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The effectiveness of laserpuncture associated with vitamin B12 in the treatment of temporomandibular disorders and orofacial pain

A eficácia da laserpuntura associada à vitamin B12 no tratamento das disfunções temporomandibulares e dores orofaciais

La eficacia de la punción laser asociada a la vitamin B12 en el tratamiento de los transtornos temperomandibulares y el dolor orofacial

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Abstract
A low-power laser is presented as a treatment proposal for painful Temporomandibular Disorders (TMD). This randomized clinical trial evaluated the effectiveness of laserpuncture using low power laser in the treatment of pain in patients with temporomandibular disorders with and without concomitant administration of vitamin B12 (methylcobalamin). A questionnaire was applied to the participants to assess the location of the orofacial pain in conjunction with the request for blood vitamin B12 dosage. The groups were randomly divided, being Group 1: placebo laserpuncture and placebo vitamin B12; Group 2: effective laserpuncture and placebo vitamin B12, and Group 3: effective laserpuncture and effective vitamin B12. The study consisted of 45 adult patients (over 18 years old), regardless of sex and race, with signs and symptoms of TMD, where pain was the main complaint. In all sessions, pain was assessed using a visual analogue scale, before and after laser therapy. Laserpuncture was applied to points of Traditional Chinese Medicine, used for treating Temporomandibular Disorders, using a laser device with an infrared wavelength and energy of 3J. Eight sessions were heldand two sessions per week for 4 weeks. Groups 2 and 3 showed improvement in pain symptoms after treatment. Group 3 patients in the fourth session already showed the effective result of the treatment. Laserpuncture when associated with the use of vitamin B12 becomes more efficient for treating TMD.
Keywords: Temporomandibular joint dysfunction syndrome; Orofacial pain; Laser therapy; Low-level laser; Vitamin B 12.

Resumo
O laser de baixa potência é apresentada como uma proposta de tratamento nos quadros dolorosos de Disfunção Temporomandibular (DTM). O presente ensaio clínico randomizado visou avaliar a efetividade da laserpuntura utilizando laser de baixa potência no tratamento da dor em pacientes com disfunções temporomandibulares com e sem a administração concomitante da vitamina B12 (metilcobalamina). Um questionário foi aplicado aos participantes para avaliar a localização da dor orofacial em conjunto com a solicitação da dosagem sanguinea da vitamina B12. Os grupos foram divididos aleatoriamente, sendo o Grupo 1: laserpuntura placebo e vitamina B12 placebo; Grupo 2: laserpuntura efetivo e vitamina B12 placebo e Grupo 3: laserpuntura efetivo e vitamina B12 efetivo. O estudo foi composto por 45 pacientes adultos (acima de 18 anos), independente de sexo e de raça, com sinais e sintomas de DTM, onde a dor era a principal queixa. Em todas as sessões, a dor foi avaliada através de escala analógica visual, antes e após a aplicação da laserteapia. A laserpuntura foi aplicada em pontos da Medicina Tradicinal Chinesa, usados para tratamento das Disfunções Temporomandibulares, usando o aparelho de laser com o comprimento de onda

infravermelho com energia de 3J. Foram realizadas oito sessões, sendo duas sessões por semana, durante 4 semanas. Os grupos 2 e 3 mostraram melhora nos sintomas de dor após o tratamento. Pacientes do grupo 3 na quarta sessão já mostravam o resultado eficaz do tratamento. A Laserpuntura quando associada ao uso da vitamina B12 se torna mais eficiente para o tratamento da DTM.
Palavras-chave: Síndrome da disfunção da articulação temporomandibular; Dor orofacial; Terapia a laser; Laser de baixa potência; Vitamina B 12.

Resumen
El láser de baja potencia se presenta como una propuesta de tratamiento para los Trastornos Temporomandibulares (TTM) dolorosos. Este ensayo clínico aleatorizado tuvo como objetivo evaluar la efectividad de la punción láser con láser de baja potencia en el tratamiento del dolor en pacientes con trastornos temporomandibulares con y sin administración concomitante de vitamina B12 (metilcobalamina). Se aplicó un cuestionario a los participantes para evaluar la localización del dolor orofacial en conjunto con solicitud de dosificación de vitamina B12 en sangre. Los grupos se dividieron aleatoriamente, siendo el Grupo 1: placebo punción láser y placebo vitamina B12; Grupo 2: laserpuntura efectiva y placebo vitamina B12 y Grupo 3: laserpuntura efectiva y vitamina B12 efectiva. El estudio consistió en 45 pacientes adultos (mayores de 18 años), independientemente del sexo y la raza, con signos y síntomas de TTM, donde el dolor era la principal queja. En todas las sesiones se evaluó el dolor mediante una escala analógica visual, antes y después de la terapia con láser. Se aplicó Laserpuntura en puentos de Medicina Tradicional China, utilizados para el tratamiento de Transtornos Temporomandibulares, utilizando un dispositivo láser con una longitud de onda infrarroja y energía de 3J. Se realizaron ocho sesiones, dos sesiones por semana durante 4 semanas. Los grupos 2 y 3 mostraron una mejoría en los síntomas de dolor después del tratamiento. Los pacientes del grupo 3 en la cuarta sesión ya mostraron el resultado efectivo del tratamiento. La punción láser cuando se asocia con el uso de vitamina B12 se vuelve más eficiente para el tratamiento de TTM.
Palabras clave: Síndrome de la disfunción de articulación temporomandibular; Dolor orofacial; Terapia por láser; Láser de baja potencia; Vitamina B 12.

1. Introduction

Temporomandibular disorders (TMD) are considered a subclassification of musculoskeletal disorders, which are deep and persistent somatic pain, which is the main factor that leads the patient to seek treatment in a significant number of cases (Ye, et al., 2022).

TMD occupy second place among the musculoskeletal conditions that most result in pain and disability, second only to chronic low back pain, being a significant public health problem worldwide (Conti, 2021).

The prevalence of TMD reaches up to 80% in the adult population, with signs and symptoms affecting more frequently adults, aged between 20 and 40 years, possibly due to hormonal factors and a greater susceptibility of this age group to present psychosomatic alterations (Alkhudhairy, et al., 2018; Manfredini, et al., 2021; Lima, et al., 2020; Maslak-Beres, et al., 2019; Pinto, et al., 2017).

There are several therapeutic options that have shown positive results for the treatment of TMD, such as pharmacological therapy (Villela, 2018), cognitive behavioral therapy (Souza & Carvalho, 2021), acupuncture (Araújo Teles, et al., 2022; Porporatti, et al., 2015; Garbelotti, et al., 2016), thermotherapy (Macedo, et al., 2022; Furlan, et al., 2015), orofacial myofunctional therapy (BMT) (Silva, 2019) and laser therapy (Carvalho, et al., 2019). The combination of treatments for pain control and training of orofacial motor functions are favorable for the rehabilitation of TMD and the association of techniques can bring better and superior results to isolated treatments (Pinheiro, et al., 2021; Cusumano, 2016; Machado, et al., 2016).

Photobiomodulation, from Low-Intensity Laser Therapy (LTBI) and/or light-emitting diode therapy (LEDT), is considered a non-invasive therapy based on the contact of light with the tissues of the human body, stimulating the physiological processes (photochemical, photophysical and photobiological) resulting in immediate tissue repair, control and/or reduction of inflammation and analgesia (Musttaf, et al., 2019; Maximo, et al., 2022; Reis, et al., 2021).

According to Alves et al. (2021) the use of photobiomodulation as a complementary therapy in traditional allopathic treatments is restricted, however, in recent years, new studies with the application of light/heat/application time/treatment

conditions have suggested that photobiomodulation is a of important tools for relieving painful conditions, such as orofacial pain (Rodrigues, et al., 2019; Abdel-Gawwad, et al., 2021; Ferreira, et al., 2022; Dias, et al., 2022; Reis, et al., 2021; Castillo-Madrigal, et al., 2023).

The mechanisms of action of photobiomodulation can be related to the absorption of light by cellular chromophore groups such as cytochrome C oxidase (COx), the main agent of light absorption and responsible for triggering an increase in ATP (adenosine triphosphate), modulating the synthesis of DNA and RNA act in proliferation and gene expression, in cellular catabolism, metabolism of the mitochondrial matrix and consequently in the alteration in phenomena and cellular responses such as mitosis, apoptosis, inflammation, and, in this way, have action in orofacial pain (Costa, et al., 2021). According to Borba et al. (2021) the anti-inflammatory effect comes from the ability to limit the release of inflammatory mediators such as bradykinin, histamine and especially prostaglandin during the inflammatory response.

In dentistry, other integrative and complementary practices are used as an option for TMD treatments and pain reduction, such as massage therapy (Beira, et al., 2017; Vilela, et al., 2020), kinesiotherapy (Galvão, et al., 2019; Vilela, et al., 2020), psychotherapy (Melo, et al., 2020; Zavanelli, et al., 2017; Oliveira, et al., 2017), postural training (Pivotto, et al., 2020; Bodoni, et al., 2018) and acupuncture (Castro, et al., 2022; Aguiar, 2020).

The effectiveness of acupuncture (acus - needle and puncture - placement), a practice of Traditional Chinese Medicine (TCM), has been proven in the treatment of craniofacial pain, trigeminal neuralgia, sinusitis, xerostomia, arthritis and temporomandibular dysfunction pain (Sampaio, et al., 2019; Fortaleza, et al., 2022). In Acupuncture, when a needle is inserted into a given acupoint, physiological actions are triggered at the energy, humoral and neural levels (Souza, et al., 2017; Araújo Teles, et al., 2022).

Laserpunture therapy (Laser-acupuncture) follows the principles of Traditional Chinese Medicine (TCM) and is as effective as traditional acupuncture. In this technique, the methodology is non-invasive, painless, aseptic, requires less application time on the acupoint and can be applied on points close to noble anatomical areas, in painful areas and after surgeries. Due to these advantages, laserpuncture may be the option of choice in the treatment of children, elderly or more sensitive people, and may be associated with other integrative practices or pharmacological treatment (Castro, et al., 2022).

B complex vitamins are used associated with other drugs or non-invasive methods in pain management (Gazoni, et al., 2016). Vitamin B12, also known as cobalamin, has important properties for various biological functions. It is a neurotrophic substance, with a predilection for neuronal tissues, recognized for its action in the maintenance and regeneration of peripheral nerves (Huang, et al., 2019).

B12 promotes the myelination process aiming at the restoration and regeneration of nerve functionality, via the positive regulation of gene transcription. Also, cobalamin acts by inhibiting ectopic discharges of peripheral primary sensory neurons in neuropathic pain states, thus helping to attenuate painful symptoms (Xu, et al., 2018; Moreno, et al., 2021).

Thus, interconnecting pharmacological and non-pharmacological treatment of TMD, the objective of this study was to evaluate the effectiveness of the combination of laserpuncture techniques and the administration of vitamin B12 as an alternative for the treatment of TMD pain and orofacial pain in adult patients.

2. Methodology

This is a controlled, randomized, blind clinical trial, characterized as a phase II interventional clinical trial, according Estrela (2018), in which 45 patients were selected, all diagnosed with TMD and orofacial pain, diagnosed through the RDC/TMD (Diagnostic Criteria of Research for temporomandibular disorders) where the main complaint was pain. As inclusion criteria, adults, men and women, over 18 years old, diagnosed with chronic myofascial pain and arthralgia, with persistent symptoms for a minimum period of 12 months, where the only accepted treatment was the use of medication to

relieve pain. Exclusion criteria were the presence of fungal, hyperplastic, erythematous, continuity or keloid dermatological alterations in the areas related to the acupuncture points; report or finding of facial trauma as a possible etiology of TMD; medical, pharmacological, physiotherapy or psychological treatment for TMD, concomitant with the therapies established in this research; special classes such as pregnant women; individuals with physical or intellectual disabilities without tutoring, patients with pacemakers and cancer patients.

The experimental project was submitted to the Human Ethics Committee/CONEP/Plataforma Brasil, so the participants were informed about the purpose of the research and those who accepted the invitation to participate signed the Informed Consent Form (ICF).

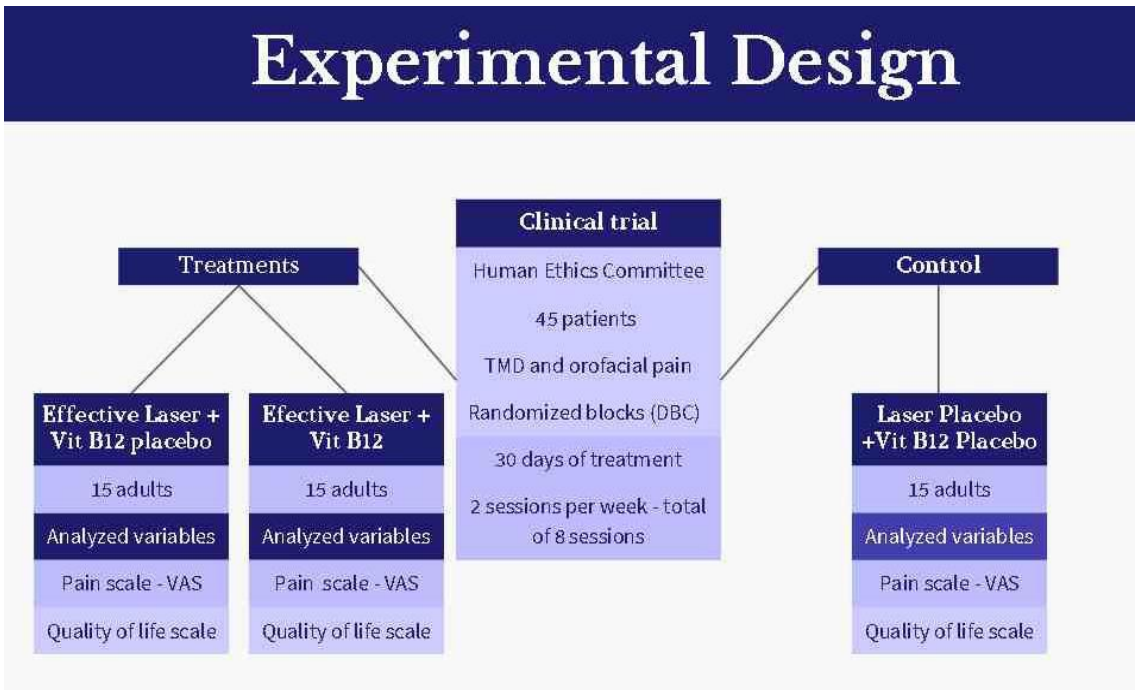
A simple random (Figure 1) allocation procedure of study participants was carried out via a randomization table created by Microsoft Excel software. The patients were divided into three treatments of 15 patients, namely:

Experimental group 1 - Placebo laserpuncture and placebo vitamin B12,

Experimental group 2 - Effective laserpuncture and placebo vitamin B12, and

Experimental group 3 - Effective laserpuncture and effective vitamin B12.

Figure 1 - Schematic representation of the randomized clinical study in patients with TMD.



Source: Authors (2023).

The therapeutic intervention was conducted by the researcher who is a dentist and acupuncturist, qualified in laser therapy. To carry out the procedure, patient and technical team must be properly dressed and use personal protective equipment (PPE) such as glasses capable of preventing any light stimulus in the visual field and/or recognition of the treatment used (blind test). The dental surgeon protected the equipment with a disposable polyethylene membrane and proceeded to clean the application site with 70% ethyl alcohol.

Groups 1 and 2 received placebo vitamin B12 and group 3 received effective vitamin B12 (methylcobalamin 1000 µg daily for 30 days).

In the application of laserpuncture, the Therapy EC-DMC® laser therapy equipment was used, with a laser radiation generator in the red and infrared spectrum. The infrared spectrum of the aluminumgallium-indium-phosphorus laser (InGaAlP,

808nm) was used at a power of 100 mW to activate the acupuncture points. The emission area of the tip (spot size) was 0.028 cm2, with adjustment of the laser dose from 1 to 9 Joules.

The parameters of dose, power and time of application of the acupuncture laser therapy followed the recommendations of Tunér and Hode (1998) so that the laser light was able to reach the acupoint in this type of therapy.

To simulate laserpuncture in patients in group 1 (negative control), the same equipment was used, but turned off, which remained on each acupoint for the same period of 30 seconds. No pressure was exerted, so that acupressure therapy was not used. At the end of 30 seconds, the device was activated to give a beep sound (session ended).

In treatments 2 and 3, laser application was continuous. The irradiation time per acupoint was 30 seconds, the irradiated area was 0.04 cm2, defining an energy of 3J and total energy density per point of 75J/cm2, following the standard protocol of the Special Laboratory of Laser in Dentistry at the University from São Paulo - LELO/USP (Carvalho, et al., 2019).

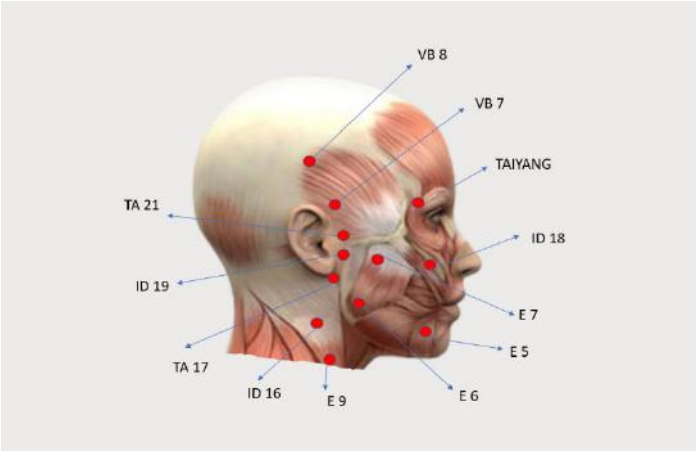
The procedure, for all treatments, was performed during eight sessions, two each week. In all sessions, before and after applying the therapy, the patient was presented with a visual analogue scale (VAS) numbered from zero to 10, where zero is no pain and ten is the most acute pain. The results obtained in each session were noted on the anamnesis form.

The selected acupuncture points for experimental application were recommended according to the literature for the treatment of orofacial pain and TMD (Feltrin, et al., 2006; Rosted, et al., 2006; Castro, et al., 2022), involving local acupoints in the orofacial region, based on the principles of Traditional Chinese Medicine (TCM) highlighted in FIGURE 2 and cited below:

- Tai Yang located in the depression between the lateral border of the eyebrow and the outer corner of the eyelid. Indications in headache, facial paralysis and ophthalmic diseases.
- VB7 located on the head, at the intersection of the vertical line that passes through the anterior region of insertion of the pinna with the horizontal line that touches the apex of the ear.
- VB8 located on the head 1.5 cun (1 cun = 3.333 cm) directly above the apex of the ear. Indications in headache. toothache, trismus, acute aphonia. Indication: migraine, vertigo, vomiting.
- E5 located in the medial region of the masseter muscle, where the chin artery is palpable, 1.3 cun antero-inferiorly to the angle of the mandible. Indications in toothache, cheek inflammation, trismus, neck pain, face pain, tongue stiffness, facial paralysis, parotitis, goiter, vocal cord diseases.
- S6 located on the cheek, 1 cun superior to the anterior angle of the mandible at the highest point of the masseter muscle. Indications in toothache, trismus, facial paralysis, neck pain and stiffness, parotitis, masseter muscle spasm, arthritis, temporomandibular joint, cheek and face pain and swelling, trigeminal neuralgia, mumps, jaw pain, hysteria.
- E7 located distal to the zygomatic bone in a depression that forms when the mouth is closed, at the lower border of the zygomatic arch. Indications in toothache, eyes and mouth deviation, deafness, tinnitus, GUNA (ulcerative gingivitis, acute necrotizing), temporomandibular arthritis, masseter muscle spasm, trigeminal neuralgia, otitis media, otalgia, ear infection, otorrhea, pain and /or jaw motor imbalance.
- E9 located in the anterolateral region of the neck, on the anterior border of the sternocleidomastoid muscle, over the carotid artery, 0.5 cun from Ren-23 (Lianquan). Indications in hoarseness, aphonia, dyspnoea, hiccups, eructation, nausea, vertigo, headache, feeling of fullness in the chest with difficulty breathing, difficulty in speech, pharyngitis, distension, edema and sore throat, tonsillitis, dysphagia, cervical adenitis, goiter, nasal flush.
- ID18 located on the face, directly below the external angle of the eye, just below the zygomatic arch. Indications eyelid spasms, facial pain, mouth and eye deviation, toothache, trigeminal neuralgia, gingivitis.

- ID19 located on the face, anterior to the tragus and posterior to the condyloid process of the mandible, in the depression found when the mouth is ajar. Indications in deafness, ear disorders, mental disorders, tinnitus, toothache, dizziness and vertigo.
- ID16 located on the lateral aspect of the neck, posterior to the sternocleidomastoid muscle, at the level of the thyroid notch of the thyroid cartilage. Indications in trismus, headache, sore throat, neck pain, neck contracture, shoulder pain, visual disturbances, deafness, tinnitus, earache, manic depression, respiratory disorders, hyperthyroidism.
- TA17 located posterior to the earlobe, in the depression between the mastoid process and the mandibular angle. Indications in tinnitus and deafness, neck and cheek swelling and toothache and the point.
- TA21 located on the face, above the tragus, in the depression behind the posterior border of the coronoid process of the mandible. Indications in tinnitus, deafness, otitis media and toothache.

Figure 2 - Laserpuncture application points according to traditional Chinese medicine and literature data.



Source: Authors (2023).

Statistical analysis

The experimental design was in randomized blocks (DBC) and the data obtained were subjected to analysis of variance and mean test (Kruskal-Wallis test followed by the Dwass-Steel-Critchlow-Fligner test - DSCF) at 5% significance.

The data obtained in the pain assessment, via VAS scale in the 8 (eight) therapy sessions were tabulated in Microsoft Excel (Microsoft Windows 2010) and analyzed in the Jamovi® Statistical Software program (Jamovi, 2022).

3. Results and Discussion

Of the 45 individuals in this study, 80% are women and 20% men, with an average age of 42 years (Table 1). In 2001, the authors Warren & Fried stated that TMD is 1.5 to 2 times more prevalent in women than in men, and that 80% of patients treated for TMD are women, which can also be seen in this study. study. These data are also in agreement with other authors who confirmed the age range of diagnosis of RDC/TMD and that the prevalence of TMD in women is higher, due to hormonal factors, arch size, use of prostheses and socioeconomic conditions (Mesquita, et al., 2022; Bueno, et al., 2018; Ye, et al., 2023; Ferreira, et al., 2016; Bonini, et al., 2014; Janal, et al., 2008).

Table 1 - Sampling distribution data (n=45) by treatment (3) according to gender (%) and age group (years). Subtitle: Vit 12= vitamin B12. Relative frequency. μ ±δ.

Treatment	Gender (%)		Age group (years)
	Masculine	Feminine	
Laser and Vit.B12 (placebo)	20	80	41,3 (± 14,8)
Effective Laser and placebo Vit b12	27	73	39,2 (± 13,4)
Effective Laser e Vit. B12	13	87	45,5 (± 17,9)

Source: Authors (2023).

In the self-assessment of the pain index (VAS) using the rating scale (0 to 10), depending on the time of development of the 3 treatments, it was observed that in the first consultation (time 0) that 42% of the patients reported pain 10 (pain maximum on the scale) and 4% pain 5 (mean scale 0-10). In the 2nd stage of the 3 treatments, pain index 10 was in 2% of patients and 31% attributed pain level 5, characterizing the inversion of maximum pain as a function of time, that is, after two sessions of laserpuncture application there was expressive pain reduction in 98% of patients. In the third session, 27% of patients scored zero pain (absence of pain), with no reports of pain index 10. In the eighth session, 62% of patients described complete absence of pain, proving the effectiveness of laserpuncture in TMD.

In the self-assessment scale of pain in the 3 treatments (association of laser + Vitamin B12, placebos and effective) as a function of time, it was verified that in the first session the pain index 10 is 27% in the laser treatment and vitamin B12 placebos (control negative), 60% effective laser associated with placebo vitamin B12 and 40% effective laser and vitamin B12.

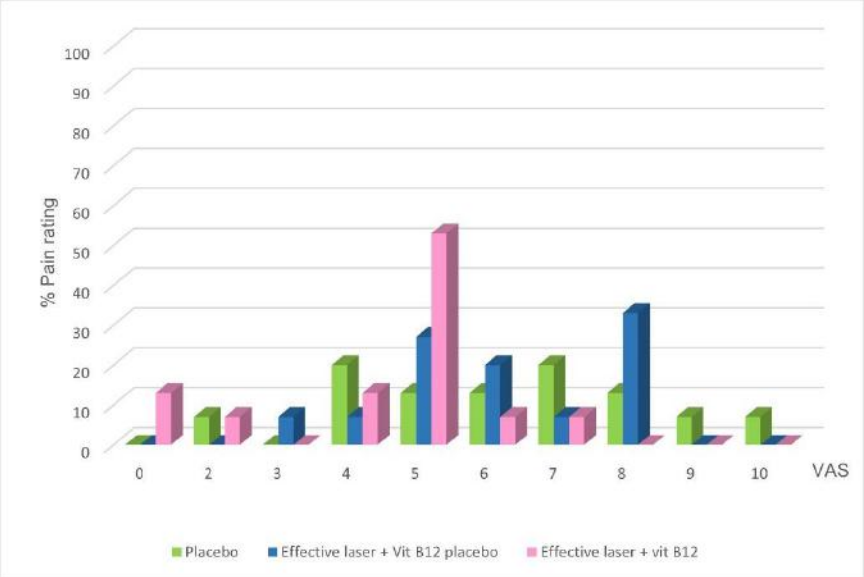
In the second application (Graph 1), the placebo treatment was verified (negative control) there was subjectivity in the evaluation of the pain index where 7% was indicated in levels 2, 9 and 10 and 20% in 4 and 7. and placebo vitamin B12 33% stated that the pain was level 8. In effective laser and vitamin B12 53% attributed pain range 5.

In the follow-up after the third session (graph 2), in the treatment with laser and vitamin placebos, 33% remained at pain level 4, indicating a small variation in the gradation of scores lower than 4 in relation to the second session and allowed us to infer that there was an increase in expectation of pain relief. In the effective laser treatment and placebo vitamin B12, 63% of the patients reported pain equal to or greater than 5. In the positive control, treatment with effective laser and vitamin B12, there was an effective response, where 67% reported zero pain (absence of pain), being that the highest pain index was equal to 5, allowing us to point out that from the third consultation onwards, the use of vitamin B12 was the potentiating factor for the improvement in the patients' pain index (Graph 2).

If we consider the pain assessment scale, Visual Analogue Scale (VAS), as an auxiliary tool in the diagnosis of pain and treatment evolution, we can say that indices from 8 to 10 are the highest pain, from 4 to 7 as pain intermediate and from 0 to 3 as bearable or very low pain (Gonçalves, et al., 2019; Conte, et al., 2021). Thus, when the patient infers “his” pain, he is subject to environmental conditions and pressures, in addition to the expectation attributed to the treatment and the physical and psychological conditions.

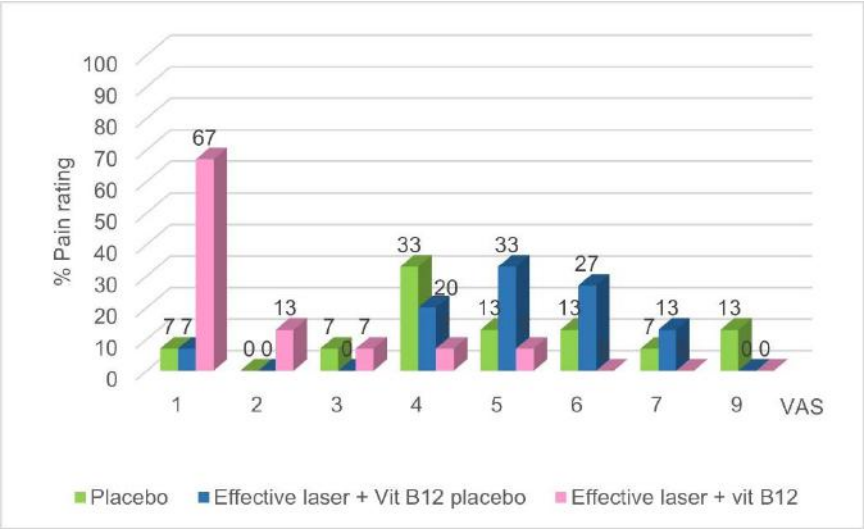
At the eighth session (Graph 3), 93% of patients in the laser and vitamin B12 placebo group reported pain. Patients with effective laser and placebo vitamin B12 treatments (87%) and effective laser and vitamin B12 (93%) ended up with zero pain index results (absence of pain) (Graph 3). It was found that under these experimental conditions, the use of laser therapy provided similar results, demonstrating that the use of the technique was effective in controlling pain. It should be noted, as shown in Graph 2, that the use of vitamin B12 associated with laserpuncture provided patients with effective results from the third session onwards, that is, there was a faster and more effective response to the treatment.

Graph 1 - Self-assessment of pain by the Visual Analogue Scale (VAS), by the patient treatments after the second session.



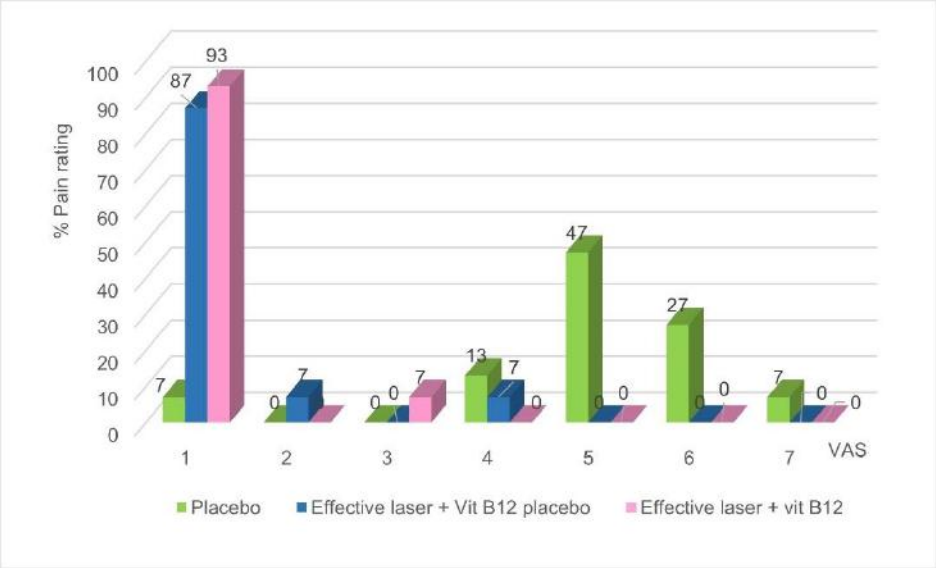
Note: Self-assessment of pain by patients, after the session, in treatments laser and vitamin B12 placebos, effective laser and vitamin B12 placebo and laser and effective vitamin B12 expressed in % of pain as a function of the time scale (time 2 or second evaluation). Source: Authors (2023).

Graph 2 - Self-assessment of pain by the Visual Analogue Scale (VAS), by the patient treatments after the third session.



Note: Self-assessment of pain by patients, after the session, in treatments laser and vitamin B12 placebo, effective laser and vitamin B12 placebo and effective laser and vitamin B12, expressed in % of pain as a function of the time scale (time 3 or third evaluation).
Source: Authors (2023).

Graph 3 - Self-assessment of pain by the Visual Analogue Scale (VAS), by the patient treatments after the last session.



Note: Self-assessment of pain by patients, after the session, in treatments laser and vitamin B12 placebo, effective laser and vitamin B12 placebo and effective laser and vitamin B12 expressed in % of pain as a function of the time scale (time 8 or eighth evaluation), where VAS 7 means the highest pain scale. Source: Authors (2023).

In patients with TMD, the presence of painful symptoms is very common, constantly associated with inflammatory processes, which may affect the TMJ and associated muscles (Araújo, et al., 2021). Pharmacological treatment can be with anti-inflammatory drugs, such as NSAIDs that act by inhibiting cyclooxygenase isoforms (Liberato, et al., 2022; Silva. et al., 2022). Although these drugs have an inhibitory effect on inflammation, with a consequent reduction in painful symptoms, their chronic use can generate unwanted effects such as collateral gastric problems, such as gastric ulcers and nephrotoxicity (Morejon Pérez, et al., 2022; Chaves & Pinto, 2021).

In this sense, clinical studies and constant systematic reviews compiled reaffirm that low power laser therapy is a non-pharmacological and non-invasive alternative to control pain and inflammation, with fewer side effects to the body or irradiated tissue, as well as providing the faster and more effective tissue recovery (Madani, et al., 2020; Ahmad, et al., 2021; Silva, 2022; Borba, et al., 2021; Magri, et al., 2021; Rodrigues, et al., 2019; Ren, et al., 2022; Castro, et al., 2022; Al-Quisiet, et al., 2023; Azevedo, 2023). This study can prove these statements as seen in the data shown in graphs 1, 2 and 3.

When the combination of laser therapy (non-pharmacological treatment) and vitamin B complex (pharmacological treatment) is used as a therapeutic resource, relief of pain and paresthesia is expected. Studies show that when vitamin B12 added to nucleotides, such as cytidine, uridine and hydroxocobalamin were associated with laser therapy, there was a beneficial effect on pain and neuropathies, as reported by Goldberg et al. (2017) and Ribeiro et al. (2021).

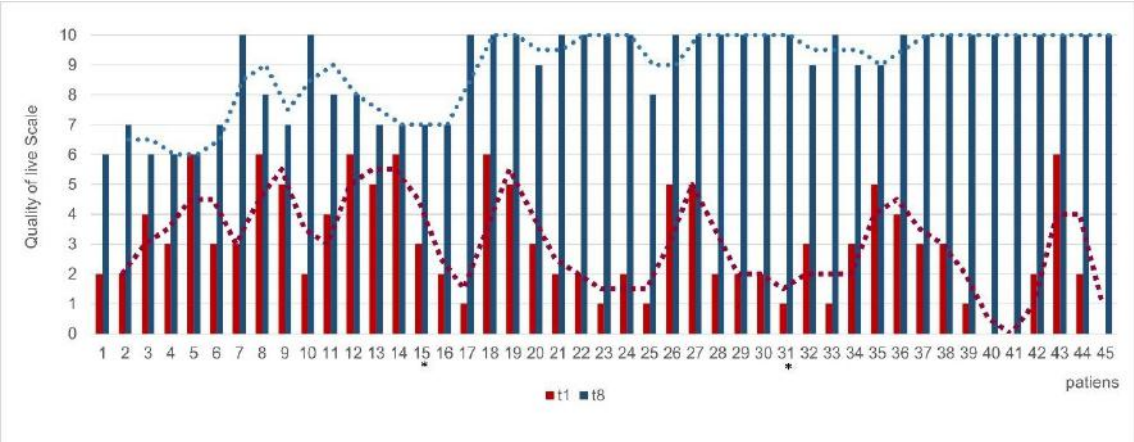
The results of this clinical study confirmed the potentiated effect of the use of laser associated with the use of vitamin B12 (methyl cobalamin) (effective laser treatment and vitamin B12), since in the third session 67% reported no longer feeling pain (zero score on the VAS), and none reported maximum pain and in the eighth session 93% no longer felt pain (graph 2). None of the treatments had the same effectiveness in the short term (3 sessions about 10 days).

In the eighth session (30 days), both patients who used vitamin B12 and received effective laser therapy and those who received effective laser therapy and placebo vitamin B12 had an excellent response in pain treatment, indicating that this response occurs gradually, as verified after analysis the data that pointed to the remission of pain and that 95% of the patients who declared an improvement in their quality of life (Graph 4).

In Graph 4 shows the moving averages, which reflect the behavior of the data set arranged in a time series, that is, of the patients at the beginning and end of the experiment, also revealing the behavior of the patients in the 3 treatments, where

observed the coherence of the data in relation to pain improvement (graphs 2 and 3), and thus the superiority of the effective vitamin B12 and laser therapy treatment (graph 3) visible in graph 4 on the x axis in the sequence 31 to 45. These results can be corroborated with clinical trials by Oliveira et al (2018) in patients with paresthesia treated with photobiomodulation techniques (laser therapy and laser acupuncture) and pharmacological treatment (nucleotides) comparing them to each other and concluded that both photobiomodulation therapies were beneficial in the treatment of paresthesia.

Graph 4 - Self-assessment of improvement in patients' quality of life after the first and last session (8th).



Note: Parameters of self-assessment of quality of life in relation to the time (sessions) of care of the 45 patients of the treatments laser and vitamin B12 placebo (1-15), effective laser and vitamin B12 placebo (16-30) and effective laser and vitamin B12 (31-45) expressed in improvement of quality of life (OHIP -14) (scores 0 to 10) where 0 (zero) poor quality of life and 10 (ten) excellent quality of life compared to the time scale (time 1 – start to 8 or eighth evaluation – final). The dotted lines represent the moving average of the treatments at times 1 (initial session, in red) and 8 (final session, in blue). Source: Authors.

4. Conclusion

Laserpuncture in association with vitamin B12 (methylcobalamin) was effective in the remission of the painful symptomatology of the temporomandibular disorder, promoting greater and faster reduction of painful symptoms (from the third session, about 10 days).

At the end of the 8 sessions, it was proven that the group that received vitamin B12 had a faster reduction in painful symptoms.

Total remission of pain symptoms was observed after 8 weeks of treatment, both in patients treated with laserpuncture in association with the use of vitamin B12 and in the group that received laserpuncture alone, with a consequent significant improvement in the quality of life of these patients.

It is suggested that future studies be carried out to deepen the study of laser therapy and laserpuncture, as well as their effects in the treatment of orofacial pain and in the patient's quality of life.

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