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# Laser and acupuncture can be a treatment for myofascial temporomandibular disorder? A randomized, controlled, single-blind clinical trial

**Laser e acupuntura podem ser um tratamento para disfunção temporomandibular de origem muscular? Um ensaio clínico randomizado, controlado e cego simples**

**¿Puede el láser y la acupuntura ser um tratamiento para el transtorno temporomandibular miofascial? Un ensayo clínico aleatorizado, controlado y ciego simple**

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**Abstract**

Background: Temporomandibular disorder (TMD) is a set of conditions with a multifactor etiology that affect the temporomandibular joint and muscles of mastication. Objective: The aim of the present study was to assess the effectiveness of treatment for myofascial TMD using acupuncture and low-level laser therapy compared to occlusal splint. Methods: 23 patients recruited through announcements and online publications. The diagnosis of TMD was confirmed using the Research Diagnostic Criteria for TDM (RDC/TMD) and all participants had moderate to severe pain upon palpation. The participants were randomly allocated to three groups: Group 1–occlusal splint; Group 2–10 sessions of acupuncture (once per week); Group 3–low-level laser therapy at 48-h intervals until the remission of symptoms or until completing 10 sessions. The participants were submitted to evaluations before and after treatment as well as 30 days after the end of treatment involving the determination of pain intensity, maximum vertical mandibular movement, as well as extraoral and intraoral palpations e analyze intra e extra group. Results: Statistically significant improvements in pain intensity were found in the acupuncture and laser groups (p=0.002). Improvements in the masseter and temporal muscles as well as the lateral pole of the temporomandibular joint were achieved with acupuncture and laser. Significant improvement was found in the posterior mandibular region using all three treatment modalities. Improvement in the submandibular region was only achieved with laser therapy. Conclusion: Treatments

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with acupuncture and low-level laser were more effective at reducing symptoms in individuals with myofascial TMD compared occlusal splint.
**Keywords:** Temporomandibular joint; Temporomandibular joint disorders; Therapeutics; Acupuncture; Laser therapy.

**Resumo**

Contexto: A disfunção temporomandibular (DTM) é um conjunto de condições com etiologia multifatorial que afeta a articulação temporomandibular e os músculos da mastigação. Objetivo: Avaliar a eficácia do tratamento para DTM muscular utilizando acupuntura e terapia com laser de baixa potência comparado à placa oclusal. Método: 23 pacientes recrutados através de anúncios e publicações online. O diagnóstico de DTM foi confirmado usando os Critérios Diagnósticos de Pesquisa para DTM (RDC/TMD) e todos os participantes apresentavam dor moderada a severa à palpação. Os participantes foram aleatoriamente alocados em três grupos: Grupo 1 – placa oclusal; Grupo 2 – 10 sessões de acupuntura (uma vez por semana); Grupo 3 – terapia com laser de baixa potência em intervalos de 48 horas até a remissão dos sintomas ou até completar 10 sessões. Os participantes foram submetidos a avaliações antes e após o tratamento, e 30 dias após o término do tratamento, envolvendo a determinação da intensidade da dor, abertura máxima de boca, palpações extraorais, intraorais, análise intra e intergrupos. Resultados: Melhora estatisticamente significativas na intensidade da dor foram encontradas nos grupos de acupuntura e laser (p=0.002). Uma melhora da dor nos músculos, assim como na articulação temporomandibular, foram alcançadas com acupuntura e laser. Uma melhora significativa foi observada na região mandibular posterior usando todas as três modalidades de tratamento. A melhora na região submandibular foi alcançada apenas com o laser. Conclusão: Tratamentos com acupuntura e laser de baixa potência foram mais eficazes na redução dos sintomas em indivíduos com DTM muscular comparados à placa oclusal.
**Palavras-chave:** Articulação temporomandibular; Transtornos da articulação temporomandibular; Terapêutica; Acupuntura; Terapia a laser.

**Resumen**

Antecedentes: El trastorno temporomandibular (TTM) es un conjunto de condiciones con una etiología multifactorial que afecta la articulación y los músculos de la masticación. Objetivo: El objetivo del estudio fue evaluar la efectividad del tratamiento para TTM miofascial utilizando acupuntura y terapia láser de bajo nivel en comparación con la férula oclusal. Métodos: Se reclutaron 23 pacientes. El diagnóstico de TTM fue confirmado utilizando los Criterios Diagnósticos de Investigación para TTM (RDC/TTM) y todos los participantes tenían dolor moderado a severo al palpar. Los participantes fueron asignados aleatoriamente a tres grupos: Grupo 1–férula oclusal; Grupo 2–10 sesiones de acupuntura; Grupo 3–terapia láser de bajo nivel a intervalos de 48 horas. Los participantes fueron sometidos a evaluaciones antes y después del tratamiento, así como 30 días después del final del tratamiento, involucrando la determinación de la intensidad del dolor, el movimiento mandibular vertical máximo, así como palpaciones extraorales e intraorales y análisis intra e intergrupal. Resultados: Se encontraron mejoras significativas en la intensidad del dolor en los grupos de acupuntura y láser (p=0.002). Se lograron mejoras en los músculos masetero y temporal, así como en el polo lateral de la articulación con acupuntura y láser. Se encontró una mejora en la región mandibular posterior utilizando los tres tratamientos. La mejora en la región submandibular solo se logró con la terapia láser. Conclusión: Los tratamientos con acupuntura y láser fueron más efectivos para reducir los síntomas en individuos con TTM en comparación con la férula oclusal.
**Palabras clave:** Articulación temporomandibular; Trastornos de la articulación temporomandibular; Terapéutica; Acupuntura; Terapia por láser.

## 1. Introduction

Temporomandibular disorder (TMD) is a term for a set of conditions with a multifactor etiology that affect the temporomandibular joint and muscles of mastication (Carvalho et al. 2009) causing discomfort in the head and neck region (Turp et al. 2004). TMD is considered the second most common cause of orofacial pain. According to a recent systematic review and meta-analysis, the prevalence of this disorder is approximately 31% among adults and older people and 11% in children and adolescents (Valesan et al. 2021). The most frequently reported symptoms are headache, joint noises and difficulty opening the mouth (Simma et al. 2009).

Treatment for TMD depends on the subtype of the disorder and the symptoms (Carvalho et al. 2009). Thus, the protocol for the treatment of individuals with orofacial pain, including TMD, can vary considerably. Analyses are generally performed on the extent to which the structures are affected, clinical symptoms and the duration of the problem. Conservative,

reversible treatment, such as behavior-modification counseling, physiotherapeutic exercises, the prescription of medications and occlusal splints (bite plates), are indicated for initial care in nearly all subtypes of TMD (Story et al. 2016).

Occlusal splints are widely used as traditional treatment for TMD, despite being palliative devices (Zhang et al. 2020). Other treatments employed as alternatives to an occlusal splint include low-level laser therapy, which has anti-inflammatory, analgesic and regenerative effects (Shukla et al. 2016), and modalities of traditional Chinese medicine, such as acupuncture, to control pain and anxiety (Cândido dos Reis et al. 2021; Sen et al. 2020).

A recent systematic review presented evidence on the use of acupuncture as a treatment option to relieve myofascial pain in individuals with TMD (Fernandes et al. 2017). The results showed that acupuncture has a significant short-term analgesic effect and exerts a positive influence on the signs and symptoms of TMD. Despite these findings, there is a need for more robust studies for the establishment of reliable scientific evidence.

Considering the scarcity of studies with adequate methodological quality comparing the effectiveness and practical implications of alternative therapies for this condition, the aim of the present study was the evaluate the effectiveness of acupuncture and low-level laser therapy for the treatment of myofascial TMD in comparison to the use of an occlusal splint.

The null hypothesis is that acupuncture treatment will be better than occlusal splint.

## 2. Methodology

### Ethical aspects

This randomized, controlled, single-blind clinical trial received approval from the institutional review board of Federal Universidad of Jequitinhonha and Mucuri Valley's under process number 2.640.273.

### Selection of participants

The participants were recruited from the patient charts of the Temporomandibular Disorder Clinic of Federal Universidad of Jequitinhonha and Mucuri Valley's as well as through announcements and online publications on social media. All volunteers signed a statement of informed consent agreeing to participate in the study. The participants were informed that they could leave the study and withdraw their consent at any time. Evaluations were performed in a reserved room to ensure anonymity and not cause the participants any embarrassment. The total number of individuals was determined by a convenience sample.

The inclusion criteria were a diagnosis of TMD using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), moderate to intense pain during intraoral and/or extraoral palpation (score $\geq 5$ on the Numerical Rating Scale), the absence of systemic health conditions and agreement to participate in the study. Individuals who took analgesics and/or anti-inflammatories and/or antidepressants for more than one year, those undergoing orthodontic treatment, those previously submitted to any type of treatment for TMD and those with a history of facial trauma were excluded.

### Randomization

The sample was composed of twenty-three patients. No determinations were made regarding age group or sex. Two dropouts occurred during the study. The participants were randomly allocated to three groups. Group 1 (G1: n = 7) underwent treatment with an occlusal splint. Group 2 (G2: n = 7) received acupuncture. Group 3 (G3: n = 7) received low-level infrared laser therapy applied to previously determined points and using the protocol established by the manufacturer of the laser device.

Twenty-one slips of paper (seven for each group [G1, G2 and G3]) were placed into an opaque envelope. Each participant removed a slip of paper from the envelope stipulating the treatment. The interventions remained concealed until the time of their execution by the researcher in charge. The researchers-maintained control of the interventions using a dental chart, individual evaluation chart for the progression of treatment, an acupuncture chart (G2), an individual map of the points selected for laser irradiation (G3) and the RDC/TMD questionnaire. To enhance the results of the treatments, all participants received counseling for individuals with TMD and for better control of stress and depression (Toassi & Petry 2021).

**Occlusal splint**

Treatment in G1 consisted of the use of a relaxation/stabilization occlusal splint. The device was fabricated by calibrated, trained examiners in rigid transparent acrylic resin (Vipi Crill Plus, Vipi, SP, Brazil). For such, molding was performed of the upper and lower arches with alginate (Algi Gel, Maquira, PR, Brazil). The proportion of water to powder and mixing rigorously followed the manufacturer's instructions to obtain the most reliable molds possible. The perforated impression trays were selected and protected with #7 wax (Cera & Rosa, Lysandra, SP, Brazil). The molds were then taken to the laboratory for the creation of the plaster models. Special type IV dental stone (Dentmix, Asfer, SP, Brazil) was used for the region corresponding to the teeth and type III dental stone (Dentmix, Asfer, SP, Brazil) was used for the base. The models were hydrated in water for assembly in the semi-adjustable articulator (JP30, Gnatus, SP, Brazil). The facial arch was used for the assembly of the upper model. A wax record and Lucia jig were used for the assembly of the lower model. Next, a single researcher installed the splint and performed occlusal adjustments with Accu Film II carbon paper (Parkell, NY, USA) to avoid inter-researcher variations. All participants in this group received information on how to use and care for the splint.

**Acupuncture**

G2 was submitted to acupuncture. An experienced acupuncturist took the specific patient history prior to the first session. Disinfection of the sites to receive the filiform needles (0 25 x 30 mm, DUX Acupunture, RS, Brazil) was performed with 70% alcohol (Rioquímica, SP, Brazil). The exact depth of each point was determined for each patient when the "*DE QI*" was reported. The acupuncture points selected were Hegu (LI4), Ermen (TA21), Ting–Kong (ID19), Taichong (LR3), YinTang, Jiache (E6), Xianguan (E7), Baihui (GV20), bladder 60 (B60), BL60 (Kunlun), LR3 (Taichong), ST36 (Zusanli) ST6 (Hyeopgeo), ST7, LI4 (Hegu), TA21, ID19, GV20 (Baihui) and YT (YinTang). All needles were activated with 10 minutes of insertion and removed after 20 minutes, in the 10 sessions of acupuncture. The same points were used in all individuals of the research.

**Low-level laser therapy**

G3 was submitted to low-level laser therapy applied to pain points determined by palpation using the Clean Line Easy Laser - LILT (Low Intensity Laser Treatment) (Clean Line, Taubaté, SP, Brazil). The laser was administered at a wavelength of 790 nm (infrared), with an energy density of 8 J/cm2 and power of 120 mW for 66 seconds over the muscle point and an energy density of 4 J/cm2 and power of 120 mW for 33 seconds over joint points. Sessions were held every 48 hours until the remission of symptoms (minimum) or until completing ten sessions (maximum), following the manufacturer's instructions. Low-level laser therapy was administered at 48-h intervals until the remission of symptoms or until completing 10 sessions

Assessments of the effect of treatment were performed in all sessions in G1 and G2. All measurements were performed by an examiner who had undergone training and calibration exercises.

**Development of study**

All groups were submitted to evaluations before and after treatment as well as 30 days after the end of treatment (follow-up to determine the long-term results of the treatments), with the assessment of pain intensity, determination of maximum vertical mandibular movement as well as extraoral and intraoral palpations. Pain intensity was measured using the Numerical Rating Scale ranging from 0 (absence of pain) to 10 (extreme pain). The patients also reported whether they had experienced an improvement or worsening or whether no change occurred in relation to pain at baseline. The result was recorded on the individual pain chart for each patient. Maximum vertical mandibular movement without assistance and without pain as well as with assistance was measured using a wooden tongue depressor and pen from the edge of the right maxillary central incisor to the edge of the right mandibular central incisor, followed by measurement in millimeters using a ruler. Extraoral and intraoral palpations were performed by a single examiner who had undergone training and calibration exercises for the administration of the RDC/TMD.

**Data analysis**

The data were tabulated with the aid of a Microsoft Excel® spreadsheet and transported to the Statistical Package for Social Sciences (SPSS), version 20 for Windows (SPSS Inc., Chicago, IL, USA). The Komogorov-Smirnov normality test was applied and revealed that the data had non-normal distribution. Thus, comparisons between groups were performed using the nonparametric Kruskal-Wallis with the complementary Mann-Whitney test. The significance level was set at 5% ($p < 0.05$).

## 3. Results

Statistically significant differences among groups were found regarding pain intensity ($p = 0.002$). The groups treated with acupuncture and low-level laser therapy presented a significant reduction in pain after treatment, whereas the same did not occur in the group treated with occlusal splints. Duration of 10 acupunture sessions and 6 months treated with occlusal splints. Moreover, the maintenance of the results for up to 30 days was found in the acupuncture and laser groups (Table 1).

**Table 1 –** Mean and standard deviation of pain intensity in occlusal splint, acupuncture and laser groups at initial, final and 30-day follow-up evaluations. ($p < 0.05$).

| | Splint | Acupuncture | Laser |
|---|---|---|---|
| Initial | $4.00 \pm 3.10^{aA}$ | $6.00 \pm 1.29^{aA}$ | $4.77 \pm 2.43^{aA}$ |
| Final | $4.14 \pm 3.33^{aA}$ | $0.28 \pm 0.75^{bB}$ | $0.00 \pm 0.00^{bB}$ |
| 30 days | $3.14 \pm 3.18^{aA}$ | $1.57 \pm 3.04^{aB}$ | $0.28 \pm 0.75^{aB}$ |

*Same lowercase letters denote statistical similarity between lines. Same uppercase letters denote statistical similarity between columns. Source: Self-Authored.

No significant difference among groups (splint, acupuncture and laser) was found regarding maximum vertical mandibular movement (without and with assistance) after treatment, demonstrating that the individuals did not exhibit a gain in mouth opening range. The mean and standard deviation results for maximum vertical mandibular movement without assistance/without pain and with assistance are displayed in Table 2.

**Table 2 –** Mean and standard deviation of vertical mandibular movement without assistance/without pain and with assistance in occlusal splint, acupuncture and laser groups before and after treatment.

| | **Splint** | | **Acupuncture** | | **Laser** | |
|---|---|---|---|---|---|---|
| | **Before** | **After** | **Before** | **After** | **Before** | **After** |
| Without | 31.14±5.52[a] | 32.71±6.15[a] | 36.71±12.98[a] | 37.14±11.06[a] | 34.55±11.39[a] | 39.85±7.69[a] |
| With | 42.42±5.28[a] | 43.00±4.72[a] | 46.85±5.58[a] | 44.71±4.99[a] | 40.33±7.84[a] | 44.00±5.44[a] |

*Same lowercase letters denote statistical similarity. Source: Self-Authored.

Considering intraoral muscle pain, a reduction was found in the lateral pterygoid muscle with all three forms of treatment. However, the results were statistically significant only in the acupuncture and laser groups. The data related to pain upon intraoral muscle palpation are displayed in Table 3.

**Table 3 –** Median intraoral muscle pain upon palpation of right and left lateral pterygoid muscle and right and temporal tendon in occlusal splint, acupuncture and laser groups at initial and final evaluations. ($p < 0.05$).

| | | **Splint** | | **Acupuncture** | | **Laser** | |
|---|---|---|---|---|---|---|---|
| Muscle | Side | Initial | Final | Initial | Final | Initial | Final |
| Temporal tendon | Left | 2.00[aA] | 0.00[aB] | 2.00[aA] | 0.00[aB] | 2.00[aA] | 0.00[aB] |
| | Right | 2.00[aA] | 0.00[aB] | 2.00[aA] | 0.00[aB] | 1.00[aA] | 0.00[aB] |
| Lateral pterygoid | Left | 1.14[aAB] | 0.42[aA] | 1.71[aA] | 0.00[aB] | 1.55[aA] | 0.00[aB] |
| | Right | 2.00[aB] | 1.00[aAB] | 1.57[aA] | 0.14[aB] | 1.22[aA] | 0.00[aB] |

*Same lowercase letters denote statistical similarity between lines. Same uppercase letters denote statistical similarity between columns. Source: Self-Authored.

Regarding joint pain, the acupuncture and laser groups exhibited statistically differences after treatment for palpation of the lateral pole ($p = 0.003$ and 0.036, respectively), which did not occur in the occlusal splint group. No significant difference in pain in the posterior ligament between evaluations was found in any of the group. For pain in the posterior mandibular region on both sides, significant reductions were found after treatment in all three groups. For pain in the submandibular region, laser therapy achieved a significant reduction on the right side, whereas no significant differences were found with the other treatments. The data on pain upon palpation of the joint are displayed in Table 4.

**Table 4 –** Mean and standard deviation of joint pain upon palpation in right and left lateral pole, posterior ligament, posterior mandibular region and submandibular region in occlusal splint, acupuncture and laser groups at initial and final evaluations.

| | | Splint | | Acupuncture | | Laser | |
|---|---|---|---|---|---|---|---|
| | | **Initial** | **Final** | **Initial** | **Final** | **Initial** | **Final** |
| Posterior ligament | Left | 1.57±1.27[a] | 0.57±0.78[a] | 0.57±0.53[a] | 0.00±0.00[b] | 1.11±1.05[a] | 0.00±0.00[b] |
| | Right | 1.57±1.27[a] | 2.00±1.15[a] | 0.50±0.53[a] | 0.14±0.37[b] | 1.00±1.11[a] | 0.14±0.37[b] |
| Mandibular region | Left | 0.71±1.25[a] | 0.14±0.37[a] | 0.28±0.75[a] | 0.00±0.00[a] | 0.66±1.11[a] | 0.14±0.37[a] |
| | Right | 0.85±1.21[a] | 0.57±1.13[a] | 0.42±0.78[a] | 0.00±0.00[a] | 0.77±1.20[a] | 014±0.37[a] |
| Submandibular region | Left | 1.14±1.21[a] | 0.42±0.78[b] | 0.42±0.78[a] | 0.00±0.00[b] | 0.77±1.30[a] | 0.00±0.00[b] |
| | Right | 1.57±1.13[a] | 0.57±0.97[b] | 0.28±0.48[a] | 0.00±0.00[b] | 0.66±1.11[a] | 0.28±0.48[b] |
| | Left | 0.57±0.97[a] | 0.57±0.97[a] | 0.28±0.48[a] | 0.00±0.00[a] | 0.88±1.16[a] | 0.42±0.78[a] |
| | Right | 0.85±0.89[a] | 1.00±1.29[a] | 0.14±0.37[a] | 0.00±0.00[a] | 1.00±1.00[a] | 0.14±0.37 |

*Same lowercase letters denote statistical similarity. Source: Self-Authored.

None of the three interventions achieved a reduction in pain upon extraoral palpation of the anterior temporal muscle. Regarding the masseter muscle, the occlusal splint and acupuncture were only significantly effective at reducing muscle pain on the left side. In contrast, laser therapy was effective at improving pain on both the right and left sides ($p = 0.0032$). No significant differences were found between the occlusal splint and acupuncture groups (Table 5).

**Table 5 –** Mean and standard deviation of extraoral muscle pain upon palpation of right and left anterior temporal and inferior masseter muscles in occlusal splint, acupuncture and laser groups at initial and final evaluations.

| | | Splint | | Acupuncture | | Laser | |
|---|---|---|---|---|---|---|---|
| | | **Initial** | **Final** | **Initial** | **Final** | **Initial** | **Final** |
| Anterior temporal | Left | 0.42±0.78[a] | 0.17±0.37[a] | 0.14±.037[a] | 0.14±0.37[a] | 0.66±1.11[a] | 0.14±0.37[a] |
| | Right | 0.42±0.53[a] | 0.28±0.75[a] | 0.85±1.06[a] | 0.14±0.37[a] | 0.66±0.86[a] | 0.14±0.37[a] |
| Inferior masseter | Left | 1.00±1.29[a] | 0.00±000[b] | 0.42±0.78[a] | 0.00±0.00[b] | 1.66±1.11[a] | 0.14±0.37[b] |
| | Right | 1.14±1.46[a] | 0.71±1.25[a] | 0.48±0.78[a] | 0.28±0.48[a] | 1.66±1.11[a] | 0.38±0.80[b] |

*Same lowercase letters denote statistical similarity. Source: Self-Authored.

## 4. Discussion

Acupuncture is reported to assist in muscle relaxation and the reduction in spasms of a muscular origin (Naik et al. 2014). However, no significant gain in maximum vertical mandibular movement was found in any of the groups studied. The normal mouth opening range (voluntary – without assistance and without pain) is 40 to 60 mm in healthy adults (Catão et al. 2012; Bianchini et al. 2004; Dimitroulis 1998; Alves et al. 2010) and the mean in individuals with TMD is 34.8 ± 0.55 mm (Kinote et al. 2010). Individuals with TMD have limited mouth opening due to the pain associated with the disorder (Bianchini et al. 2004), which causes limitation and exerts a negative impact on daily activities, such as speaking and eating (Dimitroulis 1998). A lack of a significant improvement in maximum vertical mandibular movement was also reported in studies conducted by (Schmid-Schwap et al. 2006; Zotelli et al. 2017; Madani et al. 2020) and, who found no positive results of acupuncture regarding a gain in vertical mandibular movement. A possible explanation for this result may be related to the fact that

maximum mandibular movement prior to treatment was lower in all groups compared to the normal pattern described in the literature and therefore it was not possible to find significant results in mouth opening range.

According to traditional Chinese medicine, pain results from the stagnation of Qi and/or Xue (blood) in the channels and organs (Pérez 2010). In the present study, low-level laser therapy was effective at reducing pain symptoms in intraoral muscles. Moreover, all interventions reduced joint pain intensity in the posterior mandibular region. However, acupuncture and laser achieved better results in the region of the lateral pole and laser achieved better results in the right submandibular region. Regarding joint pain upon palpation of the right and left posterior ligament, no significant differences were found for the three therapeutic resources. In contrast, (Schmid-Schwap et al. 2006) found differences in pain upon palpation following treatment with acupuncture. However, positive results were found regarding the improvement in pain in the posterior ligament of the temporomandibular joint. Both acupuncture and laser were effective at reducing pain in bilateral points of the lateral pole, which is compatible with the results described for acupuncture by (Schmid-Schwap et al. 2006). However, (Venezian 2009) found a reduction in pain in the lateral pole of the temporomandibular joint only on the right side after laser therapy.

Both the occlusal splint and acupuncture achieved good results regarding the reduction in pain during the extraoral palpation of the left masseter muscle. In contrast, laser therapy was effective at improving pain on both the right and left sides. All treatments reduced pain during the extraoral palpation of the posterior mandibular region, whereas only laser therapy achieved significant results regarding the reduction in pain in the submandibular region. The literature reports that both laser and acupuncture achieve improvements in pain and tension in these muscles, which diverges from the present results (Schmid-Schwap et al. 2006; Shen et al. 2009). Pain reported for intraoral points was reduced on both sides in the acupuncture and laser groups. Similar results are reported in the study by Schmid-Schwap et al. (2006), who only analyzed treatment with acupuncture.

A reduction in pain symptoms was found in the group treated with acupuncture, which is similar to results described in previous studies (Rezende et al. 2013; Porporatti et al. 2015; Schimid-Schwap et al. 2006). (Grillo et al. 2014) also described a reduction in pain very similar to that found in the present investigation. Treatment with low- level laser led to a reduction in mean pain after treatment that was maintained for up to 30 days, which is similar to findings described (Catão et al. 2012). In contrast, no significant difference in pain intensity was found in the group submitted to the use of an occlusal splint, although the literature reports a reduction in pain following treatment with this modality (Schimid-Schwap et al. 2006; Grillo et al. 2014).

The participants reported a reduction in pain intensity in the masseter and temporal muscles. Both acupuncture and low-level laser therapy have proven effective at relaxing the masseter and temporal muscles, suggesting a reduction in pain intensity at these sites (Borin et al. 2011). However, the use of an occlusal splint only achieved a significant improvement in the masseter muscle, with no effectiveness at reducing pain in the temporal muscle, although the authors of previous studies found this method to be effective (Schimid-Schwap et al. 2006). (Vicente-Barrero et al. 2006) found significant improvement in both muscles (masseter and temporal) following both the use of an occlusal splint and acupuncture.

Despite the relevance of the findings, this study has limitations that should be considered. The sample size was small, which could have affected the results. Moreover, a self-administered instrument was used for the analysis of pain (Numerical Rating Scale), which only provides a subjective estimate of pain intensity.

## 5. Conclusion

The use of alternative practices, such as acupuncture and low-level laser therapy, was effective for the treatment of myofascial temporomandibular disorder, leading to significantly better relief of both muscle and joint pain compared to the use

of an occlusal splint. These two interventions are safe, noninvasive, effective options for temporomandibular disorder of a muscular origin.

For future studies, it would be ideal to evaluate the electromyographic activity during the application of acupuncture in patients with temporomandibular disorder.

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