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ORIGINAL PAPER

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Short-term comparison of the 660 and 830 nm laser in the treatment of temporomandibular dysfunction – a randomized clinical trial

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ABSTRACT

Introduction. The objective of this study was to compare the effects of low-level laser therapy (LLLT), 660nm laser with 830nm, in temporomandibular dysfunction (TMD).

Aim. To compare the effect of LLLT 660 nm and 830 nm in treatment of TMD.

Material and methods. This is a randomized clinical study, composed of 30 volunteers with TMDs selected and divided into three groups: LLLT 660nm, LLLT 830nm and Sham. After the intervention, the results were reevaluated with the Fonseca anamnestic questionnaire (FAQ), American Academy of Orofacial Pain Questionnaire (AAOPQ), McGill Pain Questionnaire and Visual Analog Scale.

Results. Analysis of the results showed that, although all groups had reduced values in the FAQ, only the laser groups presented alterations in the level of classification; for AAOPQ, only the treatment groups had a reduction in the positive responses, variables, the reduction was similar for all groups.

Conclusion. LLLT produced a reduction in severity of symptoms but was like the sham for pain.

Keywords. low-level light therapy, physical therapy modalities, temporomandibular joint

Introduction

Temporomandibular dysfunction (TMD) is a set of disorders that encompass: masticatory muscles, temporomandibular joint (TMJ) and other associated structures. Posterior, postural, psychological and neuromuscular anatomical imbalances may cause changes in TMJ, resulting in clinical manifestations such as palpation pain, orofacial pain, stress and altered joint mobility.[1]

Physiotherapeutic treatment is presented as an alternative for the relief of TMD symptoms. Resources such as electrothermotherapy, manual therapy, and kinesiotherapy stand out in an attempt to reduce muscle pain that

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Participation of co-authors: A – Author of the concept and objectives of paper; B – collection of data; C – implementation of research; D – elaborate, analysis and interpretation of data; E – statistical analysis; F – preparation of a manuscript; G – working out the literature; H – obtaining funds

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mainly affects the masseter, lateral pterygoid and temporal muscles.[2] In the relief of symptomatology and in the reestablishment of TMJ function, the low-level laser therapy (LLLT) is established as an efficacious and low cost option. Its effect of analgesia and muscle relaxation is caused by factors such as increased pain threshold and the production of endorphins, and through the electrolyte blocking mechanism of nerve fibers, in addition to reducing the inflammatory process.[3,4]due to its impact on biological processes, especially inflammation, considered as an adjuvant treatment modality in TMD cases. Materials and methods: All original articles related to PBMT for TMDs in EMBASE, MEDLINE (NCBI PubMed and PMC Laser is a non-ionizing electromagnetic radiation, in which all the waves that make up the beam have the exact same wavelength, and thus are monochromatic.[5]

The most used lasers for the therapy are those that act between the red light range (630nm to 700nm) and infrared (700nm to 904nm).[6,7] In the absorption aspect, the red light, due to its lower wavelength, has a lower penetration power in the tissue and is indicated for superficial lesions, whereas the infrared due to its high penetration power reaches deeper structures.[3,8,9]

Aim

Considering that these two types of lasers present different wavelengths, with possible different receptors, but with similar applicability, it is interesting to compare the clinical effects among them, even though there are divergences in the use of this resource in the treatment of TMD due to the diversity of parameters, this research had the objective of analyzing the effect of LLLT 660 nm compared to 830 nm in TMD.

Material and methods

It is a randomized clinical trial. It was composed of 30 volunteers, who were referred by the Clínica de Odontologia of the Universidade Estadual do Oeste do Paraná (UNIOESTE), who, through a dental screening, selected volunteers with TMDs, of which 27 women and 3 men, the average age being 21.5 years, university students. After screening, the selected volunteers were invited to perform the second part of the evaluation and started the research activities after signing the Free and Informed Consent Form (TCLE), approved by the Ethics Committee of Unioeste under number 2,356,498.

We included volunteers who presented TMDs with painful processes (regardless of the source of the pain), of both sexes and any age group. Among the exclusion criteria were: individuals with and/or presenting with central or peripheral neurological disorders, systemic inflammatory disease, malignant tumors, individuals who were unable to respond to questionnaires, and those who left the therapy during the period of physical therapy treatment.

As assessment instruments were used: the Visual Analogue Pain Scale (EVA), which scores the intensity of pain, in a range from no pain (zero) to maximum pain (10 points); the QAF – Fonseca Anamnestic Questionnaire assessing the severity of TMD symptoms, classifying the patients in: without TMD (0 to 15 points), mild TMD (20 to 45 points), moderate TMD (50 to 65) and severe TMD (70 to 100 points), are 10 questions, scored according to the yes - 10, no - 0 and sometimes - 5; the American Academy of Orofacial Pain Questionnaire (AAOPQ) also presents ten specific TMD-related questions, with the dichotomous answers, yes or no, that lead to deviations from organic normality if answered positively; the McGill Pain Questionnaire presents a series of questions that indicate to the patient words that resemble their pain, which aims to quantitatively measure and associate sensory (42 descriptors), affective (14 descriptors) and evaluative (5 descriptors) and pain, in a total of 78 descriptors (17 belong to the miscellaneous subgroup).[10-12] The evaluation was performed before (EV1) and after the intervention (EV2), which lasted two consecutive weeks, for two days each week in the Centro de Reabilitação Física (CRF) of Unioeste - Cascavel campus.

According to the inclusion criteria, the volunteers were divided into three groups with a simple draw. The first group (G1) received LLLT treatment with a wavelength of 660nm, with intensity of 4 J/cm² (per point), at three points in the masseter muscle and three in the temporal bilaterally, with a power of 30 mW, with the incidence of a 90° bundle with respect to the tissue (fig.1).

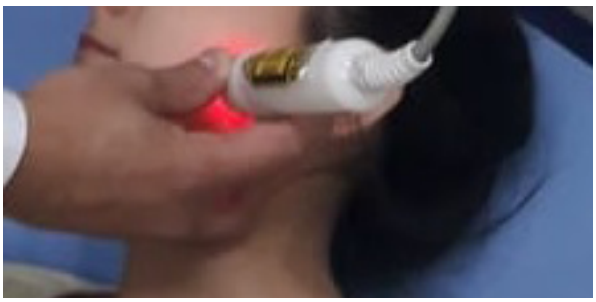

Fig. 1. Application of radiation in masseter region

The second group (G2) received the LLLT 830nm, with the same criteria as the first one. The third (G3) received sham treatment (fig.2), in that, all steps was followed by the above groups, however, there was no escape of radiation. The application was carried out taking all safety measures, such as the use of goggles for both therapists and patients, in addition, hygiene and asepsis standards were included in the pre-treatment to decrease the tissue impedance.

The sample size was calculated based on the evaluation of EVA, by the difference between the means and standard deviation of 1.5, power of 80% and sig-

nificance level of 5%, being found 10 individuals per group. The data were verified and analyzed by descriptive and inferential statistics, and the SPSS 20.0 program was used, by the Generalized Mixed Model test and after the LSD test, the accepted significance level was 5%. Also, the effect size was calculated by Hedges' g (https://www.estimationstats.com/#/), with the following interpretation: insignificant <0.19; small 0.20 – 0.49; medium 0.50 - 0.79; large 0.80 – 1.29; very large > 1.30.[13]2010

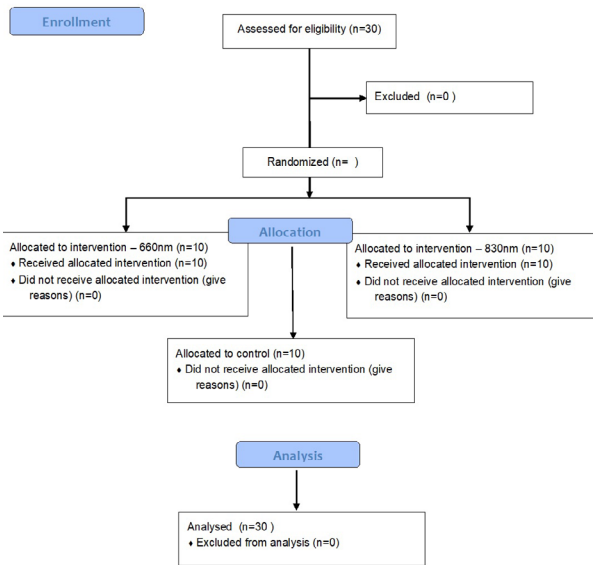

Fig. 2. Consort based flowchart

Results

When analyzing VAS data, there were different between evaluations (p<0.001), but not between groups (p=0.117) or interaction (p=0.266). When effect sizes were analyzed, before and after therapy, very large sizes were noted. The Fonseca questionnaire showed differences between the evaluations (p<0.001) and between the groups (p=0.034), but no interaction (p=0.414). The comparison between G1 and G3 was different (p=0.010), with the G1 is presenting higher values. The effect sizes were very considerable for G1 and G2, but small for G3 (table 1).

The American Academy of Orofacial Pain Questionnaire was evaluated for the rate of positive responses in pre- and post-intervention, one can notice differences between the evaluations (p=0.006), but not between groups (p=0.105) and interaction (p=0.504). Effect sizes were: large for G1 and medium for G2 and G3. Finally, for McGill's questionnaire, the differences occurred between the evaluations (p=0.039), but not between the groups (p=0.356) or interaction (p=0.724); and the effect sizes were: large for G1, medium for G2 and small to G3 (table 1).

Discussion

Literature describes TMDs as functional and often disabling problems, generating pain and difficulties in speech and chewing.[1] Therefore, important studies have been conducted evaluating therapeutics for such dysfunction, and the present study sought to compare two forms of low-level laser application in patients with painful TMD, in order to analyze pain and oral function. The groups were composed of a sample composed basically of young women referred by the Dentistry Clinic of the Unioeste, and the literature presents these characteristics as the population with the highest incidence of TMD.[14,15]

The Fonseca index was used in this study in order to identify the degree of TMD severity, both in pre-intervention and post-intervention, thus being able to identify the presence of variation in the level of TMD, and it is possible to observe in all groups, even in the placebo, significant differences indicating a reduction in severity, when analyzing by the criteria of the G1 and G2 index the volunteers were classified as severe and evolved to moderate, while G3 showed moderate classification even with the average values having decreased.[11] Thus, even if small, the clinical effect of low power laser therapy can be glimpsed by the effect sizes presented, which according to Fikácková et al. can be explained by stabilizing the membrane potential, directly interfering with the neural trans-

Table 1. Data presented in mean and standard deviation, for the different forms of evaluation, of the patients of G1, G2 and G3, with the respective effect sizes (ES)

	G1		G2		G3	
	AV1	**AV2**	**AV1**	**AV2**	**AV1**	**AV2**
VAS	6.0±1.9	2.6±0.7	6.9±1.0	2.2±1.0	5.4±1.9	1.9±1.3
ES	-2.29		-4.44		-2.03	
QAF	73.5±9.4	55.0±14.5	69.5±17.9	47.5±13.8	54.5±19.8	46.0±21.0
ES	-1.45		-1.32		-0.40	
QADOF	7.0±2.7	4.4±2.5	5.5±2.0	3.9±2.3	4.6±2.0	3.7±2.1
ES	-0.96		-0.70		0.79	
McGill	24.5±11.3	14.4±10.3	22.4±11.1	16.0±12.3	16.3±14.1	12.5±14.6
ES	-0.89		-0.52		-0.25	

mission of pain, which may result from the formation of varicosities in neurons Aδ and C neurons.[16,17]

Regarding the evaluation by the American Academy of Orofacial Pain Questionnaire, it was analyzed only according to the rates of positive responses in the pre- and post-treatment, since they indicate orofacial disorders, but it must be taken into account that this is an instrument indicated for screening patients.[11,12] When the groups were analyzed, there were larger effect sizes of G1 compared to the others, indicating a greater reduction of the former. Regardless of the wavelength, the literature points out that the LLLT favors increased blood flow and elimination of algogenic substances, thus having anti-inflammatory effects, as considerably as the output of endorphins that work right away on pain control.[18-23]

Several studies describe the use of LLLT in TMD patients, such as Catão et al. who compared the 830nm laser with the 660nm, 4 J/cm^2, in 3 points, using VAS and palpation of pain points, reported that there was a reduction of pain in both groups, with advantages for the first, however, did not use control group or placebo.[8] Borges et al. evaluating dose-response of 830 nm LLLT, in 44 individuals with TMD, distributed in 4 groups (8 Jcm^2, 60 J/cm^2, 105 J/cm^2 and control) that the LLLT of 830 nm reduced the pain, but only the first 8 J/cm2 showed functional improvements.[24] Frare and Nicolau used the 904 nm LLLT or placebo over 4 weeks (2 weekly sessions), at a dose of 6 J/cm^2 at 5 points (preauricular region and external auditory meatus), and observed reduction of the pain in the treated group.[25] The present study, differently from the ones mentioned above, used the laser at 6 points, including points in the temporal muscle region, with higher energy density and the presence of a placebo group. In the Nadershah et al. study, the treatment was performed with a 940 nm laser in regions of the temporal and masseter muscles, in addition to the pre-auricular and mastoid regions in individuals with TMD with myofascial pain, reporting the effectiveness of the treatment.[26]despite the lack of understanding of its exact mechanism. The aim of this study is to examine the effectiveness of photobiomodulation in the treatment of myofascial type TMD. Methods: Patients with unilateral TMJ and masticatory muscles pain during function were recruited and divided into two groups: a control group that received a sham laser treatment every 48 h for 10 days and a test group that received the same frequency of treatment to deliver a dose of 257 J per treatment and a total dose of 1285 J for the entire treatment. Pain was assessed using the visual analog scale (VAS It can be observed that the absence of an accurate diagnosis of the TMD origin in the present study is also a limitation. However, the laser has shown positive effects, regardless of the origin of the pain, as presented by Madani et al. in which they used both LLLT (810 nm, 21 J/cm^2, 6 J) on mandibular condyles, acoustic meatus and tendon points, or on acupuncture points (ST6, ST7 and LI4), with significant pain reduction.[27] Oliveira et al. comparing the irradiation of red (660 nm) with infrared (790 nm) by 3 therapies (at 48-hour intervals), in trigger points (8 J/cm^2) and TMJ (4 J/cm^2), observed a reduction in TMD symptoms, but the effects dissipated over time.[28]

In this study for specific pain evaluation, the McGill questionnaire was used to analyze the multidimensional aspect, and in this aspect all groups presented a reduction of scores, but the effect sizes indicated that the best results were in the treated groups, mainly at 660 nm.[10] For the intensity of the pain, evaluated by VAS, again, in general, there was a reduction in the pain, but the effect size presented greater values when the laser was used at a wavelength of 830 nm. It must be taken into consideration that pain arises not only from injured peripheral tissues, but also as an emotional experience capable of modulating the nociceptive input, thus, as the patients did not present important functional improvements for the simulacrum group, one can imagine that the placebo effect occurred, which would be the response to an inert form of treatment, dependent on various sensory and social stimuli related to the entire therapeutic act, modulated by the endogenous opioid, dopaminergic and serotoninergic system, which is influenced by anxiety, since the population of this study was composed basically of university students with TMD, which generally has high levels of anxiety.[15,29-32] This presents one more limitation of the present study, which was the lack of a control group only, which would not receive the simulation of laser use. Another limitation pointed out is that the groups initially showed themselves to be different for some variables, with the simulacrum group being less severe, thus suggesting that future studies may stratify the functional and pain variables prior to the experiment and the use of larger sample sizes.

Conclusion

It was observed that LLLT produced a decrease in the severity of the symptoms, regardless of the wavelength used, but was not different from the sham group in relation to the pain.

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