



Use of low level laser therapy in the treatment of persistent idiopathic orofacial pain and traumatic trigeminal neuropathy- a pilot study

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Abstract

Background: Nerve recovery in the orofacial region is not completely satisfactory. Nowadays, low level laser therapy (LLLT) has been recognized and accepted as a possible therapeutic option in various states of nerve damage throughout the body. LLLT is noninvasive and there are only few contraindications for its use. Therefore, the effect of LLLT on patients with idiopathic orofacial pain and traumatic trigeminal neuropathy was assessed.

Methods: Twenty one patient was enrolled in this pilot study, there were 10 patients with persistent idiopathic facial pain (PIFP) and 11 patients with traumatic trigeminal neuropathy (TTN). Each patient was treated once daily in 10 sessions using a GaAlAs laser (830 nm, 3 W, 50 ms, 50 Hz which is equivalent to an energy density of 1.5 J/cm²). The outcome of LLLT was evaluated by means of a patient survey on the relief of symptoms (0=no improvement, 1=partial improvement, 2=complete improvement). Statistical analysis was performed by use of descriptive statistics and when needed by use of chi-square test. Values lower than 0.05 were considered as significant.

Results: Complete improvement of symptoms was seen in 70% of the patients with PIFP and in 36.4% of patients with TTN. LLLT showed no improvement in 10% with PIFP and 45.4% of patients with TTN.

Conclusion: It might be concluded that LLLT is beneficial in patients with persistent idiopathic orofacial pain and traumatic trigeminal neuropathy.

Keywords: Low level laser therapy, idiopathic orofacial pain, persistent idiopathic facial pain, traumatic trigeminal neuropathy

Introduction

Low level laser therapy (LLLT) is becoming more used due to its beneficial effects in various medical conditions but also due to the fact that treatment with LLLT is painfree and has few contraindications [1]. The use of LLLT for peripheral nervous system regeneration is currently being investigated in order to achieve early functional nerve recovery. There are only few studies regarding the use of LLLT for nerve recovery in humans and rats. It seems that LLLT act analgesically since they improve endorphin release and therefore inhibit nociceptive signals and control pain mediators [2]. Low level lasers can also act analgesically by inhibiting pain signals which partially leads to the transient varicosities along the neurons which decrease impulse transmission. Cells are acidic in a lowered redox state, but after laser irradiation they become alkaline and afterwards they can act in an optimal way. It is well known that LLLT stimulate lymphocytes, activate mast cells, and increase production of adenosine triphosphate in the mitochondria and proliferation of various cell types therefore acting as anti-inflammatory [2]. Furthermore, LLLT stimulate microcirculation which results in the change of capillary hydrostatic pressure which in turn results in edema absorption and elimination of intermediary metabolites [2]. Rochkind et al., [3] reported that in patients with long-term peripheral nerve injury noninvasive

780-nm laser phototherapy can progressively improve nerve function, which leads to significant functional recovery. Gigo-Benato et al., [4] reported that 660 nm LLLT with low (10 J/cm²) or moderate (60 J/cm²) energy densities is able to accelerate neuromuscular recovery after nerve crush injury in rats. Peric [5] reported that LLLT (30 treatments during a period of 12 weeks) in patients with diabetic polyneuropathy (control group was given only vitamin therapy) showed decrease in spatial perception threshold and increase in motor medianus conduction. Ohtsuka et al., [6] treated patient with postherpetic neuralgia which manifested as burning pain in the right forehead with LLLT which resulted in the increased blood flow and relieve in neuralgia.

Persistent idiopathic orofacial pain (PIFP) is characterized by poorly localized pain and perceived as arising from muscles of the face and jaw. Symptoms wax and wane in intensity over days and weeks [7]. Traumatic trigeminal neuropathy is usually induced by oral surgical operations, particularly the removal of the impacted lower third molars, being more frequent in females. It can manifest itself with various degrees of sensory loss [8]. Considering the lack of information about the treatment of these conditions and the importance of using conservative therapeutic interventions in the treatment of orofacial pain, the aim of this study was to assess the effect of LLLT in patients

with painful orofacial conditions.

Methods

Subjects

Twenty one patients, 10 with persistent idiopathic facial pain (PIFP) and 11 with traumatic trigeminal neuropathy (TTN) were involved in this study. Diagnosis of PIFP was carried out according to criteria established the Headache Classification Subcommittee of the International Headache Society [9]: (1) Facial pain present daily for at least 1 month and persisting for all or most of the day. (2) The pain is deep and poorly localized of moderate or severe intensity, but not unbearable. (3) The pain is confined at onset to a limited area on one side of the head. (4) The pain is without paroxysms, precipitation from trigger areas, autonomic symptoms, sensory loss, and other physical signs; but dysaesthesia may occur. Diagnosis of TTN was made upon these criteria: (1) sensory defect (paraesthesia) in the region innervated by maxillary or mandibular nerve following surgical procedure and (2) minimal duration of 3 months. Three experienced dentists who are also academic staff from the Department of Oral medicine, University of Zagreb in Croatia diagnosed the painful conditions.

The exclusion criteria were other orofacial pain conditions due to odontogenic causes, vascular conditions (migraine, etc) and inability of patient to understand the text of the informed consent. None of the patients had systemic diseases nor took meds that might affect their pain.

The study was approved by the Ethical Committee of the University of Zagreb in Croatia and from every patient informed consent according to Helsinki II declaration was obtained.

Laser procedure

Laser therapy was performed with a gallium-aluminum-arsenide (GaAIs) laser (BTL-5000, www.btl.com) with wavelength of 830 nm. Each session was performed on every working day and lasted for 3 min (total number of 10 days). Break was during the weekend.

There were two irradiation cycles during one session, according to the manufacturer's recommendations for the treatment of trigeminal neuralgia. First cycle was A and consisted of 12 J/cm², duty factor 100%, cont.area 1.00 cm², max power 100 mW, duration 2 minutes and second cycle was 6 J/cm², duty factor 80%, 10 Hz, area 1 cm², max power 100 mW, duration 1 min and 15 sec. We did not use placebo as we thought that patients would suffer even more as they were not given any therapy and were already in much pain. In the case of PIFP laser was applied on the skin at the most painful surface area (1 cm²). In the case of TTN laser application area was on the lingual side of the mandible at the extraction site where the surgical injury occurred.

Evaluation and statistical analysis

Primary endpoint was patients' report on the relief of symptoms (0=no improvement, 1=partial improvement,

2=complete improvement).

Statistical analysis was performed by use of descriptive statistics (mean and standard deviation). Differences between the tested groups were assessed by chi-square test. Values lower than 0.05 were considered significant.

Results

Clinical characteristics of the patients are presented in **Table 1**. No significant differences in terms of age and gender were found between the two patient groups (PIFP vs. TTN, $p=0.077$; $p=0.645$).

Total resolution of symptoms was achieved in 70% of patients with PIFP and 36.4% of patients with TTN. Partial resolution of symptoms was achieved in 20% of patients with PIFP and 18.2% of patients with TTN. Treatment showed no improvement in 10% of patients with PIFP and 45.4% of patients with TTN. No significant differences in outcome were found between the two groups ($p=0.302$).

Discussion and conclusion

Several maxillofacial interventions can induce nerve damage, especially on the inferior alveolar nerve which usually result in the paraesthesias, dyesthesias and painful orofacial conditions. Khullar et al., [10] reported that LLLT has beneficial effect on paraesthesias with lasers 4–6 J per point along the projection of the nerve. The same authors [10] also reported that GaAIs laser therapy (820 nm, 4×6 J per treatment, in a total number of 20 treatments) results in both subjective and objective improvement in mechanical sensory perception in long standing neurosensory deficit of the inferior alveolar nerve. Pinheiro et al., [11] used 632.8 nm, 670 nm and 830 nm diode lasers in patients with temporomandibular joint pain and trigeminal neuralgia. Most of the patients had 12 applications (twice a week) with an average dose of 1.8 J/cm². Most treatment consisted of a series of 12 applications (twice a week) and in 15 cases a second series was applied. Patients were treated with an average dose of 1.8 J/cm². One hundred fifty four out of 241 patients were asymptomatic at the end of the treatment, 50 improved considerably, and 37 were symptomatic. The results confirmed that LLLT is an effective tool and is beneficial for the treatment of many disorders in the maxillofacial region. Miloro and Repasky [12] demonstrated that neurosensory recovery after bilateral sagittal split osteotomy can be significantly improved both in terms of time course and magnitude of return of function with the adjunctive use of LLLT. The authors used LLLT (4×6 J per treatment, along the distribution of the inferior alveolar nerve before surgery, 6 and 24 h after and on the 2nd, 3rd, 4th and 7th day).

Ozen et al., [13] treated four female patients after third molar surgery who had paraesthesia with LLLT (GaAIs laser, the irradiance used was 6 J per treatment site, applying 5 mW in continuous mode wave for 90 s in total of 20 treatments performed every second day) and concluded that LLLT

Table 1. Clinical characteristics of the patients.

No.	Gender	Age (years)	Diagnosis	Site	Duration of symptoms (months)	Outcome
P1	male	71	PIFP	Maxillary ridge, frontal region	3	Partial improvement
P2	male	60	PIFP	Mandibular ridge, left molar region	14	No improvement
P3	female	72	PIFP	Left mental region	27	Complete resolution
P4	female	62	PIFP	Left mental region	36	Complete resolution
P5	female	69	PIFP	Right tongue border	3	Partial improvement
P6	female	59	PIFP	Maxillary ridge, right molar region	60	Complete resolution
P7	female	69	PIFP	Mandibular ridge, left molar region	6	Complete resolution
P8	female	52	PIFP	Maxillary ridge, right molar region	72	Complete resolution
P9	female	64	PIFP	Maxillary ridge, right premolar region	15	Complete resolution
P10	female	53	PIFP	Maxillary ridge, left premolar region	5	Complete resolution
P11	male	47	TTN	Left tongue border	3	Complete resolution
P12	female	33	TTN	Left buccal mucosa	6	Complete resolution
P13	female	52	TTN	Left tongue border	5	No improvement
P14	female	62	TTN	Lower lip, right side	9	Complete resolution
P15	male	75	TTN	Left mental region	5	No improvement
P16	female	57	TTN	Right tongue border	84	Partial improvement
P17	male	66	TTN	Lower lip, left side	120	No improvement
P18	female	66	TTN	Right tongue border, lower lip right side*	3	No improvement
P19	female	52	TTN	Left buccal mucosa	12	Partial improvement
P20	female	52	TTN	Lower lip, left side	18	No improvement
P21	male	45	TTN	Lower lip, left side	4	Complete resolution

PIFP- persistent idiopathic facial pain, TTN- traumatic trigeminal neuropathy

*When two sites were affected each site underwent 10 sessions as described in 'Subjects and methods' chapter.

reduces long-standing sensory nerve impairment following third molar surgery.

Saber et al., [14] concluded that there was a significant difference in pain level between laser and placebo group after third molar surgery, however there was no difference in pain duration between the two tested groups. On the other hand, Lopez-Ramirez et al., [15] reported that LLLT (810 nm, output power 0.5 W and 5 J/cm² energy density) did not show beneficial effects in reducing pain, swelling and trismus after extraction of the impacted molars.

Eckerdal and Bastian [16] treated patients with laser (830 nm, 30 mW) for five weeks. The results demonstrated that out of 16 patients, ten were painfree, two had decreased pain levels while in four there was no change.

Moore et al., [17] also evaluated the use of Ga-Al-As diode laser (830 nm, 60mW) in patients with postherpetic neuralgia and demonstrated significant reduction in the pain intensity in their patients.

More recent studies such as one of Yang and Huang [18] studied LLLT in 16 patients with persistent idiopathic orofacial pain (PIFP) and average pain reduction of 43.47%

(ranging from 9.3% to 91.8%) was achieved which is lower percentage in comparison to our sample (70%). However, hteir patients received LLLT between one to ten times, whereas all our patients received the same LLLT regimen (ten times altogether). The same authors concluded [18] that LLLT may be an effective treatment for PIFP.

On the other hand, Tengrunsun et al., [19] concluded on the literature systematic review that there is only limited evidence suggesting that LLLT is more effective than placebo, sham laser and other active treatment in the treatment of orofacial pain.

Last but not least we have to mention the limitations of present study: small number of patients, self evaluation of symptoms (visual analogue scale should be used in the future), lack of placebo group (we didnt use placebo i.e., laser switched off as patients were in pain and already suffered a lot) and different duration of symptoms (the duration of the symptoms should be divided into acute and chronic in the future studies). However, certain strenghts such as beneficial outcome after LLLT, experienced researchers who conducted the study and homogenous group of patients in terms of

not taking meds and not having systemic diseases are also seen in this paper.

The results of our study show that LLLT could have beneficial effect on patients with orofacial pain as total resolution of symptoms was achieved in 70% of patients with PIFP and 36.4% of patients with TTN.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Authors' contributions	VVB	IR	NZ	DVJ	VB	AAR
Research concept and design	√	--	--	--	--	--
Collection and/or assembly of data	--	--	√	--	--	--
Data analysis and interpretation	--	√	--	--	--	--
Writing the article	--	--	--	--	--	√
Critical revision of the article	--	--	--	√	--	--
Final approval of article	√	--	--	--	--	--
Statistical analysis	--	--	--	--	√	--

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