

Use of Low Level Laser Therapy for Treatment of Temporomandibular Joint Pain: A Review

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ABSTRACT

Background: Temporomandibular joint (TMJ) pain can be very disastrous to the patient, particularly when it is chronic and associated with temporomandibular disorder (TMD). Lasers are newer treatment modalities in dentistry. Low-level laser therapy (LLLT) is suggested to have biostimulating and analgesic effects through direct irradiation without causing thermal response and helps in alleviating the pain and providing symptomatic relief to the patient. This article highlights the use of lasers in the management of pain associated with temporomandibular joint disorders.

Keywords: Low level laser therapy, temporomandibular joint pain, temporomandibular disorders.

INTRODUCTION

Temporomandibular disorders (TMDs) are probably the most common cause of pain of non-dental origin in the maxillofacial area ^{1,2}. These comprises of problems associated with the masticatory muscles, temporomandibular joint (TMJ) and associated structures ³. Such disorders are characterized by pain, joint sounds, and restricted mandibular movement. The incidence of TMD ranges from 40 to 75 % in general populations ⁴ and approximately 65 % of affected patients experience associated pain ⁵. Conservative treatment is preferred to relieve symptoms, diminish pain, and re-establish function ^{6,7}. As the aetiology of TMD is multifactorial, available treatments are extensive and diverse, including the use of muscle relaxants⁸, habit counselling, physiotherapy, acupuncture⁹, occlusal splints¹⁰, and transcutaneous electrical nerve stimulation¹¹, low-level laser therapy (LLLT), among many others.

Low level laser therapy 830 – 904nm has been proved effective in management of pain

associated with TMD specially low incident level of diode lasers ¹², LLLT with its analgesic, anti-inflammatory, anti-edematous, and biostimulatory effects has proven to be effective in reducing pain and muscle tension in patients with TMD^{13,14,15,16,17,18}.

MECHANISM OF ACTION

Low level laser in the infra red spectrum(>700nm wavelength) has better penetration into tissue(3-5 cm) than red lasers (between 300- 500nm, penetration 2-5mm). Infra red lasers have greater affinity for non pigmented tissues like nerves, providing photo electric effect on irradiated cells, increasing membrane potential thus decreasing nerve impulse conduction ¹⁹

One of the possible pain relief mechanisms involves the LLLT-mediated improved microcirculation in the temporal and masseter muscles, thereby relaxing and softening the affected muscles and relieving the pain.¹² LLLT increased pain tolerance because of changes in cellular membrane potency,

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vasodilatation, reduction of edema, increase in intracellular metabolism, acceleration of wound healing^{20,21}, increase of beta endorphin level, increase of pain discharge threshold, decrease of bradykinin and histamine release, increase of lymphatic flow, and blood supply, time reduction of inflammation, and promotion of muscle relaxation.²² LLLT can be applied on selected points considering the presence of nociceptors in the periarticular tissues (discal ligaments, capsular ligaments, and retrodiscal tissues), because these structures are involved in TMJ pain^{23,24,25}. Other researchers have reported that blood flow and volume increased significantly in LLLT irradiated muscles in low back pain patients as measured by laser Doppler and was accompanied by pain relief in the same muscles²⁶.

MODE OF APPLICATION

Therapeutic LLLT application is achieved through light, static and direct contact of the probe on the skin. The probe is placed perpendicular directly onto the skin at the centre of the upper joint space, approximately 1 cm. in front of the tragus. The laser beam is delivered through a laser probe. Treatment is done for 2 minutes each side at both closed mouth and maximum mouth opened positions. Repeated appointments for at least 8 weeks and three times a week are desired.²⁷ The laser should be calibrated before use, and laser probe to be wiped with alcohol before each treatment. The subject and the operator should wear protective eye wear and the state of laser instrument should be monitored and reviewed regularly to avoid untowards hazards.²⁸

REVIEW OF LITERATURE

Studies in literature of application of LLLT at various trigger points and areas of referred points by Kulekcioglu, et al.²⁹ (2003); Çetiner, Kahraman and Yücetaş¹⁴ (2006); Fikácková, et al.¹⁵ (2007); Cunha, et al.³⁰ (2008); Santos, et al.³¹ (2010); and Carvalho, et al.³² (2010) who irradiated the affected area using wavelengths in the infrared range, varying from 780 nm to 980 nm to alleviate the TMJ pain. Mazzetto, et al.²¹ (2007), Carrasco, et al.¹³ (2008), and Emshoff, et al.²⁸ (2008) applied LLLT at the TMJ. Shirani, et al.³³ (2009) and Venezian, et al.³⁸ (2010) made the application only in the muscle region all support the usefulness of

LLLT in treating TMJ pain. Kobayashi M, Kubota J¹² (1999) treated 4 patients with TMJ pain using GaAlAs diode laser, 830 nm. continuous wave, 150 mW for 5 to 10 sec/point, once per week and found satisfying results.

In terms of frequency and number of laser sessions applied, Mazzetto, et al.²¹ (2007), Carrasco, et al.¹³ (2008), and Venezian, et al.³⁴ (2010) argued for eight sessions with applications twice per week. Venancio, Camparis and Lizarelli³⁵ (2005) and Shirani, et al.³³ (2009) established the use of six sessions with a frequency of twice *per* week. Çetiner, Kahraman and Yücetaş¹⁴ (2006); Fikácková, et al.¹⁵ (2007); and León, Almagro and García¹⁷ (2007) argued for 10 sessions; however, each one established different application frequencies.

The studies of Çetiner, Kahraman and Yücetaş¹⁴ (2006); Mazzetto, et al.²¹ (2007); and Venezian, et al.³⁴ (2010) did a follow-up of patients 30 days after the last irradiation. Çetiner, Kahraman and Yücetaş⁹ (2006) and Venezian, et al.³⁴ (2010) found that pain reduction remained statistically significant during this period, while Mazzetto, et al.²¹ (2007) found that the least tenderness to palpation was seen at the last session of laser application. Lassemi, et al.¹⁶ (2008) followed patients for 2 years and observed significant results for both pain reduction and for clicking. Although most studies of this review did not make use of a patient follow-up period, it may be suggested that for those who carried out the follow-up, the laser applications promoted a relief of painful symptomatology for at least 30 days after the last irradiation.

Dostalová, T. et al.³⁶ evaluated the intensity of TMJ pain using VAS score and performed LLLT in five treatment sessions (energy density of 15.4 J/cm²) by semiconductive GaAlAs laser with an output of 280 mW, emitting radiation wavelength of 830 nm. They found that pain had reduced considerably on the VAS score and concluded that laser therapy was effective in the improvement of the range of temporomandibular disorders (TMD).

Moraes M et. al.³⁷ systematically reviewed the studies and effect of LLLT on the pain levels in individuals with TMD and found that most studies showed the positive effect of LLLT in treating TMJ

pain. However, the heterogeneity of the standardization regarding the parameters of laser calls for caution in interpretation of the results.

Salmos-Brito JA et al³⁸. studied the effect of LLLT in reducing pain intensity and improve maximal mouth opening: in patients with acute or chronic temporomandibular disorders. The sample comprised 58 myogenic TMD patients. For each patient, 12 LLLT sessions were performed (gallium-aluminum-arsenide; $\lambda = 830$ nm, $P = 40$ mW, CW, ED = 8 J/cm^2). Both groups had a significant pain intensity reduction and maximal mouth opening improvement after LLLT.

Ahrari F¹, Madani AS, Ghafouri ZS, Tunér J³⁹ did a randomized, double-blind clinical trial, in 20 patients with myogenic TMD and patients were randomly divided into laser and placebo groups. In the laser group, a pulsed 810-nm low-level laser (average power 50 mW, peak power 80 W, 1,500 Hz, 120 s, 6 J, and 3.4 J/cm^2 per point) was used on painful muscles three times a week for 4 weeks. They concluded that LLLT can produce a significant improvement in pain level and mouth opening in patients affected with myogenic TMD. However in another blind randomized controlled pilot study done by Leal de Godoy CH et al⁴⁰ Evaluated the effect of low-level laser therapy on pain, mandibular movements, and occlusal contacts in adolescents and young adults aged 14 to 23 years with temporomandibular disorder. The laser parameters were wavelength of 780 nm, energy density of 33.5 J/cm^2 , power of 50 mW, power density of 1.67 W/cm^2 , and 20-second exposure time. They found no statistically significant differences regarding pain, mandibular range of motion, or the distribution of occlusal contacts after treatment with low-level laser therapy.

Few studies have been carried out on the application of laser phototherapy (LPT) for treating painful temporomandibular disorder (TMD) in elderly population. Rodrigues JH, et al evaluated the pain, jaw movements, and psychosocial factors in ten elderly patients with painful TMD before and after LPT. For pain assessment, a visual analogue scale (VAS) was used. The LPT was carried out with an GaAlAs diode laser (780 nm; spot size 0.04 cm^2) in punctual and contact mode. They concluded that LPT is able to promote pain relief

and improvement of jaw movements in elderly patients with TMD, with a positive effect on psychosocial aspects. In the literature there is still no consensus on frequency of low-level lasers and number of sessions of laser applications. Some authors^{13,34,37,42} discussed eight sessions with application twice per week. On the other hand some authors^{35,37} found that six sessions with application of twice per week would be proper. And also some authors agreed in the number of ten sessions but in terms of frequency each one used different values³⁷.

In the treatment protocol by LLLT with diode laser for two patients Ayyildiz, S Emir F, and Sahin C⁴³ found that LLLT with a 685 nm red probed diode laser, energy density of 6.2 J/cm^2 , three times a week for one month, and application time 30 seconds produced desirable results. In literature, discussions on the effectiveness of LLLT are still continuing. Many studies report that the use of LLLT in TMD could be effective while the others report that its effectiveness is still not fully proven.

Non standardized results could be obtained in consequence of using several methods. These results were thought to occur due to the factors like types, frequencies, and time periods of low-level laser radiation in different groups of patients²⁹. For revealing the positive effects of LLLT, an accurate diagnosis and sufficient application protocol should be the key factors^{22, 44}.

CONCLUSION

LLLT is effective in reduction of pain in TMDs. The hypothesis that LLLT acts through a dose-specific anti-inflammatory effect in the irradiated joint capsule is a possible explanation of the positive results. However, there is need for more well-conducted randomized controlled trials examining LLLT as interventions for TMDs. Also laser acupuncture as well as adjunct treatment modalities should be considered in patients for long lasting results.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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