinded to the treatment allocation, at baseline, and immediately after the end of treatment, four (one-month follow-up) and 12 (three-months follow-up) weeks after the end of treatment for the three groups.

The primary outcome measure was self-reported orofacial pain intensity measured with the VAS. Secondaries outcomes were self-reported jaw function and oral health-related to quality of life (OHRQoL), and jaw range of motion (ROM) evaluated by a clinician. We also collected neck outcomes; these will be analyzed and presented in other manuscript which is under preparation. All evaluation procedures and treatment were performed in the Learning and Motor Control Laboratory at the Physiotherapy Department of Federal University of Pernambuco.

2.3.1 Orofacial pain intensity

The orofacial pain intensity was measured by VAS, which is a line with 0 to 10 centimeters, anchored by descriptors at each end point. Where, in left end "0 (zero)"

means "no pain", and in the right end "10" means "worst pain imaginable". The participants were guided to check a perpendicular line along that axis, in the point that best represented the orofacial pain at rest. The pain intensity was described as the value between the point chosen by the participants to the left end point, in cm. The validity and responsiveness (36) of the VAS to measure pain has been recognized and the reliability of VAS has been considered fair to good (ICC: 0.55-0-83).(37-39)

2.3.2 Jaw function

Jaw function was evaluated by the Mandibular Function Impairment Questionnaire (MFIQ), which permits to classify the severity of the jaw functional limitation associated to TMD. It is a reliable and valid questionnaire to evaluate the jaw function in patients with TMD and has been translated and validated for Brazilian Portuguese.(40, 41) This questionnaire was composed by 17 questions, divided in two dimensions: functional capacity and feeding, with the total score of 68 points. Higher scores represent worst functional impairment on mandibular function. The smallest detectable difference (SDD) for the total score has been established to be 8 points.(41)

2.3.3 Oral Health Related Quality of Life (OHRQoL)

The Oral Health Impact Profile – simplified version (OHIP-14) was used to evaluate the OHRQoL. This questionnaire is useful to evaluate the individual functional limitation regards to oral symptoms and emotional and social well-being, showing the impact of the oral diseases on the individual´s well-being. The OHIP-14 was developed following a conceptual model of oral health and have seven domains: physical pain, psychological disability, psychological discomfort, functional impairment, physical disability, social disability, and general disability. The questionnaire is composed by 14 questions, and each one can be scored between 0 to 4. The total score is 56 and is calculated by adding all items. The higher the score, the worst the OHRQoL. It is a reliable and valid questionnaire to evaluate the quality of life in patients with TMD and has been translated and validated for Brazilian Portuguese.(42, 43)

2.3.4 Jaw range of motion (ROM)

Jaw ROM was evaluated for the following movements: jaw opening without pain, (the participant was instructed to open her mouth as far as possible without pain); right and left lateral excursion (the participant was instructed to move her jaw as far as possible to the right/left side without pain); and protrusion (the participant was instructed to move forward her jaw as far as possible without pain). The jaw ROM was measured with a universal caliper (Digital Universal Caliper, 150 mm, São Paulo-SP, Brazil), according

to the RDC/TMD guidelines, which has a good validity to evaluate patients with TMD.(35) The measures were done three times with 30 seconds of interval, and the average between them was used for all analyses.

2.4 Intervention

This study had two active treatment groups and one placebo group. As described below.

2.4.1 Neck Motor Control Training Group (NTG)

Participants of the NTG performed an 8-week exercises program (specific and progressive) to the flexor and extensors neck muscles as described in the protocol by Falla et al.(30, 32) Patients received instructions and were individually supervised for 30 minutes, once per week for a period of 8 weeks, totaling eight sessions. During each session, the physiotherapist verified performance of the exercises taught in the previous week and if considered appropriated, exercises were progressed. This program consisted of two phases:

2.4.1.1 Phase 1

The first phase lasted six weeks. Patients performed low-load exercises targeted to the deep neck flexors and extensors neck muscles. This phase is directed to train the deep neck stabilizing muscles (longus colli and longus capitis).(30) Subjects were instructed to perform a craniocervical flexion movement in supine relaxed position, aided with a visual pressure feedback (Pressure Biofeedback Stabilizer; Chattanooga, Hixson, TN, EUA), placed under the occipital region. This device monitors the cervical lordosis flattening that occurs with the contraction of the longus colli. The exercise started with the biofeedback device inflated initially at 20 mmHg. The participant was required to perform a short craniocervical flexion movement (nodding movement: "yes"), and to maintain it for 10 seconds, with 10 repetitions and 10 seconds of rest between them. This sequence was considered as one repetition with a duration of 190 seconds in total. Then, the patient was allowed to progress the exercise during five stages of 2 mmHg of increment each, reaching a maximum pressure of 30 mmHg, based on the Stabilizer device. The participant was instructed to do the contraction slowly and smoothly, not allowing retraction or lifting the head from the bed and avoiding the co-contraction of SCM and scalene muscles. The number of repetitions and series were adapted individually, ensuring that the patient did the exercises without pain or discomfort. When possible, subjects started the exercises with a minimum of two series of 10 repetitions, and they could progress until 3 series of 10 repetitions.

In this phase, participants performed also exercises to train the deep extensor neck muscles. They executed movements of cranio-cervical extension, flexion and rotation in prone position on elbows at 90°, with neutral neck position. The patients started the exercises with a minimum of one series of 10 repetitions of three seconds each. The goal was to evolve until 3 series of 15 repetitions. When more than one series were done, there was an interval of 2 minutes between series. The number of repetitions and series were adapted individually, ensuring that they did the exercises without pain or discomfort. The protocol of exercises is available in the Appendix 01.

2.4.1.2 Phase 2

The second phase lasted two weeks and had two strengthening exercises to the neck muscles, using the head weight as a load. The first exercise consisted of strengthening the neck flexor muscles. Subjects were in supine position and they were instructed to perform a cranio-cervical flexion followed by a cervical flexion raising the head of the bed. The second exercise consisted of strengthening the cervical extensors muscles. Patients were in a 4-kneeling prone position maintaining the craniocervical region in a neutral position, while they were instructed to do a cervical extension movement. The patients started the exercises with a minimum of one series of 10 repetitions of three seconds each. The goal was to evolve until 3 series of 15 repetitions. When more than one series was done, there was an interval of 2 minutes between series. The number of repetitions and series were adapted individually, ensuring that the patient did the exercises without pain or discomfort.

2.4.1.3 All Phases

During all treatment's phases, patients were instructed to perform the exercises at home one time per day, for eight weeks. The exercises lasted between 15 to 20 minutes per day and should be done without pain or discomfort in the jaw, masticatory muscles or neck. The treatment was done by an experienced physiotherapist in the area of orofacial pain (six years of experience), who did not take part in recruitment and evaluation phases.

2.4.2 *Manual Therapy Group (MTG)*

Subjects assigned to this group received manual therapy one once per week for eight weeks, lasting approximately 30 minutes. Each session could be extended for another 10 minutes depending on the patient's needs. The treatment was done by the same physiotherapist who applied the other treatments.

The following techniques were applied:

Myofascial release to neck muscles (upper trapezius, sternocleidomastoid muscles (SCM), anterior scalene, and suboccipital, bilateral for 10 minutes.(44, 45)

Postero-anterior and latero-lateral articular mobilizations (I and II levels according to Maitland)(46, 47) of the cervical vertebrae were performed just to relieve pain. The four most painful segments during palpation at the time of the session were mobilized. Three series of ten mobilization movements were performed in each segment.

Also, stretching techniques to the neck muscles were applied by the therapist in the following postures: cervical lateral flexion, cervical flexion, cervical flexion with rotation, and cervical extension, at least for 2 series of 30 seconds to a maximum of 3 series of 30 seconds each. The number of series was decided based on patient´s capacity to perform it.

The following home activities were recommended for this group:

Relaxing techniques: self-massage with circular movements in the neck muscles and hot pads for 20 minutes every day;

Self-stretching of the neck muscles in cervical lateral flexion, cervical flexion, cervical flexion with rotation, and cervical extension. The number of series was determined by the physiotherapist during the in-clinic visit.

2.4.3 Placebo Group (PG)

The patients in this group received a placebo treatment. A therapeutic ultrasound – US (Quark®, *Pro Seven* 977) machine, which was turned-off during the therapy, was used to provide a credible placebo. Subjects were not aware of the placebo intervention. Two minutes of turned-off US were applied to the following muscles: SCM, upper trapezius and splenius, bilaterally with one-minute interval between them, one time per week, for eight weeks. The patients in this group did not perform any exercise or stretching at home. The treatment was done by the same physiotherapist who applied the other treatments.

All treatment groups were treated in the Learning and Motor Control Laboratory at the Federal University of Pernambuco, individually by the same experienced physiotherapist in the area of orofacial pain (six years of experience), who did not take part in recruitment and evaluation phases.

Co-interventions for all groups: Participants were required to refrain from other types of treatments for TMD pain during this treatment phase, including medication. If the patient received another treatment, the patient was oriented to say to the

physiotherapist and then this was noted by the researcher. However, in this study no patient referred that she received other type of treatment.

2.4.4 Study follow-up

All clinician-assessed outcomes were collected by two assessors who were blinded to the treatment allocation. All patients were evaluated immediately at the end of the treatment, four weeks after the end of treatment (one-month follow-up), and 12 weeks after the end of treatment (three months follow-up).

2.4.5 Compliance with treatment

Participants were treated in the clinic, and they were motivated to perform home exercises (NTG) or follow recommendations (MTG). The compliance with treatment in the clinic was assessed based on the attendance to each session. To monitor the compliance with exercises/recommendations at home, the patients were asked to perform the exercises/recommendations that they had done at home before the beginning of each session.

2.4.6 Statistical analyses

To test the data distribution the histograms and Kolmogorov-Smirnov test were applied. The primary and secondary outcomes were normally distributed and were described in terms of their means and standard deviations (SD).

To characterize the sample, demographic data and clinical data (i.e., age, body mass index (BMI), orofacial pain, headache pain intensity) were compared between groups by using an ANOVA test and Bonferroni post-hoc test. To analyze dichotomous variables (presence of TMJ pain, difficulty to feeding, presence of headache and presence of neck pain) a chi-square (X^2) test was used.

To determine whether there was a difference between groups over time on pain intensity (primary outcome) and jaw function, jaw ROM, OHRQoL (secondaries outcomes) a mixed ANOVA with repeated measures was conducted. The within-factor was time (baseline, final (immediately after the end of treatment), one-month follow-up (four weeks after the end of treatment), and three-months follow-up (12 weeks after the end of treatment), indicating the difference in the same group over time, and the between-factor was treatment (NTG, MTG, PG), indicating the differences between groups over time. A Bonferroni Post hoc test was applied after ANOVA to verify where the differences occurred.

All results were performed based on intention-to-treat analysis. In this case all subjects were analyzed according to the group in which they were allocated, including all dropouts. To impute the missing data from the continuous variables, we use an imputation based on plausible data models, obtained from a distribution specifically designed for each missing data point. The selected imputation method takes a set of predictors and returns a single imputation for each missing entry in the incomplete column. So, to impute each missing data, all other data in the spreadsheet is consulted. For this, the "MICE" package of the R software was used. (48) To determine the effect sizes (ES) between-groups, the Cohen´s *d* index was calculated for all outcomes and interpreted according to Cohen's guidelines.(49) All data analysis was done with the SPSS and R software.

3. Results

In total 153 volunteers were recruited, however just fifty-four accomplished the inclusion criteria, and were equally randomized between the groups. The flowchart (figure 1) presented the sample distribution according to the CONSORT statement and highlights the number and reasons for dropouts. Two patients did not complete the evaluation at the end of the treatment (main time point) and dropped out due to personal reasons (one from the NTG [she had no more transportation to come to the service] and other from MTG [she was no longer available to come to service]). No differences between groups were identified at baseline in any measures. All demographic data are presented in Table 1.

None of the participants received any co-intervention and did not report any type of adverse events. In average the patients attended 95.8%, 88.2%, and 91% of the sessions, in the NTG, MTG, and PG respectively.

3.1 *Primary outcome*

All groups significantly improved orofacial pain intensity overtime (Table 4, Appendix). Also, there were significant differences between NTG and PG groups at the end of the treatment (ES 0.9 [95%CI= 0.2; 1.6]), one-month follow-up (ES 0.8 [95%CI= 0.1; 1.5]) and three-months follow-up (ES 0.7 [95%CI= 0.1; 1.4]), favoring the intervention group (Table 2). No significant differences were observed between NTG and MTG; and MTG and PG at any time point.

3.2 *Secondaries outcomes*

3.2.1 Jaw Function

Jaw function showed an improvement in the NTG (within-group) just at one- and three-months follow-up. No significant differences were observed over time on jaw

function for the MTG and PG (Table 4, Appendix). Regards to between-groups analyses, significant differences occurred between NTG and PG at the end of treatment (ES 0.9 [95%CI= 0.3; 1.6]), one-month follow-up (ES 0.8 [95%CI= 0.1; 1.4]) and three-months follow-up (ES 0.9 [95%CI= 0.2; 1.6]), favoring the intervention group. And between NTG and MTG after three-months follow-up (ES 1 [95%CI= 0.3; 1.7]), favoring the NTG group (Table 2). No difference was verified between MTG and PG.

3.2.2 OHRQoL

The OHRQoL improved in all measure's times related to the baseline measure for NTG and MTG, but not for PG. However, all groups improved their quality of life at three-months follow-up (Table 4, Appendix). Between-groups analyses showed that the NTG was significantly better than MTG and PG at the end of treatment, one-month and three-months follow-up, with a large ES (>0.7), favoring the NTG (Table 2).

3.2.3 Jaw ROM

Jaw ROM did not show a clear improvement after treatments. The NTG improve protrusion and the MTG improved left lateral protrusion at one- and three-months follow-up (within-group analysis) (Table 5, Appendix). Between-group analyses showed that the PG obtained significantly better results in protrusion movement than MTG (ES -0.8 [95%CI= -1.4; -0.1]) (Table 3).

4. Discussion

The main results from this RCT were that an exercise program targeting neck motor control training for 8 weeks was effective to improve pain, jaw function and OHRQoL, but not jaw ROM in women with TMD. Significant improvement was verified in orofacial pain and OHRQoL over time in all treatment groups. Neck motor control training was similar to manual therapy and better than placebo to improve pain and jaw function. Nevertheless, neck motor control training was better than these treatments to improve OHRQoL. Thus, the hypothesis of the study was therefore partially confirmed.

4.1 Orofacial pain

The neck motor control training proposed in this study was able to significantly reduce orofacial pain intensity in patients with TMD. Similar results were obtained in a study using neck motor control exercises plus upper neck manual therapy.(28) The orofacial pain relief after exercises targeted to the neck might have occurred due the neuroanatomical connections between these areas, since the stimulation of the inhibitory downward path through the neck may reduce pain in the trigeminal area.(28, 50, 51) In addition, it is known that the low-intensity exercise such as motor control exercise can

provide an adequate stimulus to produce exercise induced hypoalgesia effect in patients with chronic pain.(52)

Patients with chronic MSK pain such as patients with TMD have altered sensory input that affects sensorimotor organization and processes within the central nervous system.(53) Specific exercises as motor-skill training could stimulates the cortical neuroplasticity and the organization of altered motor function seen in these patients.(53, 54) Motor control training also could improve task performance and representation of the trained musculature in the primary motor cortex better than general exercises and this could help with brain neuroplasticity and pain modulation.(53, 54)

In the present study, pain intensity also improved in the placebo group, similar to Barbosa et al (2019)'s study, who applied exercise directly to the jaw and showed a progressive decrease in perceived pain for both treatment and placebo groups (simulated laser therapy). The improvement in pain intensity in the placebo treatment may be derived from the participant's perception and experience of receiving a treatment to reduce pain, added with memories of previous experiences and current expectations.(55) Placebo effects results from the positive psychosocial context, that is capable of influencing the patient´s brain, and it is created by treatment expectations; in this way it should be considered as a powerful component in the clinical approach. It is established that the practitioner´s attitudes and competence may influence the magnitude of the placebo effects, which could represent around of 37% to 70% of the magnitude of effect the pain relief.(56-58) Moreover, the patient-therapist alliance contributes to placebo effects and health outcomes and might have contributed to the positive effect seen in these patients.(56, 57) However, we did not formally evaluate expectations and therapeutic alliance in our study. Future studies should take into consideration these factors.

4.2 Jaw function

Jaw function was better in the neck exercise training group compared to a placebo treatment, similar to Barbosa et al (2019).(55) This improvement in jaw function only in the exercise group, different from the pain assessment, could be due to the fact that the placebo effect does not influence the disease but affects the illness as a subjective perception of the patient experience.(57)

Jaw function was not significantly different after treatment between neck motor control training and manual therapy group and both groups improve jaw function similarly. The improvement in jaw function due to the treatment is expected as a consequence of pain reduction especially in patients with severe functional limitations.

In addition, as mentioned previously, jaw disability has been highly associated with neck disability and thus improvement in the neck could be reflected in improvements of the jaw function.(19)

4.3 OHRQoL

The OHRQoL improved in all treatment groups, but participants receiving neck motor control training improved more significantly than the other groups. It is well known that OHRQoL is related to worse jaw function and orofacial pain and thus the improvement in quality of life could be related to the improvements of these outcomes and facilitate the daily professional and/or social activities.(59, 60) The improvement of quality of life observed in all groups could be due to other aspects related to quality of life such as to pain beliefs, mood, ability to cope and cognitive-emotional aspects, and could be influenced by the patient-therapist relationship, characteristics of the treatment and the overall healthcare setting, which are relevant contextual factors that could affect treatment outcomes.(56, 57, 61) However the improvement were more evident in the neck motor control training group, and this aspect could be related to nature of the treatment, where the patients has a big responsibility for your treatment, consequently influencing directly in your self-care.

4.4 Jaw ROM

The improvement in the jaw ROM was not clearly observed for any of the groups. This result is in accordance with another study looking at effects of an intervention protocol directed to the neck region in patients with TMD.(28) Thus, it is hypothesized that peripheral pain sensitivity on the orofacial region did not change after this applying a treatment in the neck. It is expected that treatments that target both regions (neck and jaw) could be more effective to improve jaw ROM and function in the masticatory muscles. Future studies should analyze isolated and combined therapies and determine their effectiveness.

4.5 Strength and clinical implications

To our knowledge this is the first study that tested a specific neck motor control exercise protocol alone in a group of patients with TMD. This study showed that exercises directed to the neck (which requires low therapeutic supervision) could be useful in the management of patients with chronic jaw pain. This study chose to apply the protocol of exercises alone, to clarify the effectiveness of this type of treatment in isolation and to ensure the internal validity of the study. This study followed the methodological standards of RCTs using a good randomization and allocation concealment processes.

Although the therapist could not be blinded (due to the nature of the therapies), she was blinded to the outcome measures. In addition, patients were blinded to the hypotheses of the study decreasing the possibility of performance biases. Assessors were blinded to the allocation group, which avoid detection biases. Co-interventions were controlled in order to avoid contamination bias. Furthermore, intention to treat analysis with multiple data imputation were used, since few dropouts were found at the end of treatment, and a higher number were verified at the three-months follow-up evaluation. This analysis strategies improve the statistical power of the data, especially because a multiple imputation method was applied. This type of imputation is more advantageous than the single imputation because it uses several complete data sets and provides both the between- and within-imputation variability. Multiple imputation method provides values that could estimate the variance and the interval of the parameter of interest.(62, 63)

4.6 Limitations of the study

The main limitations of the present study are regarding to the patient recruitment. The patients were recruited in two distinct ways (specialized health service and by advertisements) and by convenience; this may be considered as a source of selection bias that could affect external validity of the study. Also, it was not possible to blind the therapist to the treatments due to their nature and also because the same therapist was involved in the treatment of all groups. It is important to highlight that our sample consisted of adults' women, and thus our results might not be generalizable to other populations.

4.7 Future directions

Further studies should explore the effectiveness of neck exercises in a longer period of time (more than 8 weeks of exercises) alone and combined with exercise for the jaw region and using longer follow-ups (six months or more). Also, studies should include men, a different age range, and different degrees of jaw disability and chronicity to determine whether this protocol would be beneficial for different subgroups.

5. Conclusion

Neck motor control training were effective to improve pain intensity, jaw function and oral health related quality of life, but not jaw ROM in women with TMD. In addition, exercises targeted to the neck were significantly better than placebo to improve pain, jaw function and oral health related quality of life, and significantly better than manual

therapy to improve oral health related quality of life. These results provide promising evidence of the use of neck motor control exercises in patients with TMD.

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Table 1. Sample Characterization

Outcomes	NTG Mean (SD) CI 95%	MTG Mean (SD) CI 95%	PG Mean (SD) CI 95%	p value	F
Age	26 (6.7) 22.6; 29.3	31.8 (9.8) 26.9; 36.7	28.8 (10.4) 23.6; 33.9	0.170	1.836
BMI	22.9 (4.4) 20.7; 25	23.5 (4.9) 21; 25.9	23.3 (4.4) 21.1; 25.4	0.916	0.088
Baseline VAS	7.25 (1.7) 6..4; 8.1	6.5 (2.2) 5.4; 7.6	7 (1.6) 6.2; 7.8	0.531	0.641
Headache VAS	7.6 (1.8) 6.7; 8.6	8 (1.9) 6.6; 9.4	8.5 (1.5) 7.5; 8.6	0.381	0.990
	YES/N total (%)	YES/N total (%)	YES/N total (%)	p value	X^2
Joint pain	17/18 (94.4)	14/18 (77.8)	18/18 (100)	0.057	5.731
Difficulty feeding	11/18 (61.1)	13/18 (77.8)	16/18 (88.9)	0.152	3.765
Headache	15/18 (83.3)	11/18 (61.1)	13/18 (72.2)	0.452	1.587
Neck pain	14/18 (77.8)	13/18 (72.2)	16/18 (88.9)	0.450	1.598

NTG: cervical training group; MTG: manual therapy group; PG: placebo group: CI95%: confidence interval; VAS: 10 cm- Visual Analog Scale; P<0.005; F: ANOVA results; X^2: Chi-square test

Table 2. Mean differences between groups of Pain intensity, Jaw function and Oral health-related quality of life.

			POST HOC BETWEEN-GROUP (MD CI 95%) (ES CI 95%)			
Outcomes	**Comparison**		**Baseline**	**End of Treatment**	**One-month follow-up**	**Three-months follow-up**
PAIN INTENSITY	**NTG vs MTG**	**MD (95%CI)**	0.6 (-0.7; 1.9)	-0.8 (-2.5; 0.9)	-1.1 (-2.5; 0.3)	-1 (-2.3; 0.3)
		ES (95%CI)	0.3 (-1; 0.3)	0.3 (-0.4; 1)	0.5 (-0.1; 1.2)	0.5 (-0.1; 1.2)
	NTG vs PG	**MD (95%CI)**	0.1 (-1; 1.2)	**-1.9 (-3.4; -0.4)***	**-1.4 (-2.6; 0.3)***	**-1.4 (-2.6; -0.2)***
		ES (95%CI)	0.1 (-0.7; 0.6)	**0.9 (0.2; 1.6)**	**0.8 (0.1; 1.5)**	**0.7 (0.1; 1.4)**
	MTG vs PG	**MD (95%CI)**	-0.5 (-1.8; 0.8)	-1.1 (-2.9; 0.7)	-0.3 (-1.9; 1.3)	-0.4 (-1.9; 1.1)
		ES (95%CI)	0.3 (-0.4; 0.9)	0.4 (-0.2; 1.1)	0.1 (-0.5;0.8)	0.1 (-0.6; 0.7)
OHRQOL	**NTG vs MTG**	**MD (95%CI)**	-6.1 (-13.8; 1.6)	**-8.5 (-14.5; -2.5)***	**-8.3 (-16.3; -0.3)***	**-11.7 (-20.9; -2.5)***
		ES (95%CI)	0.5 (-0.1; 1.2)	**0.9 (0.3; 1.6)***	**0.7 (0.1; 1.4)***	**0.9 (0.2; 1.5)***
	NTG vs PG	**MD (95%CI)**	-0.8 (-5.4; 4.2)	**-9.2 (-15.4; -3)***	-7.2 (-14.8; 0.4)	**-7.3 (-14.4; -0.2)***
		ES (95%CI)	0.1 (-0.5;0.8)	**1 (0.3; 1.7)***	0.6 (-0.1; 1.3)	**0.7 (0.1; 1.4)***
	MTG vs PG	**MD (95%CI)**	5.3 (-3.2; 13.8)	-0.1 (-8.2; 6.8)	1.1 (-8.7; 10.9)	4.4 (-5.5, 14.3)
		ES (95%CI)	-0.4 (-1.1; 0.2)	0.1 (-0.6; 0.7)	-0.1 (-0.7; 0.6)	-0.3 (-1; 0.3)
JAW FUNCTION	**NTG vs MTG**	**MD (95%CI)**	-5.4 (-12.8; 2)	-5.7 (-12.7; 1.3)	-6.9 (-14.8; 1.1)	**-12.5 (-20.1; -4.1)***
		ES (95%CI)	0.5 (-0.2; 1.1)	0.5 (-0.1; 1.2)	0.6 (-0.1; 1.2)	**1 (0.3; 1.7)**
	NTG vs PG	**MD (95%CI)**	-5.3 (-12.2; 1.6)	**-9.5 (-16.3; -2.7)***	**-8 (-15; -1)***	**-9 (-16; -2)***
		ES (95%CI)	0.5 (-0.1; 1.2)	**0.9 (0.3; 1.6)***	**0.8 (0.1; 1.4)***	**0.9 (0.2; 1.6)***
	MTG vs PG	**MD (95%CI)**	0.1 (-7.9; 8.1)	-3.8 (-12.1; 4.5)	-1.1 (-10.2; 8)	3.5 (-5.8; 12.8)
		ES (95%CI)	0 (-0.6;0.6)	0.3 (-0.3; 1)	0.1 (-0.6; 0.7)	-0.2 (-0.9; 0.4)

N: number of participants; NTG: Cervical training group; MTG: Manual therapy group; PG: placebo group; OHRQoL: oral health-related quality of life; MD: Mean difference; ES: standardized effect size.

706 Table 3. Mean differences between groups on jaw range of motion (ROM)

			POST HOC BETWEEN-GROUP (MD CI 95%) (ES CI 95%)			
Outcomes	Comparison		Baseline	End of Treatment	One-month follow-up	Three-months follow-up
Jaw opening	NTG vs MTG	MD (95%CI)	-0.9 (-10.9; 7.2)	-2.4 (-8.4, 3.6)	-1.1 (-7.8; 5.6)	0 (-5.8; 5.8)
		ES (95%CI)	-0.1 (-0.7; 0.6)	0.3 (-0.4; 0.9)	0.1 (-0.5; 0.8)	0 (-0.6; 0.6)
	NTG vs PG	MD (95%CI)	0.2 (-6.4; 6.8)	3.4 (-2.9; 9.7)	0.3 (-6.6; 7.2)	1.2 (-4.9; 7.3)
		ES (95%CI)	-0.1 (-0.8; 0.5)	-0.4 (-1; 0.3)	0.1 (-0.6; 0.7)	-0.1 (-0.8; 0.5)
	MTG vs PG	MD (95%CI)	1.1 (-5.5; 7.9)	5.8 (-0.4; 12)	1.4 (-4.5; 7.3)	1.2 (-3.8; 6.2)
		ES (95%CI)	-0.1 (-0.8; 0.5)	-0.6 (-1.3;0.1)	-0.1 (-0.7; 0.6)	-0.2 (-0.8; 0.5)
Right lateral excursion	NTG vs MTG	MD (95%CI)	0.4 (-1.2; 2)	-0.1 (-1.4; 1.2)	0.5 (-1; 2)	0.6 (-0.5; 1.7)
		ES (95%CI)	-0.2 (-0.8; 0.5)	0.05 (-0.6;0.7)	-0.2 (-0.9; 0.4)	-0.4 (-1; 0.3)
	NTG vs PG	MD (95%CI)	0.3 (-1.3; 1.9)	-1.2 (-2.8; 0.2)	0.8 (-0.7; 2.3)	0.4 (-0.7; 1.5)
		ES (95%CI)	-0.1 (-0.8; 0.5)	0.6 (-0.1; 1.2)	-0.3 (-1; 0.3)	-0.2 (-0.9; 0.4)
	MTG vs PG	MD (95%CI)	-0.1 (-2; 1.8)	-1.2 (-2.4; 0.01)	0.3 (-1; 1.6)	-0.2 (-1.3; 0.9)
		ES (95%CI)	0.0 (-0.6; 0.7)	0.6 (-0.01; 1.3)	-0.1 (-0.8; 0.5)	0.1 (-0.5; 0.8)
Left lateral excursion	NTG vs MTG	MD (95%CI)	0.5 (-0.9; 1.9)	0.1 (-1.6; 1.8)	-1 (-2.3; 0.3)	0.5 (-0.6; 1.6)
		ES (95%CI)	-0.2; (-0.9; 0.4)	-0.1 (-0.7; 0.6)	0.5 (-0.1; 1.2)	-0.3 (-1; 0.3)
	NTG vs PG	MD (95%CI)	0.1 (-1.6; 1.8)	-1.4 (-3.2; 0.4)	-0.8 (-2.2; 0.6)	0.1 (-0.5; 0.7)
		ES (95%CI)	-0.1 (-0.7; 0.6)	0.5 (-0.1; 1.2)	0.4 (-0.3; 1.0)	0.7 (-0.3; 1.7)
	MTG vs PG	MD (95%CI)	-0.4 (-2.1; 1.3)	-1.5 (-3.1; 0.1)	0.2 (-1.4; 1.8)	-0.7 (-1.8; 0.4)
		ES (95%CI)	0.1 (-0.5; 0.8)	0.6 (-0.1; 1.3)	-0.1 (-0.7; 0.6)	0.4 (-0.2; 1.1)
Protrusion	NTG vs MTG	MD (95%CI)	-0.3 (-1.4; 0.8)	-0.4 (-1.5; 0.7)	-0.1 (-1.5; 0.9)	-0.5 (-1.8; 0.8)
		ES (95%CI)	0.2 (-0.5; 0.8)	0.2 (-0.4; 0.9)	0.1 (-0.6; 0.7)	0.3 (-0.4; 0.9)

NTG vs PG	**MD (95%CI)**	0 (-1; 1)	0.9 (-0.1; 1.9)	0 (-1; 1)	0.5 (-0.4; 1.4)
	ES (95%CI)	0 (-0.6; 0.6)	-0.6 (-1.3; 0.1)	-0 (-0.6; 0.6)	-0.3 (-1; 0.3)
MTG vs PG	**MD (95%CI)**	0.3 (-0.8; 1.4)	**1.3 (0.1; 2.4)***	0.1 (-1.1; 1.3)	1 (-0.1; 2.1)
	ES (95%CI)	-0.2 (-0.8; 0.4)	**-0.8 (-1.4; -0.1)***	-0.1 (-0.7; 0.6)	-0.6 (-1.3; 0.1)

N: number of participants; NTG: Cervical training group; MTG: Manual therapy group;

PG: control group; MD: Mean difference; ES: standardized effect size.

712 Figure 1. Study flowchart according to the CONSORT statement

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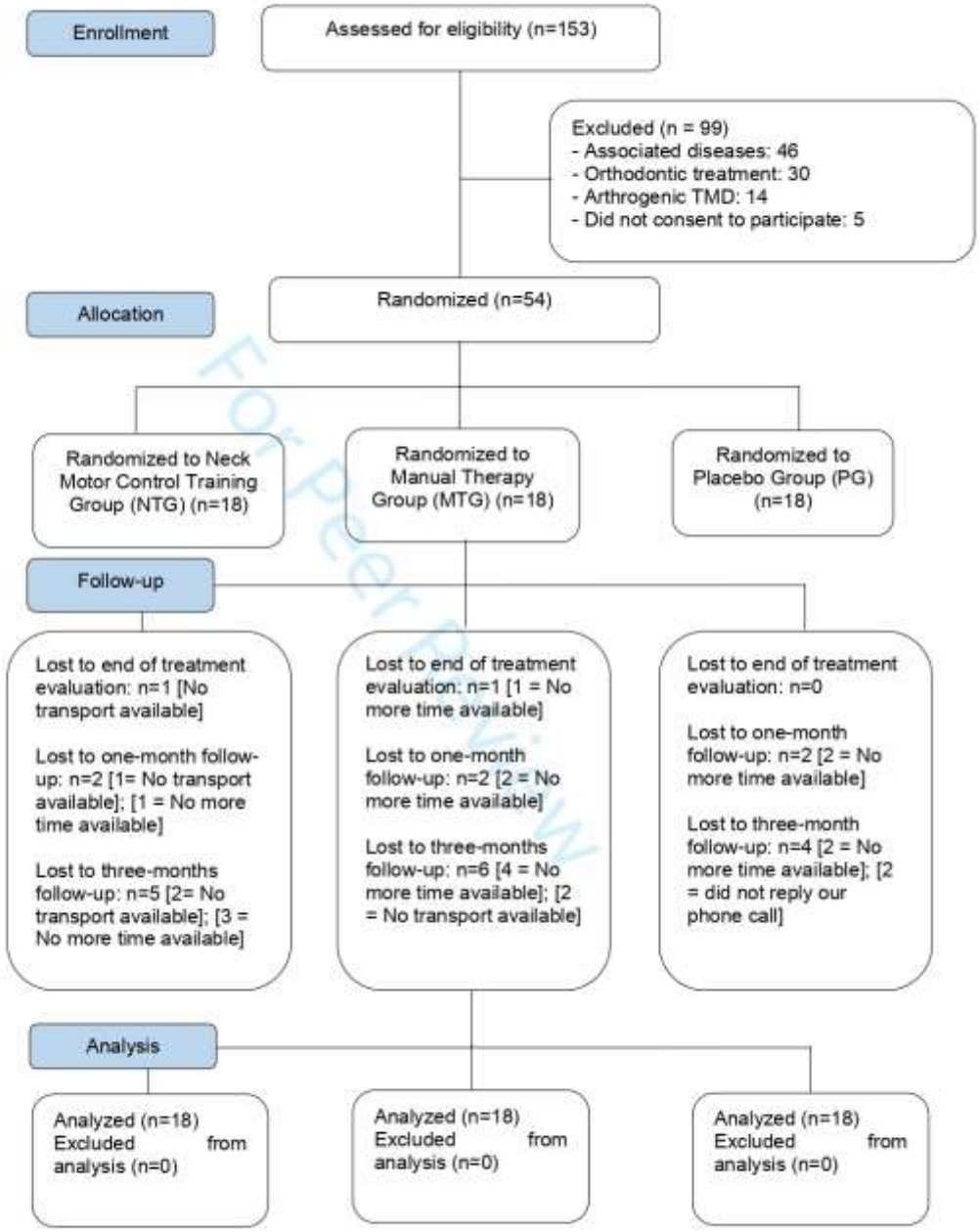

Appendix 01. Motor control exercises applied to neck motor control training group.

Phase 1

Figure 2. Deep neck flexors training

Figure 3. Deep neck extensors training

Figure 4. Deep and superficial neck flexors training

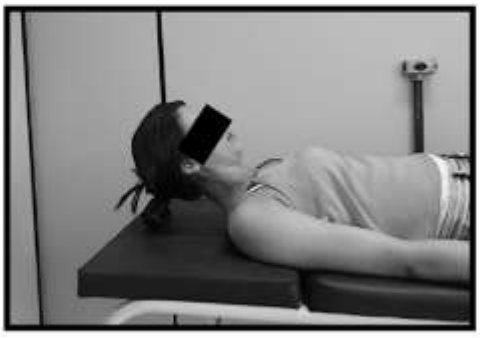

Figure 5. Deep and superficial neck extensors training

Table 4. Within-group mean differences of Pain intensity, Jaw function and Oral health-related quality of life.

OUTCOMES	GROUPS (N)	BASELINE mean (SD)	END OF TREATMENT mean (SD)	ONE-MONTH FOLLOW-UP mean (SD)	THREE-MONTHS FOLLOW-UP mean (SD)	POST HOC WITHIN-GROUP (MD 95%CI)					
						Baseline vs End of treatment MD (95%CI)	Baseline vs One-month follow-up	Baseline vs Three-months follow-up	End of treatment vs One-month follow-up	End of treatment vs Three-months follow-up	One-month follow-up vs Three-months follow-up
PAIN	NTG (18)	7.1 (1.7)	1.8 (1.9)	1.5 (1.4)	1.4 (1.4)	**5.3 (4.1; 6.5)***	**5.6 (4.5; 5.6)***	**5.7 (4.6; 6.7)***	0.3 (-0.8; 1.4)	0.4 (-0.7; 1.5)	0.1 (-0.8; 1)
	MTG (18)	6.5 (2.2)	2.6 (3)	2.6 (2.6)	2.4 (2.3)	**3.9 (2.1; 5.6)***	**3.9 (2.3; 5.5)***	**4.1 (2.6; 5.6)***	0 (-1.9; 1.9)	0.2 (-1.6; 2)	0.2 (-1.5; 1.9)
	CG (18)	7 (1.6)	3.7 (2.4)	2.9 (2)	2.8 (2)	**3.3 (1.9; 4.7)***	**4.1 (2.9; 5.3)***	**4.2 (3; 5.4)***	0.8 (-0.7; 2.3)	0.9 (-0.6; 2.4)	0.1 (-1.2; 1.4)
OHRQOL	NTG (18)	20.1 (5.3)	7.4 (6.2)	6.9 (7.5)	5.5 (9)	**12.7 (8.8; 16.6)***	**13.2 (8.8;17.6)***	**14.6 (9.6; 19.6)***	0.5 (-4.2; 5.2)	1.9 (-3.3; 7.1)	1.4 (-4.2; 7)
	MTG (18)	26.2 (15.2)	15.9 (10.9)	15.2 (15)	17.2 (17)	**10.3 (1.3;**	**11 (0.8; 21.2)***	**9 (1.9; 19.9)***	0.7 (-8.2;	-1.3 (-11; 8.4)	-0.2 (-12.8;

						19.2)*			9.6)		8.8)
	PG (18)	20.9 (9.1)	16.6 (11.3)	14.1 (14)	12.8 (11.8)	4.3 (-2.6; 11.2)	6.8 (-1.2; 14.8)	**8.2 (1; 15.2)***	2.5 (-6.1; 11.1)	3.8 (-4; 11.6)	1.3 (-7.5; 10.1)
JAW FUNCTION	NTG (18)	17.4 (9.1)	11.9 (7.6)	9.4 (8.2)	7.1 (8.2)	5.5 (-0.2; 11.2)	**8 (2.1; 13.9)***	**10.3 (4.4; 16.2)***	2.5 (-2.8; 7.8)	4.8 (-0.5; 10.1)	2.3 (-3.2; 7.8)
	MTG (18)	22.8 (12.5)	17.6 (12.4)	16.3 (14.6)	19.6 (15.4)	5.2 (-3.2; 13.6)	6.5 (-2.7; 15.7)	3.2 (-6.3; 12.7)	1.3 (-7.9; 10.5)	-2 (-11.5, 7.5)	-3.3 (-13.5; 6.9)
	PG (18)	22.7 (11.2)	21.4 (12)	17.4 (12.2)	16.1 (12)	1.3 (-6.6; 9.2)	5.3 (-2.6; 13.2)	6.6 (-4.2; 14.5)	4 (-1.5; 12.2)	5.3 (-2.8; 13.4)	1.3 (-6.9; 9.5)

N: number of participants; NTG: Neck motor control training group; MTG: Manual therapy group; PG: Placebo group; OHRQoL: oral healthy related quality of life.

OUTCOMES	GROUPS (N)	BASELINE mean (SD)	END OF TREATMENT mean (SD)	ONE-MONTH FOLLOW-UP mean (SD)	THREE-MONTHS FOLLOW-UP mean (SD)	POST HOC WITHIN-GROUP (MD 95%CI)					
						Baseline vs End of treatment	Baseline vs One-month follow-up	Baseline vs Three-months follow-up	End of treatment vs One-month follow-up	End of treatment vs Three-months follow-up	One-month follow-up vs Three-months follow-up
JAW OPENING	NTG (18)	31.4 (9)	33.3 (8.9)	33.7 (11.1)	35.2 (10.1)	-1.9 (-8; 4.2)	-2.3 (-9.1; 4.5)	-3.8 (-10.3; 2.7)	-0.4 (-7.2; 6.4)	-1.9 (-8.3; 4.5)	-1.5 (-8.7; 5.7)
	MTG (18)	32.3 (8.9)	35.7 (8.8)	34.8 (8.4)	35.2 (6.9)	-3.4 (-9.4; 2.6)	-2.5 (-8.4; 3.4)	-2.9 (-8.3; 2.5)	0.9 (-4.9; 6.7)	0.5 (-4.8; 5.8)	-0.4 (-5.6; 4.8)
	PG (18)	31.2 (10.5)	29.9 (9.6)	31.4 (9.1)	34 (7.8)	1.3 (-5.5; 8.1)	-2.2 (-8.6; 4.4)	-2.8 (-9.1; 3.5)	-3.5 (-9.8; 2.8)	-4.1 (-10; 1.8)	-0.6 (-6.3; 5.1)
RIGHT LATERAL EXCURSION	NTG (18)	8.2 (1.9)	7.8 (2.4)	9.1 (2.6)	8.7 (1.7)	0.4 (-1.1; 1.9)	-0.9 (-2.4; 0.6)	-0.5 (-1.7; 0.7)	-1.3 (-3; 0.4)	-0.9 (-2.3; 0.5)	0.4 (-1.1; 1.9)
	MTG (18)	7.8 (2.7)	7.9 (1.5)	8.6 (1.9)	8.1 (1.6)	-0.1 (-1.6; 1.4)	-0.8 (-2.4; 0.8)	-0.3 (-1.8; 1.2)	-0.7 (-1.9; 0.4)	-0.2 (-1.2; 0.8)	0.5 (-0.7; 1.7)

Table 5. Within-group mean differences of jaw movements.

	PG (18)	7.9 (2.8)	9.1 (2.1)	8.3 (1.9)	8.3 (1.6)	-1.2 (-2.9; 0.5)	-0.4 (-2; 1.2)	-0.4 (-1.9; 1.1)	0.8 (-0.6; 2.1)	0.8 (-0.5; 2.1)	0 (-1.2; 1.2)
LEFT LATERAL EXCURSION	NTG (18)	8.7 (2.1)	9.1 (2.9)	8.7 (1.6)	9.6 (1.8)	-0.4 (-2.1; 1.3)	0 (-1.3; 1.3)	-0.9 (-2.2; 0.4)	0.4 (-1.2; 2)	-0.5 (-2.1; 1.1)	-0.9 (-2; 0.2)
	MTG (18)	8.2 (2)	9 (2.2)	9.7 (2.2)	9.1 (1.3)	-0.8 (-2.2; 0.6)	**-1.5 (-2.9; -0.1)***	-0.9 (-2; 0.2)	-0.7 (-2.2; 0.8)	-0.1 (-1.3; 1.1)	0.6 (-0.6; 1.8)
	PG (18)	8.6 (3)	10.5 (2.5)	9.5 (2.5)	9.8 (2)	**-1.9 (-3.8; -0.1)***	-0.9 (-2.8; 0.1)	-1.2 (-2.9; 0.5)	1 (-0.7; 2.7)	0.7 (-0.8; 2.2)	-0.3 (-1.8; 1.2)
PROTRUSION	NTG (18)	3.9 (1.5)	4.7 (1.3)	4.5 (1.1)	5 (1.7)	-0.8 (-1.7; 0.1)	-0.6 (1.5; 0.3)	**-1.1 (-2.2; -0.1)***	0.2 (-0.6; 1)	-0.3 (-1.3; 0.7)	-0.5 (-1.5; 0.5)
	MTG (18)	4.2 (1.7)	5.1 (1.8)	4.6 (1.9)	5.5 (2.1)	-0.9 (-2.1; 0.3)	-0.4 (-1.6; 0.8)	**-1.3 (-2.6; -0.01)***	0.5 (-0.7; 1.7)	-0.4 (-1.7; 0.9)	-0.9 (-2.2; 0.4)
	PG (18)	3.9 (1.6)	3.8 (1.6)	4.5 (1.7)	4.5 (1)	0.1 (-1; 1.2)	-0.6 (-1.7; 0.5)	-0.6 (-1.5; 0.3)	-0.7 (-1.8; 0.4)	-0.7 (-1.6; 0.2)	0 (-0.9; 0.9)

N: number of participants; NTG: Neck motor control training group; MTG: Manual therapy group; PG: placebo group.

The TIDieR (Template for Intervention Description and Replication) Checklist*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
	BRIEF NAME		
1.	Provide the name or a phrase that describes the intervention.	Pages 9 and 10	Lines: 238 - 292
	WHY		
2.	Describe any rationale, theory, or goal of the elements essential to the intervention.	Pages 4 and 5	Lines: 85 - 118
	WHAT		
3.	Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers.	Pages 9 -11	Lines 235 - 326
	Provide information on where the materials can be accessed (e.g. online appendix, URL).	Appendix 1	
4.	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	Pages 9 -11 Appendix 1	Lines 235 - 326
	WHO PROVIDED		
5.	For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.	Page 10	Lines: 291 - 292
	HOW		
6.	Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	Page 11	Lines 327 - 330
	WHERE		
7.	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	Page 11	Lines 327 - 330

	WHEN and HOW MUCH		
8.	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.	NTG: Page 8 MTG: Page 10 PG: Page 11	NTG: Lines 241 – 242 MTG: Lines 295 – 296 PG: Lines 322 - 324
	TAILORING		
9.	If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.	Pages: 9 - 10	Lines: 262 – 265 Lines: 271 – 273 Lines: 285 - 286
	MODIFICATIONS		
10.*	If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).	NA	NA
	HOW WELL		
11.	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.	Page: 12	Lines: 343 - 349
12.*	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.	Page: 12	Lines: 343 - 349

** **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use '?' if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see BMJ 2014;348:g1687) which contains an explanation and elaboration for each item.

* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

APÊNDICE D – ARTIGO 4: EFFECTIVENESS OF AN 8-WEEK NECK EXERCISE TRAINING ON NECK DISABILITY AND FUNCTION OF PATIENTS WITH JAW CHRONIC PAIN: A RANDOMIZED CONTROLLED TRIAL. (ARTIGO EM FASE DE SUBMISSÃO)

Effectiveness of an 8-week neck exercise training on disability, range of motion and motor control of the neck in patients with jaw chronic pain: a randomized controlled trial.

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Abstract

Objective: to test the effectiveness of an 8-week exercise program targeted to the neck muscles compared to manual therapy, and placebo treatments on neck disability, neck range of motion (ROM), cranio-cervical motor control with the cranio-cervical flexion test (CCFT), and cinesiofobia level in patients with temporomandibular disorders (TMD).

Methods: This was a double-blinded randomized controlled trial. It was included fifty-four women between 18 to 45 years old with diagnosis of masticatory myofascial pain or mixed TMD according to the Research Diagnostic Criteria for TMD (RDC/TMD). All patients were evaluated with the Neck Disability Index (NDI), Neck ROM with CROM® device, cranio-cervical motor control with the CCFT, and cinesiofobia level with Tampa Scale at baseline, immediately after the end of treatment, four (one-month follow) and twelve (three-months follow-up) weeks after the end of the treatment. Participants were equally randomized into three groups: Neck motor control Training Group (NTG), Manual Therapy Group (MTG), and Placebo Group (PG). For all outcomes a mixed ANOVA with repeated measures was conducted and a Bonferroni post hoc test was applied. All results were performed based on intention-to-treat analyses.

Results: NTG was better than PG group on neck disability, right and left FRT at the end of treatment and three-months follow-up (ES >0.7). For global neck ROM, the MTG was better than PG in almost all movements at the end of treatment. For CCFT the NTG was better than the MTG and PG in all evaluations period (ES >0.8). No differences were found between groups regards to cinesiofobia.

Conclusion: Neck motor control exercises were effective to improve neck disability, upper cervical mobility and neck motor control, but not general neck ROM in women with TMD. While the manual therapy treatment was effective to improve almost all neck movements compared to placebo treatment. (Words: 299)

Introduction

Temporomandibular disfunction (TMD) is a multifactorial syndrome predominant in adults' women that affects the masticatory muscles and temporomandibular joint. (Riley and Gilbert 2001, Bevilaqua-Grossi, Chaves et al. 2006, de Oliveira, Dias et al. 2006) Patients with myogenic or mixed TMD commonly present persistent pain, allodynia and hyperalgesia, sometimes extending to distant regions of the face, demonstrating abnormal central nervous system function similar to other chronic painful conditions.(Sarlani and Greenspan 2003, Sarlani and Greenspan 2005, Fernandez-de-las-Penas, Galan-del-Rio et al. 2009) Moreover, cognitive (Sarlani and Greenspan 2005, Grossi, Goldberg et al. 2008) and motor (Grossi, Goldberg et al. 2008, Armijo-Olivo, Silvestre et al. 2012) dysfunction was observed in this population, which may be related to the abnormal activity of the brain regions associated with these functions. (Younger, Shen et al. 2010, Gerstner, Ichesco et al. 2011, Moayedi, Weissman-Fogel et al. 2011, Ichesco, Quintero et al. 2012)

Due to the anatomical proximity, neuronal interconnections and the convergence entries between the cervical and trigeminal areas, (Sessle 1999, Arendt-Nielsen and Svensson 2001) commonly patients with TMD present pain and disability in neck region. People with myofascial masticatory pain have greater neck disability and lower pain pressure threshold values on neck muscles when compared to people without TMD. In addition, there is a negative correlation between myogenic TMD and sensitivity of the masticatory and cervical muscles, and a negative correlation between self-reported neck disability and pain pressure threshold of the temporalis anterior, sternocleidomastoid (SCM) and upper trapezius muscles in patient with TMD. (da Costa, de Lima Ferreira et al. 2015) Also, these patients present reduced activation of the deep neck muscles, and higher electromyographic activity (EMG) in the SCM and anterior scalene muscles for all conditions of the cranio-cervical flexion test (CCFT) when compared to healthy individuals, demonstrating an abnormal muscle contraction pattern. This abnormal pattern may occur due to the contraction of superficial neck flexor muscles as a compensation since the deep cervical flexor muscles have a reduced or impaired activity. (Falla, Jull et al. 2003, Armijo-Olivo and Magee 2013) Also, individuals with TMD present less endurance of the neck flexor and extensor muscles in isometry contraction. (Armijo-Olivo and Magee 2013)

Motor control changes along with reduced ability to relax the neck muscles, prolonged muscle activity, and consecutive voluntary contractions may compromise neck motor control and consequently lead to pain and dysfunction in the cervical segment in patients with TMD. In addition, the loss of selective activation, the inhibition of certain muscles that perform synergistic action, and muscle weakness lead to further changes in neuromuscular activation patterns causing loss of stability and early fatigue, which results in loss of motor control of the cervical system. (Armijo-Olivo and Magee 2013)

Because TMD is commonly associated with other conditions affecting the head and neck region, such as headache, pain and cervical muscle dysfunction, physiotherapeutic treatment has focused on improving cranio-cervical muscle balance through the use of neck exercises. (Armijo-Olivo and Magee 2013) Interventions including postural correction exercises for head and neck and therapeutic exercises for masticatory and/or cervical muscles can be effective in relieving musculoskeletal pain, improving oral function, strength, coordination, endurance, mobility, stability, and neck motor control. (Wright, Domenech et al. 2000, Guarda-Nardini, Stecco et al. 2012, Armijo-Olivo, Pitance et al. 2016)

Furthermore, the literature evidence points out that maladaptive changes in the motor cortex can be improved after specific physical training through motor control exercises, cognitive practice, (Apkarian, Hashmi et al. 2011) strength and endurance training, as well as visual feedback. (Lin 2014, Kregel, Meeus et al. 2015) Thus, biofeedback could be used as a strategy to target cortical changes in individuals with clinical conditions and the effectiveness should be further investigated, especially in the early stages of rehabilitation (2-8 weeks). (Falla, Lindstrom et al. 2013, Lin 2014)

In this context, an 8-week specific and progressive physical training program focused on neck motor control, improved neck muscle activity and reduced pain intensity in patients with chronic neck pain. (Jull, Falla et al. 2009, Falla, Lindstrom et al. 2013) This treatment are based on the theory that in healthy individuals, the formation of the new motor skill, has been associated with improvements in task performance and greater representation of muscles trained in the primary motor cortex. (Boudreau, Farina et al. 2010) Several neck exercises have been used to relieve pain and improve motor control of neck muscles. (Jull, Trott et al. 2002, Falla, Lindstrom et al. 2013) Especially deep neck muscle endurance training has been associated with

the facilitation of endogenous analgesia through different mechanisms. As the cranio-cervical flexion exercise, which was designed to emphasize the activation of deep neck flexors muscles and minimize the activation of superficial neck flexors muscles, has the effect of relieving pain and function in patients with chronic neck pain. (Jull, Falla et al. 2009, Falla, Lindstrom et al. 2013, Schomacher, Erlenwein et al. 2015) However none studies evaluated the repercussion of this exercise protocol in the neck region of people with chronic jaw pain.

To our knowledge none of the previous studies have evaluated the effectiveness of a specific motor control exercise treatment for neck muscles in improving neck pain, disability and motor control in patients with TMD. Thus, the first aim of the present study was 1) to determine the effectiveness of an 8-week exercise program targeted to the neck muscles compared to a manual therapy, and placebo treatment on neck disability, in patients with TMD at immediately after the end of treatment, one month follow-up (four weeks after the end of the treatment) and three months follow-up (12 weeks after the end of the treatment).

The secondary objectives were: 2) to determine the effectiveness of an 8-weeks exercise program targeted to the neck muscles compared to a manual therapy, and placebo treatment on neck range of motion (ROM), cranio-cervical motor control with the cranio-cervical flexion test (CCFT), and cinesiofobia level in patients with temporomandibular disorders (TMD) immediately after the end of treatment, one-month follow-up (four weeks after the end of the treatment) and three months follow-up (twelve weeks after the end of the treatment).

It was hypothesized that, after 8-weeks, individuals receiving neck motor control training would significantly improve their neck disability, neck ROM, neck motor control and reduce the cinesiofobia when compared to a placebo treatment. Also, it was hypothesized that neck motor control training would have similar results when compared with manual therapy treatment.

Methods

Study design

This study was a randomized controlled parallel-design double blind trial. The results present here is an important focus on the neck region part of a huge RCT project developed. The blindness was done based on: (1) the assessor, who measured

the clinical-assessed outcomes, did not know about the group allocation; (2) the therapist, did not know the baseline characteristics, and (3) the patients, were unaware of the hypothesis of the study and were instructed to not discuss their allocation group with the other participants. The randomization process was performed by a researcher assistant not involved in the trial recruitment, using a website (www.randomization.com) to provide the random sequence. To ensure the allocation concealment, the same researcher assistant prepared opaque envelopes (sealed and numbered) with the randomization. The participants were equally randomized into three groups: Neck motor control Training Group (NTG), Manual Therapy Group (MTG), and Placebo Group (PG).

The RCT project was approved by the Ethics Committee of the local University prior to data collection (number: 2.131.546), and it was registered in the Brazilian Clinical Trials Register (number: RBR-3fc62c). This trial was reported according to CONSORT guidelines and template for intervention description and replication (TIDieR) checklist and guide.(Hoffmann, Glasziou et al. 2014, Boutron, Altman et al. 2017)

Sample

The recruitment was done from the Department of Dentistry of the Federal University of Pernambuco and the community through announcements in social media and in folders at the University Campus between October 2017 to September 2019.

The inclusion criteria were: (1) women aged between 18 to 45 years old; (2) orofacial pain for at least six months; and (3) diagnosis of masticatory myofascial pain or mixed TMD according to the Research Diagnostic Criteria for TMD (RDC/TMD).(Schiffman, Ohrbach et al. 2014)

The exclusion criteria were: (1) history of neck or facial trauma; (2) history of cervical spine and/or craniofacial surgery; (3) diagnosis of fibromyalgia or rheumatic or neurologic or chronic systemic issues; (4) mental illness; (5) orthodontic treatment ongoing or completed in less than six months; or (6) participants who had been using occlusal splints or regular medication or treated by physiotherapist for less than six months. An experienced clinician determined the eligibility of the subjects and used the standardized forms from the RDC/TMD to evaluate the patients.

Sample size calculation: The Sample size was determined using the Gpower software, based on the primary outcome of the whole project that was orofacial pain intensity (analyzed by a Visual Analog Scale (VAS) 100-mm). This calculation was based on a pilot study conducted by our team. Based on the estimates of the effect size (mean difference) of 26 (SD 8.3; ES = 1.4) mm between active groups (NTG and MTG) compare to PG on VAS, an $\alpha = 0.05$; and $\beta = 80\%$, 54 participants were needed in total.

All clinical outcomes were collected by two assessors who were blinded to the treatment allocation, at baseline, after 6 weeks at the beginning of treatment (Partial evaluation), at the end of treatment (Final evaluation), four weeks (one-month follow-up) and 12 weeks (three-months follow-up) after the end of treatment for all groups. The primary outcome measure was neck disability measured with the Neck Disability Index (NDI) and the secondaries outcomes were neck upper and global range of motion (ROM), neck motor control measure with the CCFT and cinesiofobia. All evaluation procedures and treatment were realized in the Learning and Motor Control Laboratory at Physiotherapy Department of Federal University of Pernambuco.

Demographic data including age, weight, and height, body mass index (BMI), TMJ pain, difficulty to feeding and headache pain intensity by Visual Analog Scale was collected for all subjects. In addition, the following outcomes were collected:

Neck disability

Neck disability was assessed using the Neck Disability Index (NDI). The NDI is a self-applicable questionnaire, translated and validated into Brazilian Portuguese, which consists of 10 questions related to disability and pain in the neck region. Each item can receive a score from 0 to 5 (0 = no pain or disability and 5 = pain or total disability), and the sum of the scores determines the degree of disability. More specifically, higher scores imply higher disability. The interpretation of scores will be: 0-4 = no disability; 5-14 = mild disability; 15-24 = moderate disability; 25-34 = severe disability; over 34 = complete disability. (Ackelman and Lindgren 2002, Cook, Richardson et al. 2006)

Cranio-cervical flexion test (neck motor control)

The performance of the deep neck flexor muscles was evaluated through the cranio-cervical flexion test (CCFT). CCFT consists of a cranio-cervical flexion

movement (nod movement), which combines the action of flexion on the cranio-cervical joint performed by the long head muscles bilaterally. (Armijo-Olivo, Silvestre et al. 2011) During the test the participants remained in a relaxed supine position with the knees flexed and the head and neck in an intermediate position (i.e. neutral position, no flexion or extension). The participant performed the nod movement in 5 progressive stages of increasing pressure by 2 mmHg (22, 24, 26, 28, and 30 mmHg) with a visual feedback pressure device under the occipital bone (Biofeedback Stabilizer Pressure; Chattanooga, Hixson, TN, USA). Participants were instructed to perform the cranio-cervical flexion movement in a slow and controlled manner until the requested target pressure levels were reached and to maintain a constant pressure at each target level for 10 seconds. The procedure was repeated two times at each level, with a rest period of 60 seconds between repetitions to avoid the fatigue effects. (Armijo-Olivo, Silvestre et al. 2011) The latest level that the patient performed the movement successfully was noted by the evaluator.

Cervical range of motion

The measurement of neck mobility was evaluated by the CROM® instrument, which has reliability and validity for clinical use, (Oliveira-Souza, Carvalho et al. 2020) with ICC values for all measurements of neck ROM from 0.73 (0.22 - 0.90) for flexion movement to 0.94 (0.87 - 0.97) for extension movement. Standard measurement error (EPM) ranges from 2° to 5° while the minimum detectable difference (MDD) ranges from 6° to 14° in healthy volunteers. In addition, CROM® has better reliability than conventional goniometer and inclinometer. (Tousignant, Smeesters et al. 2006) During the assessment of neck ROM with the CROM® device, volunteers remained seated with hip, knee and ankle joints at 90º and upper limbs positioned parallel to the trunk. The CROM® instrument was positioned on the volunteer's head according to the manufacturer's instructions. The volunteer was asked to perform the flexion, extension, lateral flexion and bilateral rotation movements for three times with a 30 second interval between each of the repetitions. The order of the tests was randomized before the volunteer entered the examination room.

Flexion Rotation Test

For the measurement of upper neck mobility (C1-C2), the Flexion Rotation Test (FRT) was used with the CROM® device attached to the volunteer's head. Those individuals who achieved a 10° reduction in FRT in relation to the normal value (44°

rotation for each side) were considered to have a reduction in upper neck mobility, thus values < 34° is considered as upper neck hypomobility. (Oliveira-Souza, Florencio et al. 2019, Oliveira-Souza, Carvalho et al. 2020) The FRT is sufficiently sensitive and accurate to monitor small changes in individual upper neck mobility. The MMD is considered when a change above 10° occurs in the measurement. (Grondin, Hall et al. 2015) During FRT assessment, the individual was positioned in supine position with the head relaxed in the examiner's hands, who performed a maximum passive flexion of the cervical spine and then a passive rotation movement to both right and left sides. (Ogince, Hall et al. 2007, Smith, Hall et al. 2008, Hall, Briffa et al. 2010) The maximum limit of rotation was given when the examiner found resistance to movement or the patient reported pain in the region near the C1-C2 segment. The volunteer was instructed to refer to the word "pain" at the initial moment of the painful sensation. Three measurements were taken with a 30-second interval between them and the final value was the average between the three measurements. The FRT evaluation with CROM® is a reliable measure. (Gugliotti, Tau et al. 2020) The order of the movements was randomized before the patient entered the exam room.

Cinesiofobia

Tampa Cinesiofobia Scale was used to evaluate the cinesiofobia, which consists of a self-administered questionnaire composed of 17 questions addressing pain and intensity of symptoms. The scores vary from one to four points, and the answer "totally disagree" is equivalent to one point, "partially disagree" to two points, "partially agree, three points and "totally agree" to four points. To obtain the final total score it is necessary to invert the scores of questions 4, 8, 12 and 16. The final score can be at least 17 and at most 68 points, and the higher the score, the higher the degree of cinesiofobia.

Treatment

This study had three groups: two active treatment (cervical training and manual therapy) groups and one control (placebo) group. As described below.

Neck Motor Control Training Group (NTG)

Participants of the NTG performed an 8-week exercises program (specific and progressive) to the flexor and extensors neck muscles as described in the protocol by

Falla et al.(Jull, Falla et al. 2009, Falla, Lindstrom et al. 2013) The duration of the treatment was 8 weeks in which the patient had one individually supervised session per week, totaling eight sessions. In each session the physiotherapist made the appropriate individual progressions of treatment. The 8-weeks program was divided into two phases:

Phase 1

The aim of the phase one was to train the deep neck flexors and extensors muscles with low-load exercises. So, two exercises were done during the first six weeks of treatment.

Deep neck flexors muscles training:

In this training the craniocervical flexion movement was guided by a visual pressure feedback (Pressure Biofeedback Stabilizer; Chattanooga, Hixson, TN, EUA), placed under the occipital bone. The participant was required to perform a short craniocervical flexion movement (nodding movement: “yes”), and to maintain it for 10 seconds, with 10 repetitions and 10 seconds of rest between them, totalizing 190 second per repetition. The exercise started with the tool inflated initially at 20 mmHg, and the patient progressed the exercise during five stages of 2 mmHg of increment each, reaching a maximum pressure of 30 mmHg, based on the Stabilizer tool. The participant was instructed to do the contraction slowly and smoothly, not allowing retraction or lifting the head from the bed and avoiding the co-contraction of SCM and scalene muscles. The number of repetitions and series were adapted individually, ensuring that the patient did the exercises without pain or discomfort. When possible, subjects started the exercises with a minimum of two series of 10 repetitions, and they could progress until 3 series of 10 repetitions.

Deep neck extensors muscles training:

For the deep extensor neck muscles training the participants performed movements of cranio-cervical extension, flexion and rotation in prone position on elbows at 90º, with neutral neck position according to Falla et al.’s protocol. The patients should to do all movement (cranio-cervical extension, flexion and rotation) holding for three seconds each. The patients started the exercises with a minimum of one series of 10 repetitions of three seconds each. The final aim was to evolve until 3 series of 15 repetitions. When more than one series were done, there was a rest period

of 2 minutes between series. The number of repetitions and series were adapted individually, ensuring that they did the exercises without pain or discomfort.

Phase 2

The second phase lasted two weeks and had two strengthening exercises to the neck muscles, using the head weight as a load. The first exercise consisted on strengthening the neck flexor muscles. Subjects were in supine position and they were instructed to perform a cranio-cervical flexion followed by a cervical flexion raising the head of the bed. The second exercise consisted of strengthening the cervical extensors muscles. Patients were in a 4-knee prone position maintaining the craniocervical region in a neutral position, while they were instructed to do a cervical extension movement. The patients started the exercises with a minimum of one series of 10 repetitions of three seconds each. The goal was to evolve until 3 series of 15 repetitions. When more than one series were done, there was an interval of 2 minutes between series. The number of repetitions and series were adapted individually, ensuring that the patient did the exercises without pain or discomfort.

All Phases

Besides the supervised care sessions, the patients were instructed to perform home exercises one time per day, for eight weeks during all treatment. The home exercises duration was between 15 to 20 minutes per day and should be done without pain or discomfort in the jaw, masticatory muscles or neck. For the deep neck flexors muscles training the subjects were instructed to use a towel roll in the occipital area to provide a sensorial feedback to perform the craniocervical flexion movement.

Although, all patients followed a general exercises program, the level and the repetitions of each exercise were adapted individually, ensuring that the patient did the exercises without pain or discomfort. When possible, subjects started the exercises with a minimum of two series of 10 repetitions, and the progress was added based on the patient response to the treatment, until three series of 10 repetitions each. The treatment was done by an experienced physiotherapist in the area of orofacial pain (six years of experience), who did take not part in recruitment and evaluation phases.

Manual Therapy Group (MTG)

Patients assigned to manual therapy received the following techniques:

(1) Myofascial release to neck muscles:

It was applied in upper trapezius, sternocleidomastoid (SCM), anterior scalene, and suboccipital muscles, bilateral for 10 minutes. This technique consisted of a guided low load, long duration mechanical forces to manipulate the myofascial complex.(Ajimsha, Al-Mudahka et al. 2015, Laimi, Makila et al. 2018)

(2) Postero-anterior and latero-lateral articular mobilizations:

It was applied the I and II levels cervical vertebrae mobilization according to Maitland technique, (Gross, Miller et al. 2010, Hengeveld 2010) with objective just to relief pain. The most painful four segments during the treatment were mobilized. Three series of ten mobilization movements were performed in each painful segment.

(3) Stretching:

It was applied stretching techniques to the neck muscles in the cervical lateral flexion, cervical flexion, cervical flexion with rotation, and cervical extension postures. The number of repetitions could vary between at least 2 series of 30 seconds to a maximum of 3 series of 30 seconds each. The number of series was decided based on the patient´s capacity to perform it.

(4) Home exercises:

Self-massage with cycling movements in the neck muscles and hot pads for 20 minutes.

Self-stretching of neck muscles in cervical lateral flexion, cervical flexion, cervical flexion with rotation, and cervical extension postures. The number of series was determined by the physiotherapist during the previous treatment session.

As the other treatment, this treatment was done one time per week for eight weeks, during approximately 30 minutes, the time of the session could vary between 30-45 minutes depending on the patient’s necessity. The treatment was done by the same experienced physiotherapist of the other groups.

Placebo Group (PG)

The patients in this group received a placebo treatment. To provide a credible placebo treatment a turned-off therapeutic ultrasound – US (Quark®, *Pro Seven* 977) machine was used. Subjects were not aware of the placebo intervention. Two minutes of turned-off US were applied to the following muscles: SCM, upper trapezius and splenius, bilaterally with one-minute interval between them, one time per week, for eight weeks. The patients in this group did any exercise at home. The treatment was done by the same experienced physiotherapist of the other groups.

Co-interventions for all groups: Participants were required to refrain from other types of treatments for TMD pain during this treatment phase, including medication. The patients were instructed to inform the physiotherapist if she received any type of treatment during the trial. However, in this study no patient referred that she received other type of treatment.

Study follow-up

All clinical outcomes were collected by two assessors who were blinded to the treatment groups. All patients were evaluated at the beginning of treatment, after six weeks of the beginning of treatment (Partial evaluation), immediately at the end of the treatment (Final evaluation) one-month follow-up (four weeks after the end of the treatment), and three-months follow-up (twelve weeks after the end of the treatment).

Compliance with treatment

Participants were treated in the clinic, and they were motivated to perform home exercises. The compliance with treatment in the clinic where assessed based on the attendance to session, which was registered in a therapist diary. To control the compliance with treatment at home, the patients were asked to perform the exercises that they had done at home before the beginning of each session, so the therapist would control whether she had progressed (confirming if she did the home exercises) or regressed (confirming if she did not the home exercises on a regular basis).

Statistical analyses

To test the data distribution, the histograms and Kolmogorov-Smirnov test were applied. The primary and secondary outcomes were considered to be normally distributed and were described in terms of their means and standard deviations (SD).

In order to characterize the sample, the demographic data were compared between groups. To compare the normally distributed data (age, body mass index (BMI), orofacial pain, and headache pain intensity) the ANOVA test with Post hoc of Bonferroni was applied. And to analyze the dichotomous variables (presence of TMJ pain, difficulty to feeding and presence of headache) a chi-square (X^2) test was used.

In order to answer the primary outcome (neck disability index) and secondaries outcomes (upper and global neck ROM, CCFT and cinesiofobia outcomes) aims, a mixed ANOVA with repeated measure was conducted. The within-units were refereed to time (baseline, partial (after six weeks of the beginning of treatment) final (immediately after the end of treatment), one-month follow-up (four weeks after the end of treatment), and three-month follow-up (12 weeks after the end of treatment), indicating the difference in the same group over time, and for between-units the factors were treatment groups (NTG, MTG and PG), indicating the differences between groups over time. In case of significant interaction between factors, the Bonferroni Post hoc test was applied to verify where the differences occurred.

All results were performed based on intention-to-treat analyses, with the model-based imputation, which is usually fitted to the individuals with the observed outcome and used to predict the unobserved outcomes. In this case all subjects was analyzed according to the group which they were allocated, including the dropouts. To determine the effect sizes (ES) between-groups, the Cohen´s *d* index was calculated for all outcomes. And it was considered: ES greater than 0.8 was large ES; ES greater than 0.5 was moderate ES, and ES less than 0.2 was small ES. All data were analyzed with the SSPS software and R Software.

Results

In total 153 volunteers were recruited, however just fifty-four was included based on the inclusion criteria. Two patients dropout of final evaluation, one of the NTG and other from MTG, for personal reasons, not related to the study protocol. The flowchart (figure 1) presented the sample distribution. No differences between groups were

identified at the majority of baseline measures, with the exception of NDI (MTG presented a higher score than PG), right and left lateral flexion and left rotation (NTG presented higher ROM than PG). All demographic data were presented in Table 1 and detail information about the measures in Tables 2 and 3.

Any participant has not done co-intervention and did not reported any type of adverse events. Considering all volunteers, in total was offered 144 sessions per group. In the NTG the patients attended in 95.8% of sessions, in the MTG they attended in 88.2% and in the PG, they attended in 91% of sessions.

Primary outcome

The neck disability index had a significant within-group interaction ($F_{3,153}$=10.9, $p < 0.0001$). And the post hoc analysis showed that just NTG improved NDI over time, until the three-months follow-up compared to the baseline measure. Also, there was a significant difference between-groups ($F_{2,51}$=3.64, $p = 0.033$) regards NTG and PG groups at the final evaluation and three-months follow-up, with a large ES (0.8 [CI95%= 0.1, 1.5]), favoring the intervention group, and the MTG presented a reduced value compared to the PG at the end of the treatment with a large ES (0.9 [CI95%= 0.2, 1.5]) (Table 2).

Secondaries outcomes

Cervical ROM

Cervical flexion and extension

There were no important interactions within-groups regards to neck flexion ($F_{2,204}$= 4.05, $p = 0.03$) and extension ($F_{4,204}$= 4.44, $p = 0.02$). However, between-subjects an interaction was found for flexion movement ($F_{2,51}$= 3.06, $p = 0.05$), where the MTG was better than NTG on partial, final and at three-months follow-up with a large ES (>0.7). But no interactions in neck extension evaluation ($F_{2,51}$= 0.133, $p = 0.875$) occurred (Table 2).

Right and left lateral flexion

No interactions were found within-groups in right ($F_{4,204}$= 0.72, $p = 0.580$) and left ($F_{4,204}$= 0.81, $p = 0.516$) lateral flexion movement. On the oppositive way interactions was found between-groups comparison for right ($F_{2,51}$= 2.9, $p = 0.06$) and left ($F_{2,51}$= 4.23, $p = 0.02$) lateral flexion movement. In a post hoc analyze the MTG presented a

better right lateral flexion than PG at the partial and one-month follow-up evaluations, with a large ES (>0.7). While for left lateral flexion the NTG was better than PG at the partial, one-month and three-month follow-ups evaluation, while the MTG was just better than PG at the partial evaluation not maintained over time.

Right and left rotation

No interactions were found within-groups in right ($F_{4,204}$= 1.01, p = 0.399) and left ($F_{4,204}$= 0.31, p = 0.871) cervical rotation. For the between comparison no interactions were found in the right rotation ($F_{2,51}$= 1.92, p = 0.157), while for the left rotation the interaction occurred ($F_{2,51}$= 5.32, p = 0.008). The post hoc analyze showed that the NTG had better ROM than PG at the final and one-month follow-up evaluation, and the MTG had better left rotation ROM at the partial, final and one-month follow-up periods with a large ES (>0.8).

FRT

It was found within-groups interaction for right FRT ($F_{4,204}$= 9.42, p < 0.0001). The right FRT improved at the end of treatment and one-month follow-up in CTG and MTG, but not in PG. However, just NTG have improved the right FRT at three-months follow-up. Regards to the left FRT just the NTG improved over time related to the baseline period. On between-groups analyses interaction was found in right FRT ($F_{2,51}$= 3.02, p = 0.05). For the right FRT the NTG was better than PG at the end of treatment, one-month and three-months follow-up, with a large ES (>0.7), while the MTG was better than PG just at the final evaluation with a large ES (>0.8). And for left FRT the NTG and MTG were higher than PG at the end of treatment, one-month and three-months follow-up, with a large ES (>0.7) (Table 2).

Motor control evaluation (CCFT)

Interactions were found either for within ($F_{4,204}$= 14.71, p < 0.0001) and between groups ($F_{2,51}$= 22.68, p < 0.0001) analyses. NTG have improved the neck motor control over time until the three-months follow-up. And It was better in all evaluation period compared to MTG and PG, with a large ES (>0.8).

Cinesiofobia

The cinesiofobia showed an interaction within-group ($F_{3,153}$= 10.7, p < 0.0001) at the end of treatment for NTG and MTG, and at three-months follow-up just on the

CTG. Having no differences over time for the PG. Regards to between-groups no interaction was found ($F_{2,51}$= 1.76, p = 0.182) (Table 2).

Discussion

The exercise program focused on neck motor control training for 8 weeks was effective to neck disability, upper cervical mobility and neck motor control, but not general neck ROM and cinesiofobia in women with TMD, compared to a placebo treatment. Neck motor control training was similar to manual therapy protocol to improve upper cervical mobility, and better than a placebo treatment. Also, the manual therapy treatment was better than placebo to improve almost all general neck ROM. Thus, the hypothesis of the study was therefore partially confirmed.

Neck disability

In the present study the neck disability improved in a short and long term after the motor control exercise when compared to placebo treatment. Until now, no study has evaluated the effect of treatment on neck region to improve neck disability in patients with TMD. However, when the same neck motor control protocol was applied in people with chronic neck pain similar results were found. Thus, this protocol could be very useful for patients with TMD since they normally present high degrees of neck disability, and it was found a strong correlation between neck disability and jaw disability (r = 0.82). (Armijo-Olivo and Magee 2013) Also, the neck disability is associated with lower pain pressure threshold in masticatory muscles which could reflect on primary hyperalgesia and contributing to the TMD pain. (da Costa, de Lima Ferreira et al. 2015)

The patients treated with neck motor control exercise and manual therapy reduced approximately fourteen and thirteen points respectively in NDI after treatment compared to a placebo group, which is considered a clinically important difference since a reduction of five points on the NDI has been determined as a clinically relevant change for neck pain. (MacDermid, Walton et al. 2009) So this treatment should be considered in a clinical practice to improve neck disability in patients with jaw pain.

Upper cervical mobility

Both motor control exercise group and manual therapy group improved the upper cervical mobility in a short- and long-term follow-up compared to a placebo treatment, with no differences between the treated groups. The difference at the end of the treatment was considered clinically significant since the values were superior to the smallest detectable change established for healthy people (right FRT = 4.8º and left FRT = 4.2º)(Satpute, Nalband et al. 2019) and for people with migraine (right FRT = 7.2º and left FRT = 7.9º) (Oliveira-Souza, Carvalho et al. 2020), unfortunately until now none values were established specifically for patients with jaw pain.

This result should be considered in the clinical practice since the patients with chronic jaw pain present more restriction in the upper cervical region, (Greenbaum, Dvir et al. 2017, Ferreira, Waisberg et al. 2019) with a higher prevalence of positive FRT between patients with TMD (90%) compare to a people without jaw pain (5%). (Greenbaum, Dvir et al. 2017) In a previous study with patients with cervicogenic headache, it was found that a combination of cervical and jaw treatment had beneficial effects over usual care alone for upper cervical neck mobility.(La Touche, Paris-Alemany et al. 2013)

Neck ROM

Regards to neck global range of motion the results occurred in a different way. The manual therapy group presented better results than placebo group in almost all neck movements (lateral flexion, and rotation) in short- and long-term evaluation. While the neck motor control exercise just improves the left lateral flexion and rotation movements compared to placebo. Also, the manual therapy was statistically better than neck motor control treatment to improve neck flexion range of motion in short- and long- term measure, however just the short-term evaluation (MD between-group = -10.6 [CI95% -17.3, -3.9) presented clinical significance, based on the SDC (flexion = 9.6º) for flexion in people with neck pain. Regards to the other movements and comparison just the manual therapy group presented a clinical significance on the left lateral flexion compared to the placebo treatment in partial, final and 4-weeks follow-up considering the SDC of 6.7º for left lateral flexion in people with neck pain. (Fletcher and Bandy 2008)

A previous study found positive effects of cervical therapy associated with orofacial techniques to improve neck range of motion in patients with cervicogenic headache. Similar to our results since the best improvement occurred on flexion and lateral flexion movements. (von Piekartz and Hall 2013) It is discussed in literature that manual therapy has hypoalgesic effects further away from the segment to which it was applied, thus probably the manual therapy has a general central or at least supramedullar effect. (La Touche, Paris-Alemany et al. 2013) Previous studies have investigated the cervical range of motion in patients with TMD. In general, the patients present a reduced range of motion,(Armijo-Olivo and Magee 2013, da Costa, de Lima Ferreira et al. 2015, Grondin, Hall et al. 2015, Ferreira, Waisberg et al. 2019) which implies in the muscles behavior of the all cranio-cervical complex. For this, to apply a treatment directly to the neck region in patient with jaw pain, should be recommended.

Neck motor control

As expected, the patients in the motor control group improved the neck motor control compared to other both groups. Unfortunately, no study has investigated the motor control activity in patients with jaw pain after a treatment, but our results are consistent with the results from previous studies with neck pain population. (Jull, Falla et al. 2009, Falla, Lindstrom et al. 2013) Commonly, patients with TMD present dysfunctions in neck muscles activity, with high activity of the superficial neck muscles and reduced activity of the deep neck muscles, which might reflect in the hole activity of the cranio-cervical complex. (Falla, Jull et al. 2003, Armijo-Olivo, Fuentes et al. 2010, Armijo-Olivo, Silvestre et al. 2011, Armijo-Olivo, Silvestre et al. 2012)

The motor control protocol chosen by this study has the objective of restoring motor control of the neck muscles. With this training it is possible to improve the task performance and increase the representation of the trained musculature in the primary motor cortex. (Boudreau, Farina et al. 2010) As confirmed by Falla et al (2013) using the same protocol in patients with neck pain, at the end of the treatment the patients present a resembled pattern of neck muscle activity that of an asymptomatic individual. (Falla, Lindstrom et al. 2013)

Cinesiofobia

No differences were observed between-group comparison after the treatment, which is accordance with previous studies that treated patients with migraine, jaw and

neck pain with manual therapy protocol. They found that the manual therapy was not effective in reducing fear of movement. And it was suggested that other types of therapy such as therapeutic education, graduated exposure, and graded activity could have better results for cinesiofobia. (Lopez-Lopez, Alonso Perez et al. 2015, Garrigos-Pedron, La Touche et al. 2018)

Although no differences were observed between-group comparison both motor control group and manual therapy group improved the cinesiofobia after long-term follow-up, which means that patients are no longer as afraid of exercise as they were at the beginning of treatment. Probably the between-group difference was not found because generally patients with TMD present similar results as healthy individuals, and just patients with chronic TMD who have more functional problems related to the jaw joint suffered a greater degree of fear of movement, (Gil-Martinez, Grande-Alonso et al. 2016, Gil-Martinez, Navarro-Fernandez et al. 2017) which was not the case of the present study since the patients had more impairment on the muscles than in the jaw joint.

Strengths and limitations

To our knowledge this is the first study that explored the neck disorders after a cervical training motor control alone in patients with TMD. This is a well-designed clinical trial following the blinding, randomization and comparison (with placebo group) requirements. Also, the data analysis was done based on the Intention to Treat analysis which make the results more accurate. So, the results from this trial could be useful for the clinical practice in order to reinforce the importance of apply a neck exercise protocol to treat patients with chronic jaw pain.

However, this study presents some limitation especially regards to the patient recruitment, because it is a convenience sample, and not randomly selected in the population. Also, the sample was just composed by adults' women, which makes it difficult to generalize the data for the general population, especially for elderly and men population. And finally, the authors did not use any kind of diary to control the co-interventions, they just used the self-report information from patients.

Future directions

Regards to these results and limitations, we want to suggest for further studies explore more the relation between chronic jaw pain and cinesiofobia, comparing with other types of interventions. Also, it is suggested that the studies verify the long-term duration of this results in a higher follow-up (at least six months). And, to apply diary in order to check the co-interventions overtime.

Conclusion

Neck motor control exercises were effective to improve neck disability, upper cervical mobility and neck motor control, but not general neck ROM and cinesiofobia in women with TMD. While the manual therapy treatment was effective to improve almost all neck movements compared to placebo treatment. These results provide promising evidence of the use of neck motor control exercises in patients with TMD.

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Figure 1. Study flowchart

712 Figure 1. Study flowchart according to the CONSORT statement

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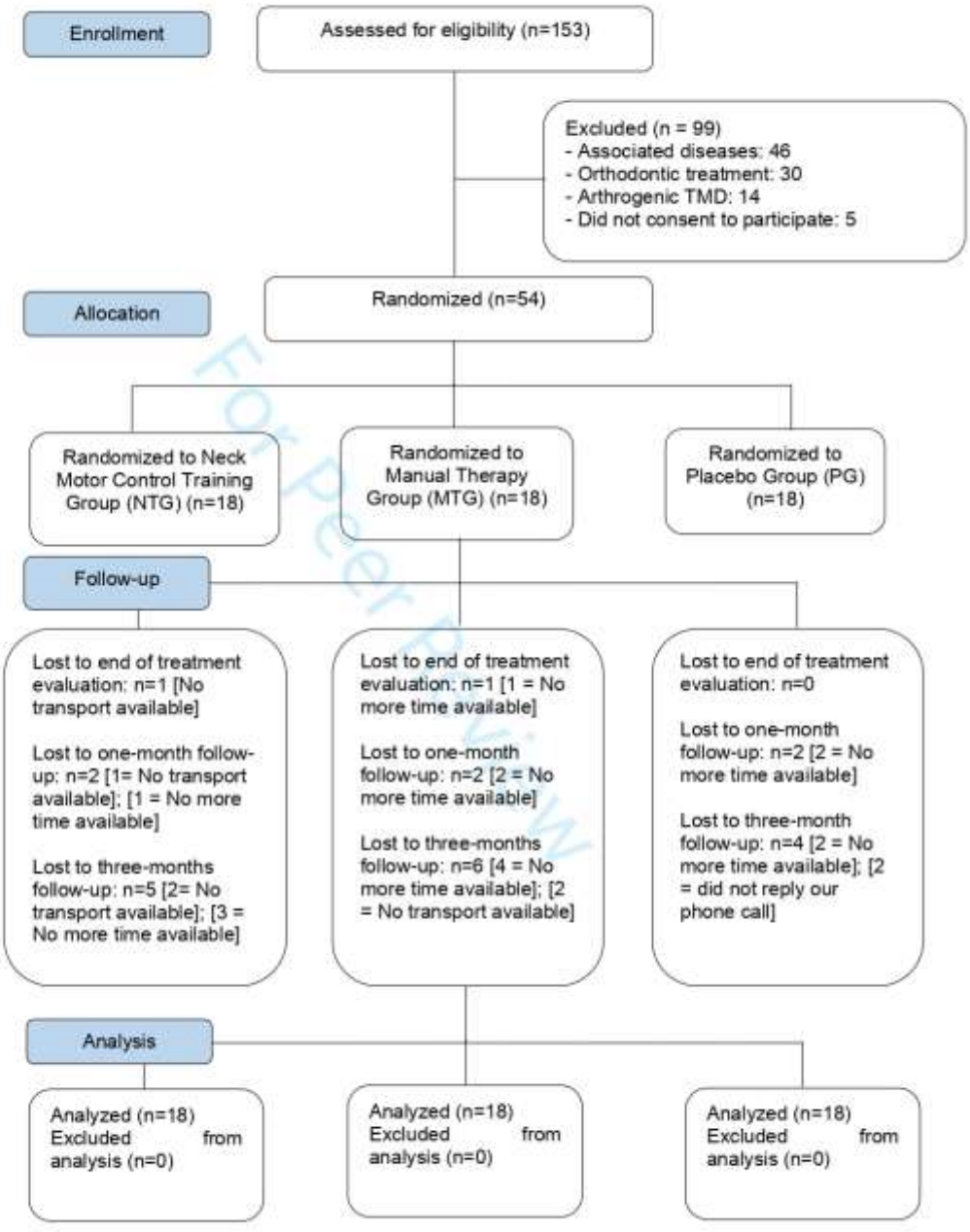

Table 1. Sample Characterization

Outcomes	CTG Mean (SD) CI 95%	MTG Mean (SD) CI 95%	CG Mean (SD) CI 95%	pValue	F
Age	26 (6.7) 22.6; 29.3	31.8 (9.8) 26.9; 36.7	28.8 (10.4) 23.6; 33.9	0.170	1.836
BMI	22.9 (4.4) 20.7; 25	23.5 (4.9) 21; 25.9	23.3 (4.4) 21.1; 25.4	0.916	0.088
Baseline VAS	7.25 (1.7) 6..4; 8.1	6.5 (2.2) 5.4; 7.6	7 (1.6) 6.2; 7.8	0.531	0.641
Headache VAS	7.6 (1.8) 6.7; 8.6	8 (1.9) 6.6; 9.4	8.5 (1.5) 7.5; 8.6	0.381	0.990
	YES/N total (%)	**YES/N total (%)**	**YES/N total (%)**	**pValue**	**X^2**
TMJ pain	17/18 (94.4)	14/18 (77.8)	18/18 (100)	0.057	5.731
Difficulty feeding	11/18 (61.1)	13/18 (77.8)	16/18 (88.9)	0.152	3.765
Headache	15/18 (83.3)	11/18 (61.1)	13/18 (72.2)	0.452	1.587

CTG: cervical training group; MTG: manual therapy group; CG: control group: CI95%: confidence interval; P<0.005; F: ANOVA results; X^2 : Chi-square test

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Outcomes	Groups (n)	Baseline mean (SD)	Final mean (SD)	1st Follow-up mean (SD)	2nd Follow-up mean (SD)	Post hoc - Within-group MD (CI95%))					
						Baseline vs Final	Baseline vs 1st follow-up	Baseline vs 2nd follow-up	Final vs 1st follow-up	Final vs 2nd follow-up	1st follow-up vs 2nd follow-up
NDI	CTG (18)	33 (17.9)	18.7 (16.5)	17.7 (19.3)	16.6 (12.2)	-14.2 * (-25.9, -2.5)	-15.2 * (-27.8, -2.6)	-16.4 * (-28.9, -4)	-1 (-13.2, 11.2)	-2.2 (-12, 7.6)	-1.2 (-12.2, 9.8)
	MTG (18)	28.9 (15.3)	19.3 (13.3)	17.7 (22.4)	20.4 (21.6)	-9.6 (-19.3, 0.1)	-11.2 (-24.2, 1.8)	-8.5 (-21.2, 4.2)	-1.8 (-14.1, 10.8)	1.1 (-11, 13.2)	2.7 (-12.2, 17.6)
	CG (18)	40.2 (14.2)	32.4 (16.9)	23.3 (16.8)	30 (20)	-7.8 (-25.3, 9.7)	-16.9 (-34.8, 1)	-10.2 (-28.4, 8.03)	-9.1 (-21.2, 3)	-2.4 (-14.9, 10.1)	6.7 (-6.4, 19.8)

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CINESIO	CTG (18)	37 (6.78)	33.31 (6.81)	25.19 (15.23)	29.54 (13.25)	-3.7 (-9, 1.6)	-11.8 * (-19.8, -3.8)	-7.5 * (-14.6, -0.3)	-8.1 (-16.5, 0.3)	-3.8 (-11.4, 3.8)	4.3 (-5.3, 14)
	MTG (18)	40.94 (10.42)	36.78 (7.57)	30.39 (19.27)	35 (12.35)	-4.1 (-10.3, 2)	-10.5 * (-21, -0.01)	-5.9 (-13.7, 1.8)	-6.4 (-16.3, 3.5)	-1.8 (-8.7, 5.1)	4.6 (-6.3, 15.6)
	CG (18)	41.11 (6.65)	36.72 (12.75)	32.89 (17.61)	36.61 (12.25)	-4.4 (-11.3, 2.5)	-8.2 (-17.3, 0.8)	-4.5 (-11.2, 2.2)	-3.8 (-14.2, 6.6)	-0.1 (-8.6, 8.3)	3.7 (-6.5, 14)

POST HOC						POST HOC			
Between-group (MD CI 95%)						Between-group (ES CI 95%)			
	Comparison	Baseline MD (CI 95%)	Final MD (CI 95%)	1st MD (CI 95%)	2nd MD (CI 95%)	Baseline ES (CI 95%)	Final ES (CI 95%)	1st follow-up ES (CI 95%)	2nd follow-up ES (CI 95%)
NDI	CTG vs MTG	-4.1 (-15.4, 7.2)	-0.6 (-10.7, 9.5)	0 (-14.1, 14.1)	-3.8 (-15.7, 8.1)	-0.25 (-0.9, 0.4)	0.1 (-0.6, 0.7)	0 (-0.6, 0.6)	0.2 (-0.4, 0.9)
	CTG vs CG	7.2 (-3.7, 18.1)	-13.7 * (-25, -2.4)	-9.5 (-18.4, 7.4)	-13.4 * (-24.6, -2.2)	0.5 (-0.2, 1.1)	0.8 (0.1, 1.5)	0.3 (-0.4, 0.9)	0.8 (0.1, 1.5)

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	MTG vs CG	11.3 * (1.3, 21.3)	-13.1 * (-23.4, -2.8)	-0.5 (-19.5, 8.5)	-9.6 (-23.7, 4.5)	-0.8 (0.1, 1.4)	0.9 (0.2, 1.5)	0.3 (-0.4, 0.9)	0.5 (-0.2, 1.1)
CINESIO	CTG vs MTG	-3.9 (-9.9, 2)	-3.5 (-9, 2.1)	-5.2 (-17, 6.6)	-5.5 (-14.1, 3.2)	0.4 (-0.2, 1.1)	0.4 (-0.2, 1.1)	0.3 (-0.4, 1)	0.4 (-0.2, 1.1)
	CTG vs CG	-4.1 (-8.7, 0.5)	-3.4 (- 10.8, 4)	-7.7 (-18.8, 3.4)	-7.1 (-15.7, 1.6)	0.6 (-0.1, 1.3)	0.3 (-0.3, 1)	0.5 (-0.2, 1.1)	0.5 (-0.1, 1.2)
	MTG vs CG	-0.2 (-6.1, 5.8)	0.1 (-7, 7.1)	-2.5 (-15, 10)	-1.6 (-9.9, 6.7)	0.1 (-0.6, 0.7)	0 (-0.6, 0.6)	0.1 (-0.5, 0.6)	0.1 (-0.5, 0.8)

Table 2. Mean differences between groups of Neck disability and cinesiofobia.N: number of participants; CTG: Cervical training group; MTG: Manual therapy group; CG: control group; OHRQoL: oral health-related quality of life;

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Outcomes	Groups (n)	Baseline Mean (SD)	Partial Mean (SD)	Final Mean (SD)	1st follow-up Mean (SD)	2nd follow-up Mean (SD)
Right FRT	CTG	28.44 (7.69)	32.04 (7.03)	35.22 (4.4)	34.48 (7.08)	35.15 (7.52)
	MTG	26.22 (7.38)	30.72 (8.8)	34.61 (7.49)	31.72 (6.91)	31.05 (9.1)
	CG	26.61 (7.34)	29.32 (6.16)	29.05 (6.33)	26.98 (7.7)	26.7 (7.28)
Left FRT	CTG	23.5 (5.93)	33.28 (6.42)	33.69 (6.53)	34.68 (6.46)	36.12 (5.84)
	MTG	27.94 (7.8)	30.22 (8.41)	32.56 (7.49)	33.06 (7.77)	31.2 (9.3)
	CG	25.83 (7.76)	29.44 (7.84)	28.02 (6.74)	27.55 (8.16)	20 (7.27)
Flexion	CTG	38.38 (9.11)	40.28 (8.62)	39.8 (9)	40.7 (9.1)	37.4 (8.7)
	MTG	41.22 (9.67)	50.89 (11.1)	47.2 (10.9)	46.4 (8.5)	44.6 (11.1)
	CG	41.72 (10.13)	43.89 (10.5)	41.9 (13.1)	43.7 (10.5)	41.7 (10.7)
Extension	CTG	41.9 (8.6)	45.7 (9.2)	46.2 (8.4)	47.1 (8.8)	46.7 (8.5)
	MTG	43.7 (6.2)	47 (9.2)	47.4 (11.1)	47.7 (8.9)	45.7 (9.6)
	CG	42 (10.8)	47.8 (15.4)	44.8 (12.3)	44.4 (13.4)	45.1 (10.3)
	CTG	35.7 (5.9)	35.1 (5.3)	36.3 (9.2)	35.2 (8.8)	35.8 (8.4)

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Right Lateral Flexion	MTG	34.6 (5.8)	38.5 (8.5)	36.7 (8.4)	36.6 (5.6)	33.4 (5.7)
	CG	31.3 (6.5)	31.9 (6.3)	31.5 (6.5)	30.6 (9.9)	32.9 (8.8)
Left Lateral Flexion	CTG	37.2 (5.2)	37.6 (5.6)	38.1 (6.8)	37.2 (4.8)	39.6 (6)
	MTG	35.5 (6.2)	38.9 (7.4)	36.7 (7.1)	37.5 (6.2)	36.8 (5.9)
	CG	33.1 (6.1)	33.1 (5.5)	34.3 (6.8)	33.3 (6.5)	33.5 (6.9)
Right Rotation	CTG	60.3 (8)	61.5 (6.6)	60.2 (6.8)	61.1 (6.9)	58.4 (7.3)
	MTG	57.7 (9.4)	62.4 (6.9)	61.7 (6.2)	61 (9.1)	60.7 (8.2)
	CG	56.4 (9.6)	58.1 (11.5)	56.9 (9.9)	54.5 (14.8)	56.9 (12.7)
Left Rotation	CTG	61.4 (9.6)	59.1 (8.9)	61.3 (6.8)	61.4 (5.8)	60.3 (6.4)
	MTG	58.2 (7.9)	60.9 (7.4)	60.1 (8.7)	61 (7.3)	59.2 (10.8)
	CG	53 (13)	53.5 (10.4)	52.4 (10.6)	53.9 (8.2)	55.1 (9)
CCFT	CTG	21.4 (1.3)	25.3 (2.9)	25.9 (2)	25.7 (2.5)	25.2 (2.7)
	MTG	20.7 (1)	21.3 (1.4)	22.6 (2.1)	21.3 (1.4)	22.4 (2.4)
	CG	21.7 (2.4)	22.4 (2)	22.9 (2.3)	22.6 (2.4)	22.3 (2.1)
Post hoc *Within-group (MD CI95%)*						

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Outcomes	Comparison	Baseline vs Partial	Baseline vs Final	Baseline vs 1st follow-up	Baseline vs 2nd follow-up	Partial Vs Final	Partial Vs 1st follow-up	Partial Vs 2nd follow-up	Final vs 1st follow-up	Final vs 2nd follow-up	1st vs 2nd follow-up
Right FRT	CTG	3.6 (-1.4, 8.6)	6.6 (2.5, 11)*	6 (1, 11)*	6.7 (1.6, 11.9)*	3.2 (-0.8, 7.1)	2.4 (-2.3, 7.2)	3.1 (-1.6, 8)	-0.7 (-4.7, 3.2)	-0.1 (-4.2, 4.1)	0.7 (-4.3, 5.6)
	MTG	4.5 (-1, 10)	8.4 (3.3, 13.4)*	5.5 (0.6, 10.3)*	4.8 (-0.8, 10.4)	3.9 (-1.6, 9.4)	1 (-4.4, 6.3)	0.3 (-5.7, 6.4)	-2.9 (-7.8, 2)	-3.6 (-9.2, 2.1)	-0.7 (-6.1, 4.8)
	CG	2.7 (-1.9, 7.3)	2.4 (-2.2, 7.1)	2.4 (-2.7, 7.5)	2.1 (-2.9, 7)	-0.3 (-4.5, 4)	-0.3 (-5.1, 4.4)	-0.6 (-5.2, 3.9)	-0.1 (-4.8, 4.7)	-0.3 (-5, 4.3)	-0.3 (-5.3, 4.8)
Left FRT	CTG	9.8 (5.6, 13.9)*	10.2 (6, 14.4)*	11.4 (7.2, 15.6)*	12.6 (8.6, 16.6)*	0.4 (-4, 4.8)	1.6 (-2.8, 6)	2.8 (-1.3, 7)	1.2 (-3.2, 5.6)	2.4 (-1.8, 6.6)	1.2 (-2.9, 5.4)
	MTG	2.3 (-3.2, 7.8)	4.6 (-0.5, 9.8)	5.1 (-0.1, 10.4)	3.3 (-2.5, 9.1)	2.3 (-3, 7.7)	2.8 (-2.6, 8.3)	1 (-5, 7)	0.5 (-4.7, 5.7)	-1.4 (-7.1, 4.3)	-1.9 (-7.7, 3.9)

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	CG	3.6 (-1.7, 8.9)	2.2 (-2.7, 7.1)	1.7 (-3.7, 7.1)	-5.8 (-10.9, -0.7)*	-1.4 (-6.4, 3.5)	-1.9 (-7.3, 3.5)	-9.4 (-14.6, -4.3)*	-0.5 (-5.5, 4.6)	-8 (-12.8, -3.3)*	-7.5 (-12.8, -2.3)*
Flexion	CTG	1.9 (-4.1, 7.9)	1.4 (-4.7, 7.5)	2.3 (-3.8, 8.5)	-1 (-7, 5)	-0.5 (-6.4, 5.5)	0.4 (-5.6, 6.4)	-2.9 (-8.7, 3)	0.9 (-5.2, 7)	-2.4 (-8.4, 3.6)	-3.3 (-9.3, 2.7)
	MTG	9.7 (2.6, 16.7)*	6 (-1, 13)	5.2 (-1, 11.3)	3.4 (-3.7, 10.4)	-3.7 (-11.1, 3.8)	-4.5 (-11.2, 2.2)	-6.3 (-13.6, 1.2)	-0.8 (-7.4, 5.8)	-2.6 (-10, 4.8)	-1.8 (-8.5, 4.9)
	CG	2.2 (-4.8, 9.1)	0.2 (-7.7, 8.1)	2 (-5, 9)	-0.1 (-7.1, 7)	-2 (-10, 6)	-0.2 (-7, 6.9)	-2.2 (-9.4, 5)	1.8 (-6.2, 9.8)	-0.2 (-8.3, 7.9)	-2 (-9.2, 5.2)
Extension	CTG	3.8 (-2.2, 9.8)	4.3 (-1.4, 10)	5.2 (-0.7, 11.1)	4.8 (-1, 10.6)	0.5 (-5.5, 6.5)	-1.4 (-7.7, 7.5)	1 (-5, 7)	0.9 (-4.9, 6.7)	0.5 (-5.2, 6.2)	-0.4 (-6.3, 5.5)
	MTG	3.3 (-2, 8.6)	3.7 (-2.4, 9.8)	4 (-1.2, 9.2)	2 (-3.5, 7.5)	0.4 (-6.5, 7.3)	0.7 (-5.4, 6.8)	-1.3 (7.7, 5.1)	0.3 (-6.5, 7.1)	-1.7 (-8.7, 5.3)	-2 (-8.3, 4.3)
	CG	5.8 (-3.2, 14.8)	2.8 (-5.2, 10.4)	2.4 (-5.8, 10.6)	3.1 (-4, 10.2)	-3.2 (-12.8, 6.2)	-3.4 (-13.2, 6.4)	-2.7 (-11.6, 6.2)	-0.2 (-8.9, 8.5)	0.5 (-7.2, 8.2)	0.7 (-7.4, 8.8)

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Right Lateral Flexion	CTG	-0.8 (-4.4, 3.2)	0.6 (-4.6, 5.8)	-0.5 (-4.8, 3.8)	0.1 (-4.1, 4.3)	1.2 (-3.9, 6.3)	0.1 (-4, 4.2)	0.7 (-3.3, 4.7)	-1.1 (-6.6, 4.4)	-0.5 (-5.9, 4.9)	0.6 (-3.9, 5.1)
	MTG	3.9 (-1, 8.8)	2.1 (-2.8, 7)	-2 (-1.8, 5.8)	-1.2 (-5.1, 2.7)	-1.8 (-7.5, 3.9)	-1.9 (-6.8, 3)	-5.1 (-10, -0.2)*	-0.1 (-4.9, 4.7)	-3.3 (-8.2, 1.6)	-3.2 (-7, 0.6)
	CG	0.6 (-3.7, 4.9)	0.2 (-5.3, 5.7)	-0.7 (-6.4, 5)	1.6 (-3.6, 6.8)	-0.4 (-5.9, 5.1)	-1.3 (-6.9, 4.3)	1 (-4.1, 6.1)	-0.9 (-7.5, 5.7)	1.4 (-4.7, 7.5)	2.3 (-4, 8.6)
Left Lateral Flexion	CTG	0.4 (-3.3, 4.1)	0.9 (-4, 5.8)	0 (-3.3, 3.3)	2.4 (-1.4, 6.2)	0.5 (-4.5, 5.5)	-0.4 (-3.8, 3.1)	2 (-1.9, 5.9)	-0.9 (-5.7, 3.8)	1.5 (-3.6, 6.6)	2.4 (-1.2, 6)
	MTG	3.4 (-1.2, 8)	1.2 (-3.3, 5.7)	2 (-2.2, 6.2)	1.3 (-2.8, 5.4)	-2.2 (-7.1, 2.7)	-1.4 (-6, 3.2)	-2.1 (-6.6, 2.4)	0.8 (-3.7, 5.3)	0.1 (-4.3, 4.5)	-0.7 (-4.8, 3.4)
	CG	0 (-3.9, 3.9)	1.2 (-3.2, 5.6)	0.2 (-4.1, 4.5)	0.4 (-4, 4.8)	1.2 (-3, 5.4)	0.2 (-3.9, 4.3)	0.4 (-3.8, 4.6)	-1 (-5.5, 3.5)	-0.6 (-5.4, 3.8)	0.2 (-4.3, 4.7)
Right Rotation	CTG	1.2 (-3.8, 6.2)	-0.1 (-5.8, 5.6)	0.8 (-4.3, 5.9)	-0.9 (-6.1, 4.3)	-1.3 (-6.6, 4)	-0.4 (-5, 4.2)	-2.1 (-6.8, 2.6)	0.9 (-4.5, 6.2)	-0.6 (-6.3, 4.7)	-1.7 (-6.5, 3.1)

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	MTG	4.7 (-0.9, 10.3)	4 (-1.4, 9.4)	3.3 (-3, 9.6)	3 (-3, 9)	-0.7 (-5.1, 3.7)	-1.4 (-6.9, 4.1)	-1.7 (-6.8, 3.4)	-0.7 (-6, 4.6)	-1 (-5.9, 3.9)	-0.3 (-6.2, 5.6)
	CG	1.7 (-5.5, 8.9)	0.5 (-6.2, 7.2)	-1.9 (-10.4, 6.6)	0.5 (-7.2, 8.2)	-1.2 (-8.5, 6.1)	-0.6 (-12.6, 5.4)	-1.2 (-9.4, 7)	-2.4 (-10.9, 6.1)	0 (-7.7, 7.7)	2.4 (-6.9, 11.7)
Left Rotation	CTG	-2.3 (-9.6, 4)	-0.1 (-5.7, 5.5)	0 (-5.4, 5.4)	-1.1 (-7.2, 5)	2.2 (-3.2, 7.6)	2.3 (-2.8, 7.4)	1.3 (-4.7, 7.1)	0.1 (-4.2, 4.4)	-1 (-6.2, 4.2)	-1.1 (-6, 3.8)
	MTG	2.7 (-2.5, 7.9)	1.9 (-3.7, 7.5)	2.8 (-2.3, 7.9)	1 (-5.4, 7.4)	-0.8 (-6.3, 4.7)	0.1 (-4.9, 5.1)	-1.7 (-6, 4.6)	0.9 (-4.5, 6.3)	-0.9 (-7.5, 5.7)	-1.8 (-8, 4.4)
	CG	0.5 (-7.5, 8.5)	0.6 (-6.6, 7.4)	0.9 (-6.5, 8.3)	2.1 (-5.5, 9.7)	-1.1 (-8.2, 6)	0.4 (-5.9, 6.7)	1.6 (-5, 8.2)	1.5 (-4.9, 7.9)	2.7 (-4, 9.4)	1.2 (-4.6, 7)
CCFT	CTG	3.9 (2.4, 5.4)*	4.5 (3.3, 5.6)*	4.3 (2.9, 5.6)*	3.8 (2.4, 5.2)*	0.6 (-1.1, 2.3)	0.4 (-1.4, 2.2)	-0.1 (-2, 1.8)	-0.2 (-1.7, 1.3)	-0.7 (-2.2, 0.8)	-0.5 (-2.2, 1.2)
	MTG	0.6 (-0.2, 1.4)	1.8 (0.8, 3)*	0.6 (-0.2, 1.4)	1.7 (0.4, 2.9)*	1.3 (0.1, 2.5)	0 (-0.9, 0.9)	1.1 (0.2, 2.4)	-1.3 (-2.5, -0.1)*	-0.2 (-1.7, 1.3)	1.1 (0.2, 2.4)

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	CG	0.7 (-0.8, 2.2)	0.9 (-0.7, 2.5)	0.9 (-0.7, 2.5)	0.6 (-0.9, 2.1)	0.2 (-1.2, 1.7)	0.2 (-1.3, 1.7)	0.1 (-1.5, 1.3)	0 (-1.6, 1.6)	-0.3 (-1.8, 1.2)	-0.3 (-1.8, 1.2)
		Post hoc ***Between-group (MD (CI 95%))***					*Post hoc* ***Between-group (ES (CI 95%))***				
Outcomes	Comparison	**Baseline MD (CI 95%)**	**PARTIAL MD (CI 95%)**	**Final MD (CI 95%)**	**1° MD (CI 95%)**	**2°° MD (CI 95%)**	**Baseline ES (CI 95%)**	**Partial ES (CI 95%)**	**Final ES (CI 95%)**	**1° follow-up ES (CI 95%)**	**2°° follow-up ES (CI 95%)**
Right FRT	CTG vs MTG	2.2 (-2.8, 7.3)	1.3 (-4.1, 6.7)	0.6 (-3.5, 4.8)	2.8 (-2, 7.5)	4.1 (-1.5, 9.7)	0.3 (-0.4, 0.9)	0.2 (-0.5, 0.8)	0.1 (-0.5, 0.7)	0.4 (-0.3, 1)	0.5 (-0.2, 1.1)
	CTG vs CG	1.8 (-3.3, 7)	2.7 (-1.7, 8.2)	6.2 (2.4, 9.9)*	5.5 (0.5, 10.5)*	6.4 (0.8, 12.1)*	0.2 (-0.4, 0.9)	0.4 (-0.3, 1.1)	1.1 (0.4, 1.8)	0.7 (0.1, 1.4)	0.9 (0.2, 1.5)
	MTG vs CG	-0.4 (-5.4, 4.6)	1.4 (-3.7, 8.5)	5.6 (0.9, 10.2)*	2.7 (-2.2, 7.7)	2.3 (-3.8, 8.5)	-0.1 (-0.7, 0.6)	0.2 (-0.5, 0.8)	0.8 (0.1, 1.5)	0.4 (-0.3, 1)	0.3 (-0.4, 0.9)
Left FRT	CTG vs MTG	-4.4 (-9.1, 0.2)	3.1 (-2, 8.1)	1.1 (-3.8, 5.9)	1.8 (-3, 6.7)	4.9 (-0.3, 10.2)	-0.8 (-1.3, 0.1)	0.4 (-0.2, 1.1)	0.2 (-0.5, 0.8)	0.2 (-0.4, 0.9)	0.5 (-0.1, 1.2)

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	CTG vs CG	-2.3 (-7, 2.3)	3.8 (-1, 8.7)	5.7 (1.2, 10.2)*	7.3 (2.3, 12.3)*	16.1 (11.6, 20.6)*	-0.3 (-1, 0.3)	0.5 (-0.1, 1.2)	0.8 (0.2, 1.5)	1 (0.3, 1.7)	2.4 (1.6, 3.3)
	MTG vs CG	2.1 (-3.2, 7.4)	0.8 (-4.7, 6.3)	4.5 (-0.3, 9.4)	5.5 (0.1, 10.9)*	11.2 (5.5, 16.8)*	0.3 (-0.4, 0.9)	0.1 (-0.6, 0.7)	0.6 (-0.1, 1.3)	0.7 (0.02, 1.4)	1.3 (0.6, 2.1)
Flexion	CTG vs MTG	-2.8 (-9.2, 3.5)	-10.6 (-17.3, -3.9)*	-7.4 (-14.1, -0.6)*	-5.7 (-11.7, 0.3)	-7.2 (-13.9, -0.4)*	-0.3 (-0.9, 0.3)	-1.1 (-1.8, -0.4)	-0.7 (-1.4, -0.1)	-0.6 (-1.3, 0)	-0.7 (-1.4, -0.1)
	CTG vs CG	-3.3 (-9.9, 3.2)	-3.6 (-10.1, 2.9)	-2.1 (-9.7, 5.5)	-3 (-9.6, 3.6)	-4.3 (-10.9, 2.3)	-0.3 (-1, 0.3)	-0.4 (-1, 0.3)	-0.2 (-0.8, 0.5)	-0.3 (-1, 0.3)	-0.4 (-1.1, 0.2)
	MTG vs CG	-0.5 (-7.2, 6.2)	7 (-0.3, 14.3)	5.3 (-2.9, 13.5)	2.7 (-3.8, 9.2)	2.9 (-4.5, 10.3)	-0.1 (-0.7, 0.6)	0.6 (0, 1.3)	0.4 (-0.2, 1.1)	0.3 (-0.4, 0.9)	0.3 (-0.4, 0.9)
Extension	CTG vs MTG	-1.8 (-6.9, 3.3)	-1.3 (-7.5, 4.9)	-1.2 (-7.9, 5.5)	-0.6 (-6.6, 5.4)	1 (-5.1, 7.1)	-0.2 (-0.9, 0.4)	0.1 (-0.6, 0.5)	-0.1 (-0.8, 0.5)	-0.1 (-0.7, 0.6)	0.1 (-0.5, 0.8)
	CTG vs CG	-0.1 (-6.7, 6.5)	-2.1 (-10.7, 6.5)	1.6 (-5.5, 8.7)	2.7 (-3, 10.4)	1.6 (-4.8, 8)	-0.01 (-0.7, 0.6)	-0.2 (-0.8, 0.5)	0.1 (-0.5, 0.8)	0.2 (-0.4, 0.9)	0.2 (-0.5, 0.8)

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	MTG vs CG	1.7 (-4.3, 7.7)	-0.8 (-9.4, 7.8)	2.8 (-5.1, 10.7)	3.3 (-4.4, 11)	0.6 (-0.1, 7.3)	0.2 (-0.5, 0.8)	0.1 (-0.7, 0.6)	0.2 (-0.4, 0.9)	0.3 (-0.4, 0.9)	0.1 (-0.6, 0.7)
Right Lateral Flexion	CTG vs MTG	1.1 (-2.9, 5.1)	-3.4 (-8.2, 1.4)	-0.4 (-5.4, 5.6)	-1.4 (-5.5, 2.8)	2.4 (-1.7, 6.5)	0.2 (-0.5, 0.8)	-0.5 (-1.1, 0.2)	-0.04 (-0.7, 0.6)	-0.2 (-0.9, 0.4)	0.4 (-0.3, 1)
	CTG vs CG	4.4 (0.2, 8.6)*	3.2 (-0.7, 7.1)	4.8 (-1.5, 11.1)	4.6 (-1.1, 10.3)	2.9 (-2.2, 8)	0.7 (0, 1.4)	0.5 (-0.1, 1.2)	0.5 (-0.1, 1.2)	0.5 (-0.1, 1.2)	0.4 (-0.3, 1)
	MTG vs CG	3.3 (-0.9, 7.5)	6.8 (1.5, 11.7)*	5.2 (-0.9, 11.3)	6 (0.5, 11.4)*	0.5 (-4.4, 5.4)	0.5 (-0.1, 1.2)	0.9 (0.2, 1.6)	0.6 (-0.1, 1.2)	0.7 (0.1, 1.4)	0.1 (-0.6, 0.7)
Left Lateral Flexion	CTG vs MTG	1.7 (-2.2, 5.6)	-1.3 (-5.7, 3.1)	1.4 (-4, 6.8)	-0.3 (-4, 3.4)	2.6 (-1.2, 6.8)	0.3 (-0.4, 0.9)	-0.2 (-0.8, 0.4)	0.2 (-0.5, 0.8)	-0.1 (-0.7, 0.6)	0.5 (-0.2, 1.1)
	CTG vs CG	4.1 (0.3, 7.9)*	4.5 (-0.7, 9.2)*	3.8 (-1.5, 9.1)	3.9 (0.1, 7.7)*	6.1 (1.7, 10.5)*	0.7 (0, 1.4)	0.8 (0.1, 1.5)	0.5 (-0.2, 1.1)	0.7 (0, 1.4)	0.9 (0.2, 1.6)
	MTG vs CG	2.4 (-1.8, 6.6)	5.8 (1.4, 10.2)*	2.4 (-2.3, 7.1)	4.2 (-0.1, 8.5)	3.3 (-1, 7.6)	0.4 (-0.3, 1)	0.9 (0.2, 1.6)	0.3 (-0.3, 1)	0.7 (0, 1.3)	0.5 (-0.1, 1.2)

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Right Rotation	CTG vs MTG	2.6 (-3.3, 8.5)	-0.9 (-5.5, 3.7)	-1.5 (-6.7, 3.6)	0.1 (-5.4, 5.6)	-1.3 (-6.6, 3.9)	0.3 (-0.3, 0.9)	0.1 (-0.8, 0.5)	-0.2 (-0.8, 0.4)	0 (-0.6, 0.7)	-0.2 (-0.8, 0.5)
	CTG vs CG	3.9 (-2.1, 9.9)	3.4 (-2.9, 9.8)	3.3 (-3, 9.6)	6.6 (-1.2, 14.4)	2.5 (-4.5, 9.5)	0.4 (-0.2, 1.1)	0.4 (-0.3, 1)	0.3 (-0.3, 1)	0.6 (-0.1, 1.2)	0.2 (-0.4, 0.8)
	MTG vs CG	1.3 (-5.2, 7.8)	4.3 (-2.1, 10.7)	4.8 (-0.8, 10.4)	6.5 (-1.8, 14.8)	3.8 (-3.4, 11)	0.1 (-0.5, 0.8)	0.4 (-0.2, 1.1)	0.6 (-0.1, 1.2)	0.5 (-0.1, 1.2)	0.3 (-0.3, 1)
Left Rotation	CTG vs MTG	3.2 (-2.7, 9.1)	-1.8 (-7.3, 3.7)	1.2 (-0.4, 6.5)	0.4 (-4.1, 4.9)	1.1 (-5.4, 7.6)	0.4 (-0.3, 1)	-0.2 (-0.9, 0.4)	0.1 (-0.5, 0.8)	0.1 (-0.6, 0.7)	0.1 (-0.5, 0.8)
	CTG vs CG	8.4 (0.7, 16.1)*	5.6 (-0.9, 12.1)	8.9 (2.9, 14.9)*	7.5 (2.7, 12.3)*	5.2 (-0.7, 11.1)	0.7 (0.1, 1.4)	0.6 (-0.1, 1.2)	1 (0.3, 1.7)	1.1 (0.4, 1.7)	0.6 (-0.1, 1.3)
	MTG vs CG	5.2 (-2.1, 12.5)	7.4 (1.3, 13.5)*	7.7 (1.1, 14.3)*	7.1 (1.8, 12.3)*	4.1 (-2.6, 10.8)	0.5 (-0.2, 1.1)	0.8 (0.1, 1.5)	0.8 (0.1, 1.5)	0.9 (0.2, 1.6)	0.4 (-0.3, 1.1)
CCFT	CTG vs MTG	0.7 (-0.1, 1.5)	4 (2.4, 5.5)*	3.3 (1.9, 4.7)*	4.4 (3, 5.8)*	2.8 (1.1, 4.5)*	0.6 (-0.1, 1.3)	1.7 (1, 2.5)	1.4 (0.7, 2.2)	2.2 (1.4, 3)	1.1 (0.4, 1.8)

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	CTG vs CG	-0.3 (-1.8, 1)	2.9 (1.2, 4.6)*	3.3 (1.8, 4.8)*	3.1 (1.4, 4.8)*	2.9 (1.3, 4.5)*	-1 (-0.8, 0.5)	1.2 (0.4, 1.9)	1.4 (0.6, 2.1)	1.3 (0.5, 2)	1.2 (0.5, 1.9)
	MTG vs CG	-1 (-2.2, 0.2)	-1.1 (-2.3, 0.1)	0 (-1.5, 1.5)	-1.3 (-2.7, 0.1)	0.1 (-1.4, 1.6)	-0.4 (-1.1, 0.2)	-0.6 (-1.3, 0.1)	0 (-0.6, 0.6)	-0.7 (-1.3, 0)	0.1 (-0.6, 0.7)

Table 3. Mean differences within and between groups of cervical range of motion and craniocervical flexion test

N: number of participants; CTG: Cervical training group; MTG: Manual therapy group; CG: control group;

APÊNDICE E – ARTIGO 5: *BRAIN CHANGES IN SUBJECTS WITH CATASTROPHIC PAIN, AS DETECTED BY MAGNETIC RESONANCE IMAGING: A SYSTEMATIC REVIEW* (ARTIGO PUBLICADO)

Neurology and Neurosurgery

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Brain changes in subjects with catastrophic pain, as detected by magnetic resonance imaging: A systematic review

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Abstract

Background: There is evidence of the association between catastrophic pain and cerebral connectivity activation. However, the nature of such neural network changes, and brain regions that are most likely to be affected are still unknown.

Objective: To summarize the data available in the literature regarding fMRI-detected brain changes in individuals with catastrophic pain.

Methods: This review included searches across the following databases: Medline-via-PubMed, Web-of-Science and Scopus. We included: cross-sectional studies; fMRI studies using the catastrophic pain scale; and control groups with healthy individuals. We measure the quality evaluation of the selected studies using the New Castle-Ottawa Quality Assessment Scale.

Results: In total, 339 articles were identified, and after the title and abstract selection, 11 references were selected for further evaluation. Unfortunately, seven works were excluded by the eligibility criteria. Thus, a total of four studies were included for qualitative analysis: two included migraine subjects; one fibromyalgia; and another temporomandibular dysfunction. The included articles presented moderate quality of evidence.

Conclusions: In healthy subjects, repeated exposure to painful stimuli generates a specific perception of pain with increased functional connectivity and somatosensory network activity. This does not happen in high catastrophic scores patients, instead may acquire a pain-associated increased state of attention and the inability to direct their attention to other situations, leading to reduced pain modulation capacity. This review finds a change in functional connectivity during processes of rumination or negative pain perception in the anterior and posterior cingulate cortex, somatosensory cortex, medial prefrontal cortex, thalamus, insula, pre-cuneus, midbrain, and retrosplenial cortex.

Introduction

The International Association for the Study of Pain (IASP) defines chronic pain as discomfort with no biological cause that persists for longer than tissue healing [1]. Epidemiological data demonstrate that chronic pain is present in approximately 2-40% of the world population. This wide range in chronic pain prevalence is justified by the different ways of evaluating pain symptomatology [2]. Painful formation and processing involve complex mechanisms requiring cognition, perception, and emotion [3], while psychological factors have also been linked to the chronicity of pain [4]. Areas such as the anterior cingulate cortex, thalamus, basal ganglia and the insula have been associated with the pain perception and may undergo structural or circuitry-related changes in subjects suffering from this dysfunction [5].

The cognitive and emotional aspects of chronic pain sensation, involve catastrophic pain-related thinking, defined as a negative state in the face of a painful experience [6]. Catastrophic pain particularly relates to thoughts and feelings associated with the painful situation, such as fear, worry and inability to divert attention and handle the pain [7].

Individual levels of catastrophic pain were associated with a decrease in pain anticipation-related cerebral activity, as assessed by neuroimaging. This reduced cerebral activity contributed to hyperalgesia in fibromyalgia patients [8]. Moreover, it has been suggested that catastrophic pain is related to nociception and that together with the patient's psychological perspective can modulate noxious stimulus perception, thus altering neural activity patterns [9].

Patients who present with a higher level of catastrophic pain seem to have increased cortical activity in response to painful stimuli that involves the posterior cingulate cortex, the anterior insula and the cerebellum [9]. There is accumulating evidence that catastrophic pain activates the somatosensory cortex, prefrontal cortex, cingulate cortex and the hippocampus [10]. However, catastrophic pain is not associated with changes in periaqueductal gray matter activation [11].

The literature presents evidence of the association between catastrophic pain and cerebral connectivity activation, as detected by

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***Key words:** catastrophizing; magnetic resonance image; neuroimaging; brain mapping*

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APÊNDICE F – ARTIGO 6: *REPERCUSSIONS OF SMOKING HABIT ON OROFACIAL PAIN AND TEMPOROMANDIBULAR DYSFUNCTION: INTEGRATIVE REVIEW*. (ARTIGO PUBLICADO)

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INTEGRATIVE REVIEW

Repercussions of Smoking Habit on Orofacial Pain and Temporomandibular Dysfunction: Integrative Review

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Abstract

Temporomandibular dysfunction (TMD) can be triggered by several factors, such as parafunctional habits, among them: smoking. However, the relationship between these two conditions is unclear. The aim of this study was to describe the repercussions of smoke habits in patients with TMD. This is an integrating review with a guiding question considered Population, Intervention, Comparison and Outcomes (PICO). The search strategy was conducted following some Preferred Reporting Items for Systematic Reviews and Meta-Analyses and the methodological quality analysis of the studies was carried out according to New Castle Ottawa for cross-sectional studies. The databases: Cumulative Index to Nursing and Allied Health Literature, Medline via Pubmed, Web of Science and Scopus. The risk of bias in the analysis, extraction and inclusion of the manuscripts was reduced by independent peer evaluation. In conclusion smoking is able to negatively affect the pain perception of patients with TMD, besides influencing comorbid aspects such as fatigue, pain control, sleep quality and psychological distress. Moreover, it is not possible to consider that there is an association between worsening of pain intensity and biomechanical aspects of smoking because of the scarcity of good evidence.

Keywords

Smoking, Tobacco, Facial Pain, Temporomandibular Joint Dysfunction Syndrome

Introduction

Temporomandibular dysfunction (TMD) is one of the most common causes of orofacial pain, affecting approximately 10-15% of the population [1]. TMD is associated with the presence of pain in the preauricular region, muscular fatigue of the masticatory muscles, limitation or deviations during jaw movement and may be associated with noises during opening and closing of the mouth [2,3]. The prognostic factors related to the development of TMD are still very imprecise and studied. Previous studies have shown that this population has higher levels of distress, catastrophic feelings and increased somatic awareness compared to healthy controls.

TMD has been associated with other conditions of psychological and chronic pain, including fibromyalgia, back pain, headaches, and chronic generalized pain [4-6]. One of the major dysfunctions of muscle tissue affecting TMD patients is myalgia. The two primary precipitating factors associated with TMD-related myalgia are the formation of symptomatic myofascial trigger points and parafunctional habits [2,3,5,7], including smoking habit.

The investigation of smoking in patients with TMD is very important, not only because of the direct negative potential of cigarette smoke, but also because smoking habit may be related to the effects of other TMD risk factors, including perceived stress, anxiety, and depression [8,9]. It is known that tobacco smoke plays an important negative role in various types of chronic pain,

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APÊNDICE G – ARTIGO 7: *TOOLS TO ASSESS THE RISK OF BIAS AND REPORTING QUALITY OF RANDOMIZED CONTROLLED TRIALS IN REHABILITATION*. (ARTIGO SUBMETIDO)

Archives of Physical Medicine and Rehabilitation

Tools to assess the Risk of bias and Reporting Quality of Randomized Controlled Trials in Rehabilitation

--Manuscript Draft--

Manuscript Number:	
Article Type:	Original Research
Keywords:	randomized controlled trials, quality tools, rehabilitation, reporting, risk of bias
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Abstract:	Objective to determine whether new tools and items have been developed to evaluate the risk of bias (RoB) and reporting of Randomized Controlled Trials (RCTs) in rehabilitation area; to verify if the CONSORT statement and its relevant extensions include all relevant items when reporting RCTs in the rehabilitation area. Data sources Electronic searches were conducted in electronic databases between 2013-2019. No language or publication type limits were applied. Study selection Studies should describe a newly developed tool to evaluate the RoB or quality of reporting for RCTs in the area of rehabilitation. Selection of studies was conducted by two independent reviewers, based on titles or abstracts, followed by full-text screening. Data extraction It was divided into two Steps: 1) we extracted the items from the new tools; 2) we compare them to the items provided by the CONSORT statement and its extensions. The new items were added to our matrix. Items were classified based on existing domains, biases they target and whether they included reporting or conduct. Data synthesis Among the 868 citations found, 19 articles were deemed potentially relevant. From these, only three new scales (NICMAN, SPAC, TESTEX) were found. In addition, the newly updated Cochrane RoB tool (CRoB) was included. Our matrix contained 122 general items for any rehabilitation area, 46 items (37.7%) were related to conduct and 58 (47.5%) to the reporting; 18 (14.8%) were related to both. Overall, 76 new items were added among all domains. The CRoB tool added 21 items and CONSORT statements and its extensions added 43 news items. Conclusions

	Our results indicate a lack of agreement on a core set of items to be used when reporting and when evaluating the RoB of rehabilitation trials. Future research should look into developing a core set of items to be used in rehabilitation RCTs.

APÊNDICE H – ARTIGO 8: *ATTRITION, MISSING DATA, AND COMPLIANCE RELATED BIASES IN RANDOMIZED CONTROLLED TRIALS OF REHABILITATION INTERVENTIONS: TOWARDS IMPROVING REPORTING AND CONDUCT*. (ARTIGO PUBLICADO)

European Journal of Physical and Rehabilitation Medicine
EDIZIONI MINERVA MEDICA

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The final version may contain major or minor changes.

Attrition, Missing Data, and Compliance related biases in Randomized Controlled Trials of Rehabilitation Interventions: Towards improving reporting and conduct

Susan Luz ARMIJO-OLIVO, Wendy MACHALICEK , Ana Izabela Sobral DE OLIVEIRA-SOUZA, Liz DENNETT, Nikolaus BALLENBERGER

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Attrition, Missing Data, Compliance, and related biases in Randomized Controlled Trials of Rehabilitation Interventions: Towards improving reporting and conduct

Running title: Improving reporting and conduct of RCTs

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Abstract

Background: Attrition, missing data, compliance, and related biases can influence the magnitude of treatment effects in randomized controlled trials (RCTs). It is unclear which items should be considered when reporting and evaluating the influence of these biases in trial reports in the rehabilitation field.

Objectives: To describe which individual items considering attrition, missing data, compliance, and related biases are included in quality tools used in rehabilitation research. In addition, we aim to determine whether the existing reporting guidelines, such as the CONSORT and its extensions include all relevant items related to these biases when reporting RCTs in the area of rehabilitation.

Methods: Comprehensive literature searches and a systematic approach to identify tools and items looking at attrition, missing data, compliance, and related biases in rehabilitation were performed. We extracted individual items linked to these biases from all quality tools. We calculated the frequency of quality items used across tools and compared them to those found in the CONSORT statement and its extensions. A list of items to be potentially added to the CONSORT statement was generated.

Results: Three new tools to assess the conduct and reporting of trials in the rehabilitation field. From these tools, 28 items were used to evaluate the reporting as well as the conduct of trials considering attrition, missing data, compliance, and related biases in the rehabilitation field. However, our team found that some of these items lack specificity in the information required and therefore more research is needed to determine a core set of items used for reporting as well as assessing the risk of bias (RoB) of RCT in the rehabilitation field.

Conclusions: Although many items have been described by existing tools and the CONSORT statement (and its extensions) that deal with attrition, missing data, compliance, and related biases, several gaps in reporting were identified. It is crucial that future research

investigate a core set of items to be used in the field of rehabilitation to facilitate the reporting as well as the conduct of RCTs.

Keywords: Bias, Data Reporting, Methodological Studies, Rehabilitation, Clinical Trials as Topic

APÊNDICE I – ARTIGO 9: *WHAT ARE THE BEST PARAMETERS OF LOW-LEVEL LASER THERAPY TO REDUCE PAIN INTENSITY AND IMPROVE MANDIBULAR FUNCTION IN OROFACIAL PAIN? A SYSTEMATIC REVIEW AND META-ANALYSIS*. (ARTIGO EM ELABORAÇÃO)

What are the best parameters of Low-Level Laser Therapy to reduce pain intensity and improve mandibular function in orofacial pain? A systematic review and meta-analysis.

Ana Izabela Sobral de Oliveira-Souza[1], Norazlin Mohamad[2], Ester Moreira de Castro Carletti[3], Frauke Müggenborg[4], Liz Dennett[5], Daniella Araújo de Oliveira[6*], Susan Armijo-Olivo[2,4*]

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Abstract

Introduction: In order to clarify the evidence about the effectiveness of laser therapy to reduce orofacial pain and symptoms, and to define the best laser therapy parameters for these conditions, this systematic review was conducted.

Objective: to quantify the effectiveness of laser therapy when compared with other therapies in patients with orofacial pain. In addition, to determine which parameters (e.g. laser type, frequency, dosage, exposure time, application point, duration and number of laser sessions) provide the best effect sizes to reduce pain, improve function and quality of life in adults with orofacial pain.

Methods: It is a systematic review. The searches were conducted in the following databases: Medline (Ovid), Embase (Ovid), Cinahl (EBSSCOhost), Cochrane Library Trials, Web of Science and Scopus. No time or language restriction were applied. It was included studies with adults of both sexes with orofacial pain, diagnosed clinically or based on standardized criteria. Two independent reviewers have screened articles through the title, abstract, and full text. The quality assessment (risk of bias) was performed through the Revised Cochrane risk-of-bias tool for randomized trials (RoB 2). Overall evidence quality was performed by the GRADE system. A narrative synthesis and meta-analysis were performed and structured around the type of orofacial pain, and outcome measures.

Results: Our searches found 3.301 articles, of which 424 full texts were selected and 73 were finally included and analyzed. The majority of studies (n=59, 80.8%) were considered to have high risk of bias and the others 14 (19.2%) studies had some concerns. In general, the results showed that laser therapy was better than placebo to improve pain, maximal mouth open (MMO), protrusion movement and tenderness at the end of the treatment, but with a low or moderate level of evidence.

Conclusion: This systematic review and meta-analysis found that the laser therapy was better than placebo to improve pain, MMO, protrusion movement and tenderness. Also, laser therapy was better than medication to improve pain, but not better than TENS and Splint therapy. In general, with moderate level of evidence and moderate risk of bias.

APÊNDICE J – ARTIGO 10: *MRI IN MIGRAINEURS: ARE THERE ABNORMALITIES IN THE AREA WHERE THE MYOFASCIAL TRIGGER POINTS ARE PALPABLE AND IN VOLUME MEASUREMENTS?* (ARTIGO PUBLICADO)

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Diagnostic Methods

MRI in migraineurs: are there abnormalities in the area where the myofascial trigger points are palpable and in volume measurements?

Mariana Luiza da Silva Queiroz [a], Paula Rejane Bezerra Diniz [b], Eduardo José Nepomuceno Montenegro [c], Joaquim José de Souza Costa Neto [d], Eolo Santana de Albuquerque Filho [e], Marcelo Moraes Valença [f], Ana Izabela Sobral de Oliveira Souza [b], Angélica da Silva Tenório [c], Débora Wanderley [c, *], Daniella Araújo de Oliveira [c]

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ABSTRACT

Introduction: Patients with migraine may present a higher quantity of myofascial trigger points (MTrP) and alterations in the cervical muscles when compared to non-migraineurs. The magnetic resonance imaging (MRI) is a robust method for the study of human soft tissues and could be useful to investigate these points.
Objectives: To identify the presence of MTrP in the descending fibers of the trapezius muscle in women with migraine and to quantify the muscle volume by MRI, correlating it with the headache characteristics.
Methods: A cross-sectional analytic study was conducted among 14 women, eight in migraine group, and six in without migraine group. The presence of MTrP was evaluated using Simons' criteria, and linolenic acid capsules subsequently marked the areas. MRI was performed with 1.5T, T1-weighted sequence, and T2 in the axial, sagittal, and coronal planes. The T1-weighted sequences were performed with and without gadolinium contrast.
Results: The T1-weighted image analysis with and without gadolinium did not show any signal alteration in the MTrP areas in both groups. The migraine group presented more MTrP in the trapezius muscle (MD [95%CI] = 1[1; 3]; MD [95%CI] = 1[0; 2] right and left side, respectively), and a smaller muscle volume (MD [95%CI] = −198.1[-338.7;-25.6], MD [95%CI] = −149.9[-325.05;-0.13] right and left side, respectively) than non-migraineurs. The migraine frequency presented a negative strong correlation with the trapezius volumes ($r = -0.812$; $p = 0.014$).
Conclusion: Migraineurs present more MTrP and a smaller muscle volume than non-migraineurs. The trapezius volume is negatively correlated with migraine frequency. MRI is not a suitable outcome measure for assessing MTrP.

1. Introduction

The pathophysiological mechanisms involving migraine are not completely elucidated. However, several authors have suggested the implication of peripheral structures such as craniocervical muscles in migraine pathogenesis (Fernández-de-las-Peñas et al., 2008, Winter et al., 2012; Tali et al., 2014; Burch et al., 2015,

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1360-8592/

APÊNDICE L – ARTIGO 11: CATEGORIAS DA CIF COMPROMETIDAS NA MIGRÂNEA. (ARTIGO PUBLICADO)

ORIGINAL ARTICLE

Categorias da CIF comprometidas na Migrânea

ICF categories compromised in Migraine

Suellen Freitas da Silva[1], Hugo Feitosa[1], Alyne Karine de Lima Santos[1], Manuella Moraes Monteiro Barbosa Barros[1], Karinne Josepha Oliveira Ferro[1], Ana Izabela Sobral de Oliveira Souza[1], Tamara Cavalcanti de Morais Coutinho Neta[1], Paulo José Moté Barboza[2], Pedro Augusto Sampaio Rocha Filho[3], Débora Wanderley[1], Daniella Araújo de Oliveira[1]

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Silva SF, Feitosa H, Santos AKL, Barros MMMB, Ferro KJO, Souza AISO, Coutinho Neta TCM, Barboza PJM, Rocha Filho PAS, Wanderley D, Oliveira DA. Categorias da CIF comprometidas na Migrânea. Headache Medicine. 2018;9(4):177-82

RESUMO

Objetivo: Identificar quais categorias da Classificação Internacional de Funcionalidade, Incapacidade e Saúde (CIF) estão comprometidas em pacientes com migrânea sob a perspectiva dos profissionais de saúde. **Métodos:** Trata-se de um estudo transversal desenvolvido no ambulatório de cefaleia do Hospital das Clínicas de Pernambuco, do Hospital Universitário Oswaldo Cruz e no Laboratório de Aprendizado e Controle Motor da Universidade Federal de Pernambuco. Foi utilizado um questionário composto por cinco seções na versão impressa e online baseado no checklist 2.1 da CIF. Foram convidados profissionais de saúde de diferentes especialidades, que tivessem experiência no tratamento de pacientes com migrânea. Os profissionais foram instruídos a preencher o questionário e eleger, com base em sua experiência clínica, quais categorias apresentam maior grau de comprometimento ou maior relação com a condição clínica de pacientes com migrânea, sendo considerado um ponto de corte de 70% para aprovação das categorias. **Resultados:** Dezesseis profissionais participaram da pesquisa. O questionário foi composto por 106 categorias, das quais 32 atingiram o ponto de corte de 70% para serem consideradas aprovadas. Dentre estas categorias, sete (21,8%) fazem parte do componente funções do corpo, cinco (15,6%) de estruturas do corpo, 13 (40,6%) de atividades e participação e sete (21,8%) de fatores ambientais. **Conclusão:** Na percepção dos profissionais de saúde, os indivíduos com migrânea apresentam comprometimento em todos os domínios da CIF e os domínios atividades e participação foram os que apresentaram maior número de categorias comprometidas.

Palavras-chave: Transtornos de enxaqueca; Classificação Internacional de Funcionalidade, Incapacidade e Saúde; pessoal de Saúde; atividades e participação

ABSTRACT

Objective: To identify which categories of the International Classification of Functioning, Disability, and Health (ICF) are compromised in patients with migraine from the perspective of health professionals. Methods: This is a cross-sectional study conducted at the headache outpatient clinic of the Clinical Hospital of Pernambuco, Oswaldo Cruz University Hospital and at the Motor Learning and Control Laboratory of the Federal University of Pernambuco. A five-section printed and online questionnaire based on ICF checkList 2.1 was used. Health professionals from different specialities who had experience in treating patients with migraine were invited. Professionals were instructed to complete the questionnaire and to choose, based on their clinical experience, which categories had the highest degree of impairment or the highest relationship with the clinical condition of migraine patients. A cut-off point of 70% for approval of categories was considered. Results: Sixteen professionals were enrolled in the survey. The questionnaire was compost by 106 categories, of which 32 reached the cut-off point of 70% to be considered approved. Among these categories, seven (21.8%) are part of the body functions component, five (15.6%) body structures, thirteen (40.6%) activities, and participation and seven (21.8%), of environmental factors. Conclusion: In the perception of health professionals, individuals with migraine present impairment in all domains of the ICF and the activity and participation domains presented the highest number of compromised categories.

Keywords: Migraine disorders; International Classification of Functioning, Disability, and Health; health personnel; activity and participation

APÊNDICE M – ARTIGO 12: ALTERAÇÕES DE FUNCIONALIDADE DE MULHERES MIGRANOSAS. (ARTIGO PUBLICADO)

ORIGINAL ARTICLE

Alterações de funcionalidade de mulheres migranosas

Functionality changes of migraine women

Alyne Karine Lima Santos[1], Hugo Feitosa[1], Suellen F Silva[1], Manuella Moraes Monteiro Barbosa Barros[1], Josepha Karinne de Oliveira Ferro[1], Ana Izabela Sobral de Oliveira Souza[1], Tamara Cavalcanti de Morais Coutinho Neta[1], Paulo José Maté Barboza[2], Pedro Augusto Sampaio Rocha Filho[3], Débora Wanderley[1], Daniella Araújo de Oliveira[1]

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Santos AKL, Feitosa H, Silva SF, Barros MMMB, Ferro KJO, Souza AISO, Coutinho Neta TCM, Barboza PJM, Rocha Filho PAS, Wanderley D, Oliveira DA. Alterações de funcionalidade de mulheres migranosas. Headache Medicine. 2018;9(4):183-89

RESUMO

Objetivo: Identificação das alterações na funcionalidade de mulheres com migrânea de acordo com a Classificação Internacional da funcionalidade, incapacidade e saúde (CIF). Método: Trata-se de um estudo qualitativo, realizado no formato de entrevistas em grupos focais, no qual foram incluídas mulheres entre 18 e 55 anos com diagnóstico de migrânea baseado nos critérios da Sociedade Internacional de Cefaleia. As mulheres foram divididas em grupos com médias de duas a quatro pessoas e, guiadas por um moderador, foram incentivadas a falar sobre a influência da migrânea na realização das tarefas a que são expostas diariamente, levando em consideração o ambiente em que estão inseridas. As categorias que alcançaram o ponto de corte de 30% de concordância nos grupos foram aprovadas. Resultados: Foram realizadas 10 rodadas de entrevistas, cada uma com um grupo focal com média de duas a quatro pessoas, totalizando 29 mulheres com média de idade de 34,7 anos (95%; IC: 18 - 51). Foram aprovadas 18 categorias, sendo quatro no domínio de Função do Corpo, quatro no domínio de Estruturas do corpo, seis categorias no domínio de Atividade e Participação e quatro categorias no domínio de Fatores Ambientais. Conclusão: Mulheres com migrânea percebem alteração na funcionalidade em todos os domínios da CIF, sendo o domínio Atividades e Participação o que apresentou mais categorias mencionadas.

Palavras-chave: Transtornos de enxaqueca; Classificação Internacional de Funcionalidade, Incapacidade e Saúde; impacto psicossocial; biopsicossocial; atividades e participação.

ABSTRACT

Objective: Identification of changes in functionality of women with migraine according to the International Classification of Functioning, Disability, and Health (ICF). Method: This is a qualitative study conducted in the format of focus group interviews, which included women between 18 and 55 years old diagnosed with migraine based on the criteria of the International Headache Society. The women were divided into groups with averages of two to four people and, guided by a moderator, they were encouraged to talk about the influence of migraine on performing the tasks to which they are exposed daily, taking into account the environment in which they are inserted. The categories that reached the 30% agreement cut-off point in the groups were approved. Results: There were 10 rounds of interviews, each with a focus group with an average of two to four people, totaling 29 women with a mean age of 35 years old (95% CI: 18 - 51). Eighteen categories were approved, four in the Body Function domain, four in the Body Structure domain, six categories in the Activity and Participation domain and four categories in the Environmental Factors domain. Conclusion: Women with migraine perceive alteration in functionality in all ICF domains, with the Activities and Participation domain presenting the most mentioned categories.

Keywords: Migraine disorders; International Classification of Functioning, Disability, and Health; psychosocial impact; biopsychosocial; activity and participation.

APÊNDICE N – TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

UNIVERSIDADE FEDERAL DE PERNAMBUCO

Programa de pós-graduação em Neuropsiquiatria e ciências do comportamento
Laboratório de Aprendizagem e Controle motor

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

(PARA MAIORES DE 18 ANOS OU EMANCIPADOS - Resolução 466/12)

Convidamos o (a) Sr. (a) para participar como voluntário (a) da pesquisa "*Efetividade de um programa de exercícios cervicais na dor e funcionalidade de pacientes com disfunção temporomandibular: Ensaio clínico controlado e randomizado*", que está sob a responsabilidade do (a) pesquisador (a) Ana Izabela Sobral de Oliveira, com endereço na Rua Dep Pedro Pires Ferreira, nº 95, Graças, CEP: , telefone: (79) 999916968 e email: anaizabela.oliveira@hotmail.com, inclusive ligações a cobrar. Este projeto esta sob a orientação de: Prof. Dra. Daniela Araújo de Oliveira, e-mail sabinodaniellaufpe@gmail.com.

Caso este Termo de Consentimento contenha informações que não lhe sejam compreensíveis, as dúvidas podem ser tiradas com a pessoa que está lhe entrevistando e apenas ao final, quando todos os esclarecimentos forem dados, caso concorde com a realização do estudo pedimos que rubrique as folhas e assine ao final deste documento, que está em duas vias, uma via lhe será entregue e a outra ficará com o pesquisador responsável.

Caso não concorde, não haverá penalização, bem como será possível retirar o consentimento a qualquer momento, também sem nenhuma penalidade.

INFORMAÇÕES SOBRE A PESQUISA:

O objetivo da presente pesquisar é testar a eficácia de um novo protocolo terapêutico para o tratamento de pacientes com disfunção temporomandibular. E para isso o (a) Sr. (a) precisará passar inicial por uma avaliação que terá duração de aproximadamente 60 minutos, nesta etapa o (a) Sr. (a) responderá 6 questionários: O primeiro questiona aspectos como idade, escolaridade, existência de dor na região orofacial e pescoço, e a intensidade dessa dor; O segundo questiona a respeito de fatores sociais que possam influenciar sua dor; O terceiro é referente a capacidade de realizar movimentos com a boca, especialmente de alimentação; O quarto avaliará a sua qualidade de vida relacionado à saúde bucal; O quinto é relacionado à quanto a sua dor no pescoço, caso tenha, o atrapalha nas tarefas do dia a dia; E o sexto falará sobre o medo de realizar movimentos. Após responder os questionários, iniciaremos a avaliação do movimento da boca e do pescoço, assim como os testes de força. Todas as etapas desta avaliação ocorrerão no Laboratório de Aprendizam e Controle Motor (LACOM), localizado na Universidade Federal de Pernambuco. Pode acontecer do (a) Sr. (a) sentir dor, desconforto ou tontura durante a avaliação da força. Portanto, o (a) Sr. (a) pode interromper os testes a qualquer momento caso não se sinta à vontade de dar seguimento.

Finalizado a avaliação iremos sortear os participantes em três grupos, dois grupos de intervenção e um grupo placebo. Ou seja, o (a) Sr. (a) poderá cair em qualquer um dos três grupos. Aqueles que estiverem no grupo 01 de intervenção irão realizar um programa de exercícios para fortalecimento da musculatura cervical, no grupo 02 de intervenção um tratamento com técnica de fisioterapia convencional, e aqueles que forem sorteados para o grupo placebo receberão terapia com ultrassom terapêutico (US). Ambos os grupos serão tratados 1x por semana no LACOM, com duração de tratamento de aproximadamente 30 minutos. Após 6 semanas, ambos os grupos serão reavaliados e continuarão com mais duas semanas de terapia. Nesta etapa será acrescentado um novo questionário referente a sua percepção de melhora com o tratamento. Ao fim das oito semanas uma nova reavaliação, completa, será realizada. Ligaremos para o (a) Sr. (a) um mês, três meses e seis meses depois que a fisioterapia for finalizada para analisarmos como você se encontra em relação à intensidade da dor e função orofacial. Terminado o período de acompanhamento por telefone os participantes que fizeram parte do grupo placebo, se desejarem poderão realizar os exercícios propostos aos outros grupos.

Este protocolo não oferece riscos aos pacientes, no entanto caso algum inconveniente aconteça os pesquisadores se responsabilizam em oferecer todo suporte necessário para o reestabelecimento da normalidade do paciente. O principal benefício do presente projeto é favorecer a comprovação de um novo protocolo de tratamento fisioterapêutico para pacientes com disfunção temporomandibular,

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Laboratório de Aprendizagem e Controle motor

beneficiando dessa forma tanto os pacientes que sofrem dessa doença quanto os profissionais da área que encontram-se defasados de tratamentos com comprovação científica.

Todas as informações desta pesquisa serão confidenciais e serão divulgadas apenas em eventos ou publicações científicas, não havendo identificação dos voluntários, a não ser entre os responsáveis pelo estudo, sendo assegurado o sigilo sobre a sua participação. Os dados coletados nesta pesquisa (questionários e avaliação física), ficarão armazenados em pastas de arquivo no computador pessoal, sob a responsabilidade do pesquisador, no endereço acima informado pelo período de mínimo 5 anos.

Nada lhe será pago e nem será cobrado para participar desta pesquisa, pois a aceitação é voluntária, mas fica também garantida a indenização em casos de danos, comprovadamente decorrentes da participação na pesquisa, conforme decisão judicial ou extra-judicial. Se houver necessidade, as despesas para a sua participação serão assumidas pelos pesquisadores (ressarcimento de transporte e alimentação).

Em caso de dúvidas relacionadas aos aspectos éticos deste estudo, você poderá consultar o Comitê de Ética em Pesquisa Envolvendo Seres Humanos da UFPE no endereço: **(Avenida da Engenharia s/n – 1º Andar, sala 4 - Cidade Universitária, Recife-PE, CEP: 50740-600, Tel.: (81) 2126.8588 – e-mail: cepccs@ufpe.br).**

_____

(assinatura do pesquisador)

CONSENTIMENTO DA PARTICIPAÇÃO DA PESSOA COMO VOLUNTÁRIO (A)

Eu, _____, CPF _____, abaixo assinado, após a leitura (ou a escuta da leitura) deste documento e de ter tido a oportunidade de conversar e ter esclarecido as minhas dúvidas com o pesquisador responsável, concordo em participar do estudo pesquisa *"Efetividade de um programa de exercícios cervicais na dor e funcionalidade de pacientes com disfunção temporomandibular: Ensaio clínico controlado e randomizado"*, como voluntário (a). Fui devidamente informado (a) e esclarecido (a) pelo(a) pesquisador (a) sobre a pesquisa, os procedimentos nela envolvidos, assim como os possíveis riscos e benefícios decorrentes de minha participação. Foi-me garantido que posso retirar o meu consentimento a qualquer momento, sem que isto leve a qualquer penalidade ou interrupção de meu acompanhamento/ assistência/tratamento.

Local e data _____

Assinatura do participante: _____

Impressão digital (opcional)

Presenciamos a solicitação de consentimento, esclarecimentos sobre a pesquisa e o aceite do voluntário em participar. (02 testemunhas não ligadas à equipe de pesquisadores):

Nome: Nome:

Assinatura: Assinatura:

ANEXOS A – COMPROVANTE DE APROVAÇÃO DO COMITÊ DE ÉTICA

UNIVERSIDADE FEDERAL DE PERNAMBUCO CENTRO DE CIÊNCIAS DA SAÚDE / UFPE-

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: EFETIVIDADE DE UM PROGRAMA DE EXERCÍCIOS CERVICAIS NA DOR E NA FUNCIONALIDADE DE PACIENTES COM DISFUNÇÃO TEMPOROMANDIBULAR: ESTUDO CLÍNICO CONTROLADO E RANDOMIZADO

Pesquisador: Ana Izabela Sobral de Oliveira

Área Temática:

Versão: 1

CAAE: 68010717.8.0000.5208

Instituição Proponente: Pós Graduação em Neuropsiquiatria e Ciências do Comportamento

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 2.131.546

Apresentação do Projeto:

Projeto de pesquisa relacionado ao doutorado de ANA IZABELA SOBRAL DE OLIVEIRA, pelo Programa de Pós Graduação em Neuropsiquiatria e Ciências do Comportamento, orientado pela profa. dra. Daniella Araújo de Oliveira

Objetivo da Pesquisa:

Comparar os efeitos de três intervenções sobre a dor da articulação temporo-mandibular: 1.Um programa de treinamento físico específico e progressivo de 8 semanas, que teve como objetivo melhorar o controle motor da coluna cervical; 2. fisioterapia convencional; 3; ultrassom terapêutico (chamado pelos autores como controle placebo).

Avaliação dos Riscos e Benefícios:

Todas as intervenções são bem toleradas, não havendo grandes riscos para o participante. Os maiores riscos são possível indisposição ou dor na região temporo-mandibular após as primeiras intervenções, mas que posteriormente somem sem sequelas.

como benefícios, os resultados deste estudo serão futuramente utilizados para a escolha do tratamento mais adequado para o tipo de dor da ATM. Os participantes do grupo controle terão a

Endereço: Av. da Engenharia s/nº - 1º andar, sala 4, Prédio do Centro de Ciências da Saúde
Bairro: Cidade Universitária **CEP:** 50.740-600
UF: PE **Município:** RECIFE
Telefone: (81)2126-8588 **E-mail:** cepccs@ufpe.br

possibilidade de realizar posteriormente a intervenção experimental, caso esta se mostre mais eficaz;

Comentários e Considerações sobre a Pesquisa:

Pesquisa relevante, submetida por grupo com reconhecida competência no assunto.

Considerações sobre os Termos de apresentação obrigatória:

Todos presentes.

Recomendações:

Não há

Conclusões ou Pendências e Lista de Inadequações:

Não há.

Considerações Finais a critério do CEP:

O Protocolo foi avaliado na reunião do CEP e está APROVADO para iniciar a coleta de dados. Informamos que a APROVAÇÃO DEFINITIVA do projeto só será dada após o envio da Notificação com o Relatório Final da pesquisa. O pesquisador deverá fazer o download do modelo de Relatório Final para enviá-lo via "Notificação", pela Plataforma Brasil. Siga as instruções do link "Para enviar Relatório Final", disponível no site do CEP/UFPE. Após apreciação desse relatório, o CEP emitirá novo Parecer Consubstanciado definitivo pelo sistema Plataforma Brasil.

Informamos, ainda, que o (a) pesquisador (a) deve desenvolver a pesquisa conforme delineada neste protocolo aprovado, exceto quando perceber risco ou dano não previsto ao voluntário participante (item V.3., da Resolução CNS/MS Nº 466/12).

Eventuais modificações nesta pesquisa devem ser solicitadas através de EMENDA ao projeto, identificando a parte do protocolo a ser modificada e suas justificativas.

Para projetos com mais de um ano de execução, é obrigatório que o pesquisador responsável pelo Protocolo de Pesquisa apresente a este Comitê de Ética, relatórios parciais das atividades desenvolvidas no período de 12 meses a contar da data de sua aprovação (item X.1.3.b., da Resolução CNS/MS Nº 466/12).

O CEP/UFPE deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (item V.5., da Resolução CNS/MS Nº 466/12). É papel do/a pesquisador/a assegurar todas as medidas imediatas e adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e ainda, enviar notificação à ANVISA – Agência Nacional de Vigilância Sanitária, junto com seu posicionamento.

UNIVERSIDADE FEDERAL DE PERNAMBUCO CENTRO DE CIÊNCIAS DA SAÚDE / UFPE-

Continuação do Parecer: 2.131.546

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_896339.pdf	08/05/2017 08:51:55		Aceito
Projeto Detalhado / Brochura Investigador	projeto_ana.docx	08/05/2017 08:51:34	Ana Izabela Sobral de Oliveira	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_doutorado.docx	08/05/2017 08:50:25	Ana Izabela Sobral de Oliveira	Aceito
Outros	currciulo_orientador.pdf	07/05/2017 22:47:38	Ana Izabela Sobral de Oliveira	Aceito
Outros	curriculo_pesquisador.pdf	07/05/2017 21:37:13	Ana Izabela Sobral de Oliveira	Aceito
Outros	comprovante_matricula.pdf	07/05/2017 21:35:55	Ana Izabela Sobral de Oliveira	Aceito
Outros	Termo_confidencialidade.pdf	07/05/2017 21:34:20	Ana Izabela Sobral de Oliveira	Aceito
Folha de Rosto	Folha_de_rosto.pdf	07/05/2017 21:30:45	Ana Izabela Sobral de Oliveira	Aceito
Declaração de Instituição e Infraestrutura	Carta_de_anuencia.pdf	12/04/2017 17:03:14	Ana Izabela Sobral de Oliveira	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

RECIFE, 22 de Junho de 2017

Assinado por:
LUCIANO TAVARES MONTENEGRO
(Coordenador)

Endereço: Av. da Engenharia s/nº - 1º andar, sala 4, Prédio do Centro de Ciências da Saúde
Bairro: Cidade Universitária **CEP:** 50.740-600
UF: PE **Município:** RECIFE
Telefone: (81)2126-8588 **E-mail:** cepccs@ufpe.br

ANEXO B - COMPROVANTE DE REGISTRO DO PROJETO NO REBEC

RBR-3fc62c

Efetividade de um programa de exercícios cervicais na dor e na funcionalidade de pacientes com disfunção temporomandibular: estudo clínico controlado e randomizado

Data de registro: 5 de Abril de 2017 às 09:40
Last Update: 5 de Fev. de 2018 às 10:54

Tipo do estudo:

Intervenções

Título científico:

PT-BR
Efetividade de um programa de exercícios cervicais na dor e na funcionalidade de pacientes com disfunção temporomandibular: estudo clínico controlado e randomizado

EN
Effectiveness of a cervical exercises program in pain and functionality of patients with temporomandibular dysfunction: controled and randomized clinical trial

Identificação do ensaio

Número do UTN: U1111-1195-1453

Título público:

PT-BR
Efetividade de um Programa de Exercícios no Pescoço na Dor e na Função de pacientes com Disfunção na articulação da boca.

EN
Effectiveness of a Neck Exercises Program in Pain and Function of patients with mouth Articulation Dysfunction.

Acrônimo científico:

Acrônimo público:

Identificadores secundários:

Nº do Parecer do CEP 2.131.546
Órgão emissor: Comitê de Ética em Pesquisa da Universidade Federal de Pernambuco

Número do CAAE: 68010717.8.0000.5208
Órgão emissor: Plataforma Brasil

Patrocinadores

Patrocinador primário: Universidade Federal de Pernambuco

ANEXO C - HISTÓRICO ESCOLAR PELO SIGA-UFPE

SIGAA - Sistema Integrado de Gestão de Atividades Acadêmicas
UFPE - UNIVERSIDADE FEDERAL DE PERNAMBUCO
PROPESQ

Av. Prof. Moraes Rego, 1235 - Cidade Universitária, Recife - PE

Histórico Escolar - Emitido em: 14/12/2020 às 05:39

Dados Pessoais

Nome: **ANA IZABELA SOBRAL DE OLIVEIRA SOUZA** Matrícula: **20173028140**
Data de Nascimento: **12/03/1992** Local de Nascimento: **ARACAJU/SE**
Nome do Pai: **JOSE AUGUSTO COSTA DE OLIVEIRA**
Nome da Mãe: **ANTONIA MARIA SOBRAL DE OLIVEIRA**

Dados do Vínculo do Discente

Programa: **COORDENACAO DA POS-GRADUACAO EM NEUROPSIQUIATRIA E CIENCIAS DO COMPORTAMENTO - CCS**
Nível: **DOUTORADO**
Curso: **NEUROPSIQUIATRIA E CIÊNCIAS DO COMPORTAMENTO -**
Currículo: **NEPD11** Status: **ATIVO**
Área de Concentração: **NEUROCIRURGIA**
Linha de Pesquisa:
Orientador: **2779450 - DANIELLA ARAUJO DE OLIVEIRA**
Forma de Ingresso: **SELEÇÃO DE PÓS-GRADUAÇÃO**
Mês/Ano Inicial: **MAR/2017**
Trancamentos: **0 meses**
Prorrogações: **0 meses**
Mês/Ano de Saída:

Índices Acadêmicos
CR: **3.63**
(Índice de Coeficiente de Rendimento: 0.0 - 4.0)

Mês Atual: **46º**
Prazo para Conclusão: **FEV/2021**
Tipo Saída:
Data da Defesa:

Disciplinas e Atividades Cursadas/Cursando

Início	Fim	Componente Curricular		Turma	CH	CR	Freq %	Conceit	Situação
02/2017	07/2017	DNP902	METODOLOGIA DA PESQUISA CIENTÍFICA	DM	60	4	100,0	B	APROVADO
02/2017	07/2017	DNP936	INTRODUÇÃO A NEUROIMAGEM	DM	45	3	100,0	A	APROVADO
02/2017	07/2017	DNP941	TEORIAS EPISTEMOLÓGICAS	TE	60	4	100,0	A	APROVADO
07/2017	02/2018	DNP937	ATUALIDADES EM DEPENDÊNCIAS QUÍMICAS	DN	45	3	100,0	A	APROVADO
07/2017	02/2018	DNP939	SEMINÁRIOS AVANÇADOS EM NEUROTRANSMISSÃO	DN	60	4	100,0	A	APROVADO
07/2017	02/2018	DNP940	SEMINÁRIOS EM NEUROCIÊNCIAS	DN	60	4	100,0	C	APROVADO
02/2018	07/2018	DNP944	SEMINÁRIOS AVANÇADOS EM NEUROCIÊNCIAS II	DN	45	3	97,8	A	APROVADO
08/2018	02/2019	DNP942	NEUROCIÊNCIA E COMPORTAMENTO	DN	60	4	100,0	A	APROVADO
02/2019	08/2019	PGFT900	BIOESTATÍSTICA	02	60	4	100,0	A	APROVADO
03/2020	--	DNP895	ATIVIDADE DE ORIENTAÇÃO INDIVIDUAL	--	0	0	--	--	MATRICULADO
10/2020	--	DNP895	ATIVIDADE DE ORIENTAÇÃO INDIVIDUAL	--	0	0	--	--	MATRICULADO

Carga Horária Integralizada/Pendente

	Obrigatórias	Optativos	Total
Exigido	300 h	180 h	480 h
Integralizado	300 h	195 h	495 h
Pendente*	0 h	0 h	0 h

*Contabilizado com base no valor estabelecido no mínimo exigido da estrutura curricular.

Componentes Curriculares Obrigatórios Pendentes:2

Código	Componente Curricular	CH
DNP899	TESE DE DOUTORADO	0 h
DNP897	ATIVIDADE DE QUALIFICAÇÃO/PRÉ-BANCA DE DOUTORADO	0 h

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UFPE - UNIVERSIDADE FEDERAL DE PERNAMBUCO
PROPESQ

Av. Prof. Moraes Rego, 1235 - Cidade Universitária, Recife - PE

Histórico Escolar - Emitido em: 14/12/2020 às 05:39

Nome: **ANA IZABELA SOBRAL DE OLIVEIRA SOUZA** Matrícula: **20173028140**

Atenção, agora o histórico possui uma verificação automática de autenticidade e consistência, sendo portanto dispensável a assinatura da coordenação do PPG ou da PROPESQ. Favor, ler instruções no rodapé.

ANEXO D – QUESTIONÁRIO DE LIMITAÇÃO FUNCIONAL MANDIBULAR (MFIQ)

Questionário de Limitação Funcional Mandibular

Questões	Respostas possíveis				
Com relação às queixas relativas à sua mandíbula, quanta dificuldade você tem para realizar as seguintes atividades:	Nenhuma dificuldade	Pouca dificuldade	Dificuldade moderada	Muita dificuldade	Muitíssima dificuldade ou impossível sem ajuda
1. Atividades sociais					
2. Falar					
3. Dar uma grande mordida					
4. Mastigar alimentos duros					
5. Mastigar alimentos macios (moles)					
6. Trabalhar e/ou realizar atividades de vida diária					
7. Beber					
8. Rir					
9. Mastigar alimentos resistentes					
10. Bocejar					
11. Beijar					

Comer alimentos inclui morder, mastigar e engolir. Quanta dificuldade você tem para comer os seguintes alimentos:	Nenhuma dificuldade	Pouca dificuldade	Dificuldade moderada	Muita dificuldade	Muitíssima dificuldade ou impossível sem ajuda
1. Bolacha dura					
2. Carne					
3. Cenoura crua					
4. Pão francês					
5. Amendoins/amêndoas					
6. Maçã					

ANEXO E – QUESTIONÁRIO DE QUALIDADE DE VIDA RELACIONADO À SAÚDE BUCAL

Agora serão feitas perguntas sobre como a saúde de sua boca e dentes afetam o seu dia-a-dia. Responda cada uma das questões de acordo com a freqüência com que elas interferem na sua vida, ou seja, nunca, raramente, às vezes, constantemente ou sempre, em relação ao último mês de internação. Para cada questão só deve ser dada uma única resposta. Não se preocupe, pois nenhuma resposta é mais certa do que a outra. Responda aquilo que você realmente pensa.

Oral Health Impact Profile (OHIP–14)

Perguntas	**Respostas**				
	0	1	2	3	4
1.Você teve problemas para falar alguma palavra por causa de problemas com sua boca ou dentes?					
2.Você sentiu que o sabor dos alimentos ficou pior por causa de problemas com sua boca ou dentes?					
3.Você sentiu dores em sua boca ou nos seus dentes?					
4.Você se sentiu incomodado ao comer algum alimento por causa de problemas com sua boca ou dentes?					
5.Você ficou preocupado por causa de problemas com sua boca ou dentes?					
6.Você se sentiu estressado por causa de problemas com sua boca ou dentes?					
7.Sua alimentação ficou prejudicada por causa de problemas com sua boca ou dentes?					
8.Você teve que parar suas refeições por causa de problemas com sua boca ou dentes?					
9.Você encontrou dificuldade para relaxar por causa de problemas com sua boca ou dentes?					
10. Você sentiu-se envergonhado por causa de problemas com sua boca ou dentes?					
11. Você ficou irritado com outras pessoas por causa de problemas com sua boca ou dentes?					
12. Você teve dificuldades em realizar suas atividades diárias por causa de problemas com sua boca ou dentes?					
13. Você sentiu que a vida, em geral, ficou pior por causa de problemas com sua boca ou dentes?					
14. Você ficou totalmente incapaz de fazer suas atividades diárias por causa de problemas com sua boca ou dentes?					

NUNCA RARAM. AS VEZES

CONST. SEMPRE

ANEXO F – ÍNDICE DE INCAPACIDADE RELACIONADO AO PESCOÇO

UNIVERSIDADE FEDERAL DE PERNAMBUCO
Programa de pós-graduação em Neuropsiquiatria e ciências do comportamento
Laboratório de Aprendizagem e Controle motor

Índice de Incapacidade Relacionada ao Pescoço (Neck Disability Index)

Este questionário foi criado para dar informações ao seu doutor sobre como a sua dor no pescoço tem afetado a sua habilidade para fazer atividades diárias. Por favor responda a cada uma das perguntas e marque em cada seção apenas uma alternativa que melhor se aplique a você.

Seção 1 – Intensidade da dor

- ☐ Eu não tenho dor nesse momento.
- ☐ A dor é muito leve nesse momento.
- ☐ A dor é moderada nesse momento.
- ☐ A dor é razoavelmente grande nesse momento.
- ☐ A dor é muito grande nesse momento.
- ☐ A dor é a pior que se possa imaginar nesse momento.

Seção 2 – Cuidado pessoal (se lavar, se vestir, etc)

- ☐ Eu posso cuidar de mim mesmo(a) sem aumentar a dor.
- ☐ Eu posso cuidar de mim mesmo(a) normalmente, mas isso faz aumentar a dor.
- ☐ É doloroso ter que cuidar de mim mesmo e eu faço isso lentamente e com cuidado.
- ☐ Eu preciso de ajuda mas consigo fazer a maior parte do meu cuidado pessoal.
- ☐ Eu preciso de ajuda todos os dias na maioria dos aspectos relacionados a cuidar de mim mesmo(a)
- ☐ Eu não me visto, me lavo com dificuldade e fico na cama.

Seção 3 – Levantar coisas

- ☐ Eu posso levantar objetos pesados sem aumentar a dor.
- ☐ Eu posso levantar objetos pesados mas isso faz aumentar a dor.
- ☐ A dor me impede de levantar objetos pesados do chão, mas eu consigo se eles estiverem colocados em uma boa posição, por exemplo em uma mesa.
- ☐ A dor me impede de levantar objetos pesados, mas eu consigo levantar objetos com peso entre leve e médio se eles estiverem colocados em uma boa posição.
- ☐ Eu posso levantar objetos muito leves.
- ☐ Eu não posso levantar nem carregar absolutamente nada.

Seção 4 – Leitura

- ☐ Eu posso ler tanto quanto eu queira sem dor no meu pescoço.
- ☐ Eu posso ler tanto quanto eu queira com uma dor leve no meu pescoço.
- ☐ Eu posso ler tanto quanto eu queira com uma dor moderada no meu pescoço.
- ☐ Eu não posso ler tanto quanto eu queira por causa de uma dor moderada no meu pescoço.
- ☐ Eu mal posso ler por causa de uma grande dor no meu pescoço.
- ☐ Eu não posso ler nada.
- ☐ Pergunta não se aplica por não saber ou não poder ler.

Seção 5 – Dores de cabeça

- ☐ Eu não tenho nenhuma dor de cabeça.
- ☐ Eu tenho pequenas dores de cabeça com pouca freqüência.
- ☐ Eu tenho dores de cabeça moderadas com pouca freqüência.
- ☐ Eu tenho dores de cabeça moderadas muito freqüentemente.
- ☐ Eu tenho dores de cabeça fortes freqüentemente .

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Laboratório de Aprendizagem e Controle motor

- [ ] Eu tenho dores de cabeça quase o tempo inteiro.

Seção 6 – Prestar Atenção

- [ ] Eu consigo prestar atenção quando eu quero sem dificuldade.
- [ ] Eu consigo prestar atenção quando eu quero com uma dificuldade leve.
- [ ] Eu tenho uma dificuldade moderada em prestar atenção quando eu quero.
- [ ] Eu tenho muita dificuldade em prestar atenção quando eu quero.
- [ ] Eu tenho muitíssima dificuldade em prestar atenção quando eu quero.
- [ ] Eu não consigo prestar atenção.

Seção 7 – Trabalho

- [ ] Eu posso trabalhar tanto quanto eu quiser.
- [ ] Eu só consigo fazer o trabalho que estou acostumado(a) a fazer, mas nada além disso.
- [ ] Eu consigo fazer a maior parte do trabalho que estou acostumado(a) a fazer, mas nada além disso.
- [ ] Eu não consigo fazer o trabalho que estou acostumado(a) a fazer.
- [ ] Eu mal consigo fazer qualquer tipo de trabalho.
- [ ] Eu não consigo fazer nenhum tipo de trabalho.

Seção 8 – Dirigir automóveis

- [ ] Eu posso dirigir meu carro sem nenhuma dor no pescoço.
- [ ] Eu posso dirigir meu carro tanto quanto eu queira com uma dor leve no meu pescoço.
- [ ] Eu posso dirigir meu carro tanto quanto eu queira com uma dor moderada no meu pescoço.
- [ ] Eu não posso dirigir o meu carro tanto quanto eu queira por causa de uma dor moderada no meu pescoço.
- [ ] Eu mal posso dirigir por causa de uma dor forte no meu pescoço.
- [ ] Eu não posso dirigir meu carro de maneira nenhuma.
- [ ] Pergunta não se aplica por não saber dirigir ou não dirigir muitas vezes

Seção 9 – Dormir

- [ ] Eu não tenho problemas para dormir.
- [ ] Meu sono é um pouco perturbado (menos de uma hora sem conseguir dormir).
- [ ] Meu sono é levemente perturbado (1-2 horas sem conseguir dormir).
- [ ] Meu sono é moderadamente perturbado (2-3 horas sem conseguir dormir).
- [ ] Meu sono é muito perturbado (3-5 horas sem conseguir dormir).
- [ ] Meu sono é completamente perturbado (1-2 horas sem sono).

Seção 10 – Diversão

- [ ] Eu consigo fazer todas as minhas atividades de diversão sem nenhuma dor no pescoço.
- [ ] Eu consigo fazer todas as minhas atividades de diversão com alguma dor no pescoço.
- [ ] Eu consigo fazer a maioria, mas não todas as minhas atividades de diversão por causa da dor no meu pescoço.
- [ ] Eu consigo fazer poucas das minhas atividades de diversão por causa da dor no meu pescoço.
- [ ] Eu mal consigo fazer quaisquer atividades de diversão por causa da dor no meu pescoço.
- [ ] Eu não consigo fazer nenhuma atividade de diversão.

ANEXO G – ESCALA DE PERCEPÇÃO GLOBAL DE MUDANÇA

Escala de Percepção Global de Mudança (PGIC versão Portuguesa)

Nome: _____ Data: _____

Queixa principal: _____

Desde o início do tratamento nesta instituição, como é que descreve a mudança (se houve) nas LIMITAÇÕES DE ACTIVIDADES, SINTOMAS, EMOÇÕES E QUALIDADE DE VIDA no seu global, em relação à sua dor (seleccione UMA opção):

Sem alterações (ou a condição piorou)	☐ 1
Quase na mesma, sem qualquer alteração visível	☐ 2
Ligeiramente melhor, mas, sem mudanças consideráveis	☐ 3
Com algumas melhorias, mas a mudança não representou qualquer diferença real	☐ 4
Moderadamente melhor, com mudança ligeira mas significativa	☐ 5
Melhor, e com melhorias que fizeram uma diferença real e útil	☐ 6
Muito melhor, e com uma melhoria considerável que fez toda a diferença	☐ 7

ANEXO H – ESCALA TAMPA DE CINESIOFOBIA

Aqui estão algumas das coisas que outros pacientes nos contaram sobre sua dor. Para cada afirmativa, por favor, indique um numero de 1 a 4, caso você concorde ou discorde da afirmativa. Primeiro, você vai pensar se concorda ou discorda e, a partir daí, se totalmente ou parcialmente.

		Discordo totalmente	Discordo parcialmente	Concordo parcialmente	Concordo totalmente
1.	Tenho medo de me machucar, se eu fizer exercícios.	1	2	3	4
2.	Se eu tentasse superar esse medo, minha dor aumentaria.	1	2	3	4
3.	Meu corpo está dizendo que alguma coisa muito errada está acontecendo comigo.	1	2	3	4
4.	Minha dor provavelmente seria aliviada se eu fizesse exercício.	1	2	3	4
5.	As pessoas não estão levando minha condição médica a sério.	1	2	3	4
6.	A lesão colocou meu corpo em risco para o resto da minha vida.	1	2	3	4
7.	A dor sempre significa que o meu corpo está machucado.	1	2	3	4
8.	Só porque alguma coisa piora a minha dor, não significa que essa coisa é perigosa.	1	2	3	4
9.	Tenho medo de que eu possa me machucar acidentalmente.	1	2	3	4
10.	A atitude mais segura que posso tomar para prevenir a piora da minha dor é, simplesmente, ser cuidadoso para não fazer nenhum movimento desnecessário.	1	2	3	4
11.	Eu não teria tanta dor se algo realmente perigoso não estivesse acontecendo no meu corpo.	1	2	3	4
12.	Embora eu sinta dor, estaria melhor se estivesse ativo fisicamente.	1	2	3	4
13.	A dor me avisa quando devo parar o exercício para eu não me machucar.	1	2	3	4
14.	Não é realmente seguro para uma pessoa, com problemas iguais aos meus, ser ativo fisicamente.	1	2	3	4
15	Não posso fazer todas as coisas que as pessoas normais fazem, pois me machuco facilmente.	1	2	3	4
16.	Embora alguma coisa me provoque muita dor, eu não acho que seja, de fato, perigoso.	1	2	3	4
17.	Ninguém deveria fazer exercícios, quando está com dor.	1	2	3	4

Tabela 1 - *Escala Tampa para Cinesiofobia - Brasil.*