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ORIGINAL ARTICLE

Wavelength effect in temporomandibular joint pain: a clinical experience

Carolina M. Carvalho · Juliana A. de Lacerda · Fernando P. dos Santos Neto · Maria Cristina T. Cangussu · Aparecida M. C. Marques · Antônio L. B. Pinheiro

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Abstract Temporomandibular disorders (TMDs) are common painful multifactorial conditions affecting the temporomandibular joint (TMJ) and whose treatment depends on the type and symptoms. Initially, it requires pain control, and, for this, drugs, biting plates, occlusal adjustment, physiotherapy or their association are used. Lately, laser phototherapy (LPT) has been used in the treatment of pain of several origins, including TMDs. This study reports the treatment of a selected group of 74 patients treated at the Laser Center of the Federal University of Bahia between 2003 and 2008. Following standard anamneses, clinical and imaging examination and with the diagnosis of any type of TMD, the patients were prepared for LPT. No other intervention was carried out during the treatment. Treatment consisted of three sessions a week for 6 weeks. Prior to irradiation, the patients were asked to score their pain using a visual analog scale (VAS). Lasers of wavelength (λ) 780 nm, λ790 nm or λ830 nm and/or λ660 nm were used at each session (30/40 mW; spot (φ) ~3 mm; mean dose per session 14.2±6.8 J/cm^2; mean treatment dose of 170± 79.8 J/cm^2). Of the patients, 80% were female (~46 years old). At the end of the 12 sessions the patients were again examined, and they scored their pain using the VAS. The results were statistically analyzed and showed that 64% of the patients were asymptomatic or had improved after treatment and that the association of both wavelengths was statistically significant (P=0.02) in the asymptomatic group. It was concluded that the association of red and infrared (IR) laser light was effective in pain reduction on TMJ disorders of several origins.

Keywords Low-level laser therapy (LLLT) · Laser therapy · Laser phototherapy

C. M. Carvalho · J. A. de Lacerda · F. P. dos Santos Neto · A. M. C. Marques · A. L. B. Pinheiro (✉)
Laser Center, School of Dentistry,
Federal University of Bahia (UFBA),
Av. Araújo Pinho, 62, Canela,
40140-110 Salvador, BA, Brazil
e-mail: albp@ufba.br

M. C. T. Cangussu
Dental Public Health, School of Dentistry,
Federal University of Bahia (UFBA),
Salvador, BA, Brazil

Introduction

Temporomandibular joint disorders (TMDs) are multifactorial conditions in which the most common symptoms are pain (joint, muscles), limited movement or locking of the jaw, and grating sounds in the TMJ when the mouth is being opened or closed [1].

Nonsurgical treatment of TMDs generally consist of medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and antidepressants. NSAIDs may reduce the inflammation but may also increase the risk of complications, such as gastric ulcer and nephrotoxicity [2, 3].

Other treatments used are occlusal splints, physical therapy, treatment of parafunctional activities and alternatives therapies [4].

Laser phototherapy (LPT) [5] is an option for the treatment of musculoskeletal disorders, due to its analgesic, anti-inflammatory and regenerative effects [6]. Previous studies have shown positive effects of LPT, with good patient acceptance and reduction in the use of drugs [7–9].

The results of the placebo-controlled study of Cetiner et al. [4] in 39 patients concluded that LPT is an appropriate treatment for TMDs and should be considered as an alternative to other methods. Statistically significant

improvements in maximal mouth opening and reduction of both pain and chewing impairment were observed in the irradiated group when compared with the control group. Núnez et al. [10] evaluated the effectiveness of LPT and transcutaneous electrical neural stimulation (TENS) on the improvement of mouth opening in patients with TMD and concluded that both methods were effective, but the results with LPT were better than with TENS. Fikácková et al. [11] showed the effectiveness of LPT in patients with arthralgia of the TMJ and confirmed the analgesic and anti-inflammatory effects of LPT by infrared thermography. Pinheiro et al. [12] evaluated the condition of 124 patients suffering from TMJ pain treated with LPT and reported that, at the end of the treatment, 82 patients were asymptomatic, 20 had improved considerably, and 22 were symptomatic. However, Emshoff et al. [13] evaluated TMJ pain after treatment with helium–neon (HeNe) laser or sham LPT and found that LPT was not better than placebo in reducing TMJ pain during function.

This study examined 74 patients at the Laser Center of the Federal University of Bahia that were suffering from TMD pain treated with LPT.

Patients and methods

This study reports on the treatment of 74 patients complaining of TMJ pain treated with LPT at the Laser Center of the Federal University of Bahia between the 2003 and 2008. Their files were reviewed, and the cases of TMDs were selected. There were 383 treatments carried out on patients suffering from several maxillofacial abnormalities, and 74 patients fulfilled the following inclusion criteria of complaint of TMJ pain during initial examination; not being treated with any other type of therapeutics; attended 12 sessions of treatment; and signed the informed consent form. The patients also underwent imaging.

All patients were treated with diode lasers of wavelength (λ)660 nm and/or λ780 nm, λ790 nm or λ830 nm [BioWave©, Kondortech, São Carlos, SP, Brazil; 30 mW/40 mW, continuous wave (CW), φ ~3 mm; Twin Flex, MM Optics, 40 mW/50 mW, CW, spot (φ) ~4 mm]. Laser light was delivered in most of cases at four contact points around the TMJ [infrared (IR)] (Fig. 1), and, in some cases, it was also applied to sore muscles (red), 1–2 J/cm^2 per point. LPT was applied at 48 h intervals for 6 weeks. The dose per session was calculated according to the severity of the symptoms. The time of laser application was automatically set by the laser units according to the dose selected, following the calibration of the manufacturer. The patients were examined at the end of each of the 12 sessions. Statistical analysis was carried out with Minitab 14® software and was comprised of analysis of variance (ANOVA) and χ^2 test.

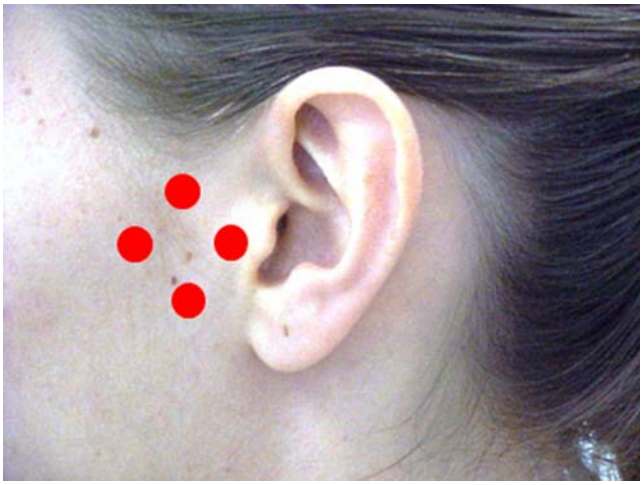

Fig. 1 Schematic points of laser irradiation on the TMJ

Results

The patients in this study consisted of 15 men and 59 women (n=74). Their mean age was 46.3±14.6 years. Twenty-nine patients complained of TMJ pain in just one TMJ, and 45 complained of pain in both TMJs. All patients were treated with IR laser light (λ780 nm, λ790 nm or λ830 nm). Visible red light (λ660 nm) was also used on 47 patients when muscles were involved. There were 12 treatment sessions for all patients. The mean dose per session was 14.2±6.8 J/cm^2 and the mean treatment dosage was 170±79.8 J/cm^2. At discharge, 27 patients were still symptomatic [visual analog scale (VAS) score≥5); 32 had improved (VAS score≤5 and ≥2], and 15 were pain free (VAS score=0). Sixty-four percent of the patients were asymptomatic or had improved at the end of the treatment (Fig. 2).

The statistical analysis (χ^2test) showed that the final result of the treatment was only influenced by the use of two wavelengths (P=0.02). Of the asymptomatic patients (15) at the end of the treatment, 14 had been treated with the combination of wavelengths (Fig. 3). Gender, age, number of sessions, dose per session and total dose of the treatment had no influence on the outcome of the treatment.

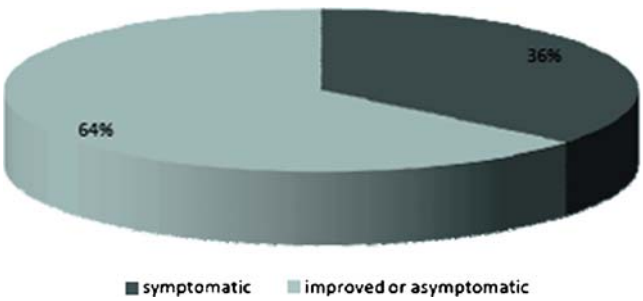

Fig. 2 Patients asymptomatic and symptomatic at the end of the treatment

Discussion

The number of women was higher in this study. Although previous studies have demonstrated the prevalence of women with TMD, it is important to consider that women are more concerned about their health and seek treatment more frequently than men do.

The patients entered the study when they registered at the Laser Center and if they fulfilled the inclusion criteria. There was no major variation in their ages. It is known that this condition needs different therapeutics according to the age group, duration of ongoing disease, and subtype of the disease, but we did not intend to treat the TMD but the pain related to the condition. Most patients reported long-term associated pain.

The pathological condition was diagnosed in accordance with the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (K07.6) and included Costen′s complex or syndrome, derangement of temporomandibular joint, snapping jaw, and temporomandibular joint pain dysfunction syndrome [14]. Clinical diagnosis was based on the criteria suggested by Okeson [15]. There was no difference in the protocol used, as the treatment was carried out to treat the painful symptom not the TMD.

Advances in diagnostic methods were also used, mainly in the imaging examinations. The initial and TMJ modified Orthopantomograph radiographs were normal for all patients. If necessary, computed tomography (CT) and/or magnetic resonance imaging (MRI) were also performed. Electromyography, motion performance assessment, and joint vibration analysis were also used if necessary.

Light penetration and absorption in biological tissue are dependent on several variables, and one of them is the wavelength of the laser. Infrared laser light has been demonstrated to have a typical penetration depth of nearly 3 mm, while red laser light has a penetration of approximately 1 mm [8]. In all cases in this study the infrared laser was used on the TMJ due its higher penetration than the red laser. Visible red light was used only on sore muscles. The best result in this study was achieved with the combination of the two wavelengths. Most of the patients had pain in the joint and muscle.

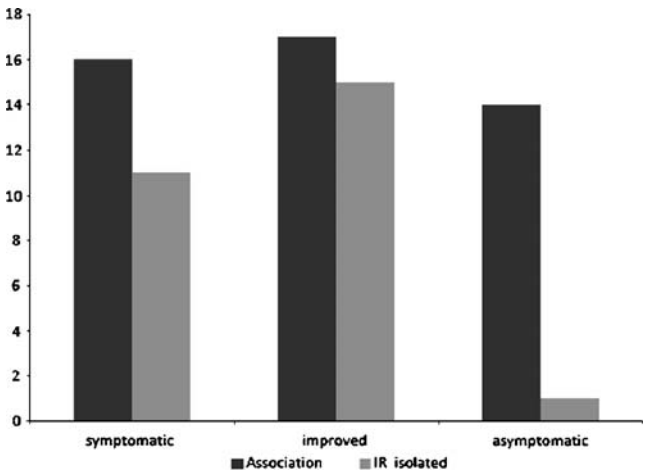

Fig. 3 Wavelength related to the end of the treatment

After the diagnosis of TMD is important to establish pain control as the first aspect in the treatment, and LPT is effective in this stage of the treatment. The laser light, through a biochemical mechanism, increases the levels of histamine and serotonin, increases the circulation of blood, and decreases prostaglandin E2 levels [16]. LPT was used in this work to relieve pain, independent of both the etiology of the TMD and the age of the patients, as the main therapeutic goal was to treat the pain and not the TMD. LPT is an important method of relieving pain, but if the cause is not treated the pain will recur. After elimination or significant reduction of the pain the patients were referred to other clinics for treatment of the etiology of the TMD.

Many studies reported positive findings in the use of LPT for pain management of musculoskeletal conditions [17, 18], but some results remain controversial and many of them lack information on the parameters used [8, 19].

Bjordal et al. [20] reviewed the effects of LPT on acute pain and concluded that LPT may modulate the inflammatory process in a dose-dependent manner and may also significantly reduce acute inflammatory pain. However, they considered that further clinical trials with adequate doses are needed to determine the action of LPT precisely. Another study investigated the reduction in pain of patients suffering from TMD and treated or did not treat with LPT (10 J/cm^2 or 15 J/cm^2, λ830 nm). The authors concluded that LPT was significantly more effective in reducing pain, especially long-lasting pain [21]. However, in that study only patients with short-term conditions were included, and the LPT reduced the acute pain in most patients.

Laser light has a wavelength-related ability of alter some cellular functions, and, depending on the doses, LPT may inhibit or stimulate some of these functions [12]. Bjordal et al. [8] assumed that doses of 0.4–19 J and power densities of 5–21 mW/cm^2 would be capable of reducing inflammation at the target joint capsule without compromising fibroblast metabolism. Their study concluded that the optical parameters for the treatment of osteoarthritis, for infrared gallium–aluminum–arsenide (GaAlAs; λ830nm), were 6–24 J per session and 3–210 mW/cm^2 of intensity. The mean dose in our study was 14.2±6.8 J/cm^2 per session, aligned with previous studies [6, 20, 21]. During the treatment the dose was adjusted when necessary. When there was no change in the symptom after 1 week, the dose would then be increased and again reassessed until a

response was achieved. If the initial dose was too high, there was an increase in the pain symptom and it was necessary to reduce it.

It may be assumed from our data that LPT is effective in the reduction of pain in patients with TMDs, especially when the combination of red and infrared laser light is used.

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