



Use of Single Dose 940 nm diode Laser to Relief Facial Pain

Muthenna Sh. Rajab⁽¹⁾
Yasir Kh. Mohmmad⁽²⁾
Elias M. Talab⁽³⁾
Abdullah S. Hamad⁽⁴⁾
Talat A. Mahmud⁽⁵⁾
Abraham A Gh Alokaily⁽⁶⁾

^{1,2} College of Dentistry, Tikrit university, Tikrit, Iraq.^{3,4,5,6} Dental student, College of Dentistry, Tikrit university, Tikrit, Iraq.

Article Info:

-Article History:

-Received: 3/1/2022

-Accepted: 8/6/2022

-Available Online:

Jun, 2022

Keywords: Epic x diode laser, orofacial pain, myofacial pain, pulpitis, pericoronitis.

Corresponding Author:

Name: Muthenna Sh. Rajab

E-mail: muthenna@tu.edu.iq

Tel:07707530855

Affiliation:

Professor in Department of conservative dentistry, College of Dentistry, Tikrit university, Tikrit, Iraq.

Abstract

Objective: the purpose of the study is to evaluate the effect of single high dose Epic x diode laser on several types of facial and dental pain. **Methods:** a total of 10 patients were diagnosed with orofacial pain, 8 of them were suffering from myofacial pain, while the other two patients, one of them had pulpitis and the other one was suffering from pericoronitis. The patients were treated using Epic x diode laser with the following settings (940 nm wavelength, 4 w, 1200J). Each patient was treated in a single session. The headpiece was directed toward the involved symptomatic area and the overall pain and discomfort were analyzed into a scale of six degrees including before and after the treatment.

Results had 40% of the cases are with complete resolution of pain and 60% of the cases had partial improvement, and the sessions were delivered as a single session of 300 seconds irradiation for each patient and the degrees of improvement were (1,2,3) on the pain scale.

Conclusion: Diode laser (Epic x) is effective in reducing the orofacial pain with single session treatment

Introduction:

The following is the definition of a diode laser: A laser diode (LD), injection laser diode (ILD), or diode laser is a semiconductor device that produces a laser beam at the diode's junction, like a light-emitting diode. 1 Barcode readers, laser pointers, CD/DVD/ Blu-ray disc

reading/recording, laser printing, laser scanning, and light beam lighting are all examples of fiber optic communications, and medical laser applications are just a few of the many applications for laser diodes. The laser diode works on the idea that if electrons at higher energy levels are provided with an external source of

energy, every atom in its excited state can generate photons. Absorption, spontaneous emission, and stimulated emission are the three primary ways in which an atom can emit light energy.¹

Wavelengths of diode laser in dentistry

• Diode lasers have wavelengths between 800 and 830 nm with an aluminum, gallium, and arsenide semiconductor active medium., can be used for numerous 'fixed' soft tissue procedures including gingival hyperplasia, tooth exposure and hyperpigmentation.

• 940 nm diode laser using aluminum/indium, gallium, and arsenide active medium, Because of its ease of use, improved coagulation, lack of need for suturing, reduced swelling and pain, and capacity to correct physiologic gingival pigmentation, it can be employed in oral and face soft tissue surgery.

•Diode laser-- 980 nm, active medium of indium, gallium, and arsenide, variety of oral soft tissue procedures that can be performed successfully with the 980 nm diode laser.

Elevated temperature build-up in the target tissue can indeed be decreased by moving the laser beam faster.²

Diode laser and dentistry

1. Caries and sub gingival calculus are detected using this method.: Diode laser with wavelength of 655 nm is a caries detection tool. Fluorescence of laser appears to be used as one of the traditional approaches for detecting caries in the occlusal fissure and sub gingival calculus. 633 nm and 655 nm diodes are used to measure blood flow in the pulp.³

2. Surgery of soft tissues: The soft tissue surgeries suggested to be done with diodes are frenectomies, Hypertrophic lesion surgery, opercullectomy surgeries, gingival contouring, uncovering submerged implants and periodontal surgeries.⁴ When compared to traditional scalpel procedures, it has significant advantages.^{4:}

- Its high precision, dependability, and visual access to the operated region.

- The hemostasis management is excellent, and there is no tissue damage.

- With less edema, inflammation, and pain, tissue healing is quick.

- Can perform without infiltration or block of local anaesthetic, but topical anesthesia may be required in some cases.

3. Decontamination of periodontal pockets and root canals: Periodontal pockets and root canals are disinfected using diodes with wavelengths of 810-980 nm. Photoactivated dye disinfection of pockets uses diodes with wavelengths of 635,670, and 830 nm. Within the canals, diode laser optic fibres are placed 3 mm short of the apex and gradually withdrawn at one minute of lasing time per canal. Diode laser wavelengths are well absorbed by pigmented anaerobic bacteria (*Prevotella intermedia* and *Porphyromonas gingivalis*). The laser photonic energy penetrates the damaged epithelium and granulation tissue, causing coagulative changes in the microorganisms as their temperature rises, reducing their colony forming activity. Because of the canal morphology and the children's participation levels, disinfecting primary canals using diode lasers can be advantageous. When compared to traditional techniques of disinfection, lasing primary canals can save time and cause less worry in youngsters.⁵

4. Bleaching by photo thermal means: 810-980 nm diodes are utilized. To avoid thermal impacts on pulp, The photothermal bleaching power level should be kept within the 2 W safety limits. At the same time, the power setting should be high enough to cause the bleaching agent hydrogen peroxide to break down into free radicals. The pigmented molecules within the tooth structure are oxidized by these free radicals (enamel).²

5. Diode laser in orthodontics: In orthodontics, 635 nm diode lasers are utilized for model scanning and holographic storage. Other applications include soft tissue care prior to orthodontic treatment. Frenectomies and the partial or complete removal of gingival tissue covering the tooth are soft tissue treatments required prior to orthodontic treatment. Diode lasers create a dry, bloodless environment during surgery, allowing brackets to be bonded right away.⁵
6. Root canal therapy: Diode lasers are used in root canal therapy to disinfect canals and as pulpotomy medicaments. During the pulpotomy procedure, 810 nm diodes in continuous mode at 2 W power level are used to amputation the pulp. Lasers give quick hemostasis when compared to other pulpotomy treatments.⁴
7. Low level laser therapy (LLLT): LLLT is the ability of lasers to affect cell function non-thermally and non-destructively. In the medical field, diodes are the only lasers utilized for LLLT. Serotonin, acetylcholine, histamine, and prostaglandins are among the neurochemicals that LLLT has been claimed to have significant neuropharmacologic effects on the synthesis, release, and metabolism in cells. LLLT has been shown to boost fibroblast production and collagen synthesis significantly. These cellular responses have a wide spectrum of biological tissue benefits, as well as a changed pain threshold. LLLT is sometimes known as "Soft laser Therapy" or "Biostimulation."⁶

Clinical trials on the impact of LLLT on injured nerves have demonstrated enhanced nerve function and myelin synthesis capability. In animal models, LLLT has also been demonstrated to help promote axonal development in damaged nerves.^{7,8,9,10}

Pain according to (ISAP) is "An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."

Orofacial pain: is a symptom that can appear in a variety of disorders. It could be a symptom of orofacial disease, generalized musculoskeletal or rheumatic disease, peripheral or central nervous system (CNS) disease, or psychiatric disorder; or it could be referred pain from another source (eg, cervical muscles or intracranial pathology). OFP can even happen when there are no obvious physical, imaging, or laboratory problems. Some of these conditions are simple to diagnose and treat, while others defy classification and are resistant to current treatments.¹¹

Facial neuralgias: The classic craniofacial neuralgias are a distinct set of neurologic illnesses involving the cranial nerves that are characterized by:

- (a) Short bursts of shooting, electric shock-like pain along the damaged nerve branch's path.
- (b) Trigger zones on the skin or mucosa that, when touched, cause painful assaults.
- (c) pain-free intervals between attacks and refractory intervals following an attack during which no new episode can be started. These clinical features distinguish neuropathic pain from other types of pain.¹²

Trigeminal neuroglia: The most prevalent of the cranial neuralgias, also known as (Tic douloureux), primarily affects people over the age of 50. When there is no underlying neurologic disease, TN is classed as classic TN, and when there is no neurologic disorder, it is classified as symptomatic TN..¹²

It is probable that it will cause harm to youngsters or even those who are younger. Trigeminal neuralgia affects one out of every 15,000 people, however due to frequent misdiagnosis, the number could be significantly higher. 13 Trigeminal neuralgia (TN) is a painful condition that affects the forehead, scalp, nose, lips, eyes, and jaws, and is usually limited to one side of the face (95 percent). 13 The patient is pain-free in between the two-minute pain episodes. It can happen on its own or be provoked by everyday actions like shaving, chatting, cleaning one's teeth, eating, and drinking. This type of discomfort normally lasts simply a matter

of seconds. It has a negative influence on an individual's quality of life, ranging from a single attack per a day to multiple attack per a minute.¹³

The maxillary or mandibular divisions are the most typically implicated branches, while the ophthalmic branch is the least frequently involved. 14 Pain usually begins once trigger points are stimulated. Some everyday tasks, such as eating and speaking, are known to induce the onset of pain.^{14,15,16}

Suggested treatment: When the reason of the TN can be identified, therapy entails removing the cause. However, in cases of idiopathic disease, a number of pharmacological and surgical therapy options should be investigated. Carbamazepine, baclofen, phenytoin, gabapentin, oxcarbazepine, pimozide, lamotrigine, and tizanidine hydrochloride are some of the medications used to treat seizures.^{13,17}

Peripheral nerve branch surgeries are another option when medicine is no longer effective.¹⁸

Trigeminal root sectioning, microvascular decompression surgery, and sectioning of the trigeminal tract in the lower medulla are all open surgical techniques.¹⁸

When medication therapy fails to control TN discomfort, surgical options are considered. The outcomes are determined by the neurosurgical team's experience, expertise, and proper procedure selection. The diode laser is also used to cure or relieve idiopathic trigeminal neuralgia.

Temporomandibular joint dysfunction

is a catch-all phrase for discomfort and dysfunction of the masticatory muscles (those that move the jaw) as well as the temporomandibular joints (the joints which connect the mandible to the skull). 19 TMJ (temporomandibular joint) dysfunction TMD affects 65 to 85 percent of adults in the United States at some point in their life, with roughly 12 percent experiencing chronic pain or disability as a result of the condition. The most frequent TMD has an unclear origin. The following are some of the factors that have been proposed: ¹⁹

- 1- Parafunctional habits (eg, nocturnal bruxing, tooth clenching, lip, or cheek biting).
- 2- Emotional distress.
- 3- Acute trauma from blows or impacts.
- 4- Trauma from hyperextension (eg, dental procedures, oral intubation for general anesthesia, yawning, hyperextension associated with cervical trauma).
- 5- Instability of maxillomandibular relationships
- 6- Laxity of the joint.
- 7- Comorbidity of other rheumatic or musculoskeletal disorders.
- 8- Poor general health and an unhealthy lifestyle. ¹⁹

Clinical presentations of TMJ disorder are varying from clicking on chewing, talking, and yawning to sever pain. Pain commonly radiates to temporal region, angle of mandible, sternocleidomastoid. Patients describe pain as earache and may suffer popping noises and tinnitus. Other clinical presentation as bruxism and clenching anxiety. ¹⁹

Bruxism and myofacial pain:

Parafunction (i. e . nonfunctional) , including clenching & / or grinding the teeth (referred to as bruxism) as well as various other oral habits . The term muscle hyperactivity has also been used to describe any increased muscular activity over and above that necessary for function. An increase in the level of muscle tonus. Some of these activities may be responsible for creating TMD symptoms.²⁰

Parafunctional activity can be subdivided into two general types:

A-Diurnal that occurs at day.

B-Nocturnal that occurs at night.

Both diurnal and nocturnal parafunctional activities occur at subconscious level: therefore, people are commonly unaware of this activity.²⁰

Most functional activity consists of well-controlled and rhythmic contraction and relaxation of the jaw muscles. This isotonic activity allows enough blood to flow through the tissues, oxygenating them and removing waste products that have accumulated at the cellular level. As a result, functional activity is a physiologic muscle activity.²⁰

Parafunctional activity, on the other hand, frequently results in long-term muscular contractions. Normal blood flow inside the muscular tissues is inhibited by this type of isometric action. As a result, there is an increase in metabolic by-products in muscle tissues, resulting in tiredness, discomfort, and spasm.

Recently, Bruxism, as well as symptoms of facial pain, earache, and headache, have been linked to the usage of selective serotonin reuptake inhibitors (SSRIS). When the dosage was reduced or buspirone was introduced, the bruxing symptoms disappeared. Buspirone has a postsynaptic dopaminergic action that may help to partially restore dopamine levels that have been lowered due to the usage of SSRIS.²

Toothache: Other lesions that expose the root, such as abrasion, erosion, unsuitable dental filling, and gingival recession, might cause toothache of dentinal origin. Fluoridated varnish, rigorous cleanliness, desensitizing chemicals, restoration of exposed portions, and crowning the tooth are all options for reducing dentin hypersensitivity.^{21,22}

Analgesic effect of laser: The following analgesic actions of the low power lasers are now recognized:²³

1. Low power lasers stop mediators from being released from wounded tissues. That means, they lower the concentrations of chemical pain mediators such as histamine, serotonin, acetylcholine, H⁺, and K⁺.
2. Through enhanced acetylcholine esterase activity, low-power lasers reduce the levels of acetylcholine, a pain mediator.

3. They produce vasodilation and increased blood flow to tissues, allowing released substances to be excreted more quickly. Better circulation, on the other hand, leads to a reduction in tissue edema.
4. They improve lymph outflow, which reduces tissue edema. They also relieve pressure on nerve ends, resulting in a reduction in stimulation.
5. These lasers reduce pain receptor sensitivity as well as impulse transmission.
6. They raise pain threshold by decreasing permeability of cell membrane for Na⁺ and K⁺ and causing nerve hyperpolarization.
7. The electromagnetic radiation of a laser increases the metabolism of injured tissue. This is brought about by the synthesis of ATP and the repolarization of the cell membrane.
8. Low-power lasers boost descending analgesic impulses in the dorsal spinal horn and block pain sensations at the cortex level.
9. As a response to pain, they balance the activity of the autonomous system.
10. Low-power lasers stimulate serotonin and glucocorticoid excretion in the urine, resulting in increased -endorphin synthesis.²³

The previous studies of the effect of lasers on pain were as many studies have shown the **effect** of the low-level lasers in relief the orofacial pain, here we are going to present some of these studies as below:

1. toothache of dental origin: Brugnera et al²⁴ employed a low-power He-Ne laser to treat dentin hypersensitivity in 300 patients in a study on the effect of low-level laser on tooth ache of dental origin. According to reports, the success rate was 92 percent. There was a substantial difference in patient complaints after one minute of low-level laser application on the apical and cervical portions of teeth compared to the control group, and this difference was even bigger after the 2nd and 3rd laser applications. ²⁵ Corona et al²⁶ shown that a low-level Ga-Al-As laser has a similar effect as fluoridated varnish.

2. Following surgical excision of third molars, pain treatment or prevention is possible. Although studies in the 1990s suggested that the pain after third molar surgery do not affected by low-level lasers, Markovi & Todorovi²⁹ discovered that patients who treated with 100 mg of diclofenac sodium before operation and were also exposed to laser after operation had less pain than those who treated with 100 mg of diclofenac sodium before operation but were not exposed to laser after operation. Bjordal et al³⁰ examined researched the impact of several dosages of low-power laser and their effects on pain after third molar surgery on 658 individuals and found that 0.37-0.96 J cm² laser had no effect on symptom eradication, but 6-7 J laser reduced pain more. As a result, more research into the use of low-level lasers to alleviate pain is needed to establish the optimal dose.
3. According to Eckerdal & Bastin³¹, a low-level laser with a wavelength of 830 nm was effective in treating 81 percent of trigeminal neuralgia patients, with 42 percent having no pain after a year. After a year, only 20% of patients who received alcohol injections remained pain-free, whereas 50% of patients who received alcohol injections improved. Low-level laser has also been shown to be far more effective than placebo in pain relief. ³² Several studies have also shown that low-level laser therapy can help prevent and treat post-herpetic neuralgia.^{33,34}
4. Effect on myofacial pain:- Several studies have demonstrated that multiple sessions with an 830-nm wavelength laser can lessen or eradicate myofacial pain. Up to 3 months, Altofini et al³⁷ observed no pain in their patients. Furthermore, the effectiveness of laser acupuncture in reducing myofacial discomfort has been proven.³⁸
5. Effect on TMJ disorder pain: - In 35 individuals, Kulokciglu et al³⁹ found a reduction in discomfort due to temporomandibular joint abnormalities. In another study, pain in patients with temporomandibular joint issues who were subjected to the 785-nm laser decreased dramatically when compared to the placebo group. During the six-month follow-up phase, they experienced no pain.⁴⁰

The goal of this research is to see how a single high dose of (Epic x) diode laser affects several types of facial and dental discomfort.

Materials and Methods:

A total of 10 educated patients, were diagnosed as 8 with chronic myofacial pain and the other two patients, one had chronic pulpitis and the other with chronic pericoronitis. The diagnosis of the cases was carried out according to the criteria of examination chart of oral medicine department / College of dentistry/ University of Tikrit, the diagnosis was delivered with a written case sheet for each patient. the patients were treated using 940 nm wavelength Epic XTM diode laser fig (1). A straight handpiece with an arch shaped end was used. During applying the laser, the handpiece was directed toward the symptomatic region with a slowly up and down motion, using a scanning non-contact mode with energy density of 1200 J/cm² and a power of 4W as a pain therapy option, as for the time required for each session, it was continuous 300 seconds as well as a sequence of follow ups consisting of 1 day, 3 day and a week. The outcome of the diode laser therapy was evaluated by the patient who were given a survey to fill that express their symptoms relief after the treatment. A satisfactory pain scale was used to describe their status fig (2).

Results:

Clinical characteristics of the patients are presented in **Table1**. The results were as follow 40% of the cases had complete resolution and 60% of the cases had partial improvement with a significant difference

between the degree of pain before the treatment and the degree of pain after treatment. Each patient was treated in a single session for 300 seconds irradiation for the session, we got complete resolution of four patients (p3,p6,p7,p9) and the improvement measured using our pain scale was a 3 degrees improvement in P3, 2 degrees improvement in P7&P9 and 1 degree improvement in P6. Also, a significant partial resolution in was detected in P (1,2,4,5,8,10) and the improvement was 3 degrees in P1,P2&P10 and 2 degrees improvement in P4,P5 & P8.

It is important to mention that we treated P1 & P2 with 2 additional sessions (net.: 3 sessions) as follow up cases and each session was with the same parameters(300 seconds irradiation, 4 J...), and the final result of these two cases (follow up cases) was complete resolution of pain with a follow up sequence of 1 day, 3 days and several weeks.

So according to this study, we have proved the effectiveness of Epic X diode laser in relieving orofacial pain with high single dose.

Discussion:

There has been a lot of research done to examine how low-level laser therapy impacts orofacial discomfort. Many studies have found that laser therapy is useful in treating orofacial pain, whereas others have found no benefit. Laser therapy appears to be a feasible alternative to traditional treatment methods, which come with a slew of negative side effects.

In two studies, Ijima et al^{9,41} used the He-Ne laser, both of which demonstrated a positive reduction in PHN after 20 and 50 sessions. Walker discovered that the He-Ne laser helped patients with post-herpetic neuralgia, trigeminal neuralgia, osteoarthritis, and sciatica after 30 irradiation sessions. ⁴² Another study used a He-Ne laser with a wavelength of 632.5 nm and a power of 1 mW to treat trigeminal neuralgia for 30 sessions and found that it was successful after a year of follow-up. ¹⁰ In the studies indicated, each point got 6 to 10 J in chronic forms and 3 to 6 J in acute versions. A laser was

used to treat trigger points, nerve pathways through bone, and acupuncture points, among other places. There has never been a study that compares various radiation levels. Simunovic believes that the He-Ne laser is the best laser for treating trigeminal neuralgia, and that treating trigger sites with radiation is more effective than treating other areas with radiation. ⁴³ LLLT's efficacy in resistant PHN has also been discovered. In that study, they used diode laser with a wavelength of 830 nm and a power of 60 mW. After only four sessions, they experienced positive results, which is much less than the He-Ne laser treatment. ⁴⁴ Kemmotsu et al³¹ used GaAlAs and an irradiation laser for an average of 36 sessions in resistant PHN cases, with satisfactory long-term results. Vernon and Hasbun³⁰ used a diode laser to treat a patient with trigeminal neuralgia. They discovered that LLLT was quite effective in pain relief after 12 sessions. They did, however, finish 20 doses of irradiation. Mann et al⁴⁵ observed considerable pain relief after 15 radiation treatments with a combi-laser (12x70 watts, 1000Hz). Mittal et al⁴⁶ used a combilaser (5000 Hz and 8 J/cm²) for 16 sessions and had similar results.

Increase in beta-endorphins level in CSF, increase urinary secretion of glucocorticoids, increase the nerve fibers pain threshold, increase urinary secretion of serotonin, and increase in serotonin urinary secretion have all been proposed. Changes in norepinephrine and epinephrine activity, rise in ATP generation, improvement in local circulation, lymph node circulation, and edema reduction ^{47,48}

z et al.,⁴⁹ Dundar et al.,⁵⁰ Altan et al.,⁵¹ and Hansen et al. did not agree with our findings. ⁵² Various laser wavelengths and intensities, as well as different sample sizes and treatment sessions, were used in the aforesaid study. However, they all used a case control approach, and the outcomes were similar. There was no significant difference in pain relief between the laser and control groups, according to all of them.

z et al²⁴ treated 20 patients with myofascial pain twice a week with an 820

nm low-level diode laser with a 3 J/cm² energy density and 300 mW power (10 sessions). The control patients wore an occlusal splint around the clock for three months. Laser therapy was just as beneficial as an occlusal splint in relieving myofascial pain, with no statistically significant difference between the two groups.

The energy density of the laser employed in several previous experiments was not mentioned. Others preferred energy densities greater than 20 J/cm² or less than 5 J/cm². A modest energy density was chosen by only a few investigations. As a result, we used an energy density of 6.36 J/cm². Carrasco et al²⁹ employed extremely high energy densities (25, 60, and 105 J/cm²) in their experiments. We utilized a lower energy density based on the specified energy density values for GaAsAl lasers³⁰ because they did not get satisfactory results. The energy densities used in the studies by z et al. and Hansen et al. were 24 3 J/cm² and 27 4.7 and 9.4 J/cm², respectively. We chose a higher energy density based on their findings.

In our study, the epic x diode laser may be due to its photo biochemical reaction with tissue and stimulation of nervous tissue, as well as its significant neuropharmacologic effects on the synthesis, release, and metabolism of a range of neurochemicals, including histamine, serotonin, and acetylcholine, all of which are pain mediators, and leaser reduce cell membrane permeability for sodium and cause neuronal hyperpoly.

Low-power leasers reduce serotonin and glucocorticoids, increase beta endorphine production, as well as their effect on metabolite removal, and increase blood flow to muscle in painful situations through local vasodilation, all of which have an analgesic effect. In addition, the diode laser is now a viable choice for pain management in the circumstances. The study's originality is the alleviation of facial discomfort with a single diode laser dose.

Conclusion:

1. Facial pain could be relieved using single dose of diode laser (Epicx).
2. Single dose with long duration (300s) is better than multiple short doses.

Recommendation

1. Large sample of patients for better results.
2. Studying the effect on another type of facial pain.

Compliance with Ethical Standards

- Conflict of Interest: Prof. Muthenna Sh. Rajab, Lec. dr. Yasir Kh. Mohmmad, Elias M. Talab, Abdullah S. Hamad, Talat A. Mahmud, and Abraham A Gh Alokaily declare that they have no conflict of interest.
- Funding: There is no funding source.
- Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.



Fig (1): Epic x dental laser.



Fig (2): Faces with different emotions to describe patient satisfaction to treatment.

Table 1: Clinical characteristics of the patients

.No	Gender	Age (year)	Diagnosis	Site	Duration of symptoms (month)	DOPBT. On our pain scale (6)	DOPACT. On our pain scale (6)	Degree of improvement (P after – P before)	Outcome
P1	male	22	MFP	R. masseter M. & temporal M. Re.	8	2	5	3	Partial improvement
P2	male	22	MFP	L. masseter M. & temporal M. Re.	8	2	5	3	Partial improvement
P3	male	23	MFP	R. Masseter M. .Re	6	3	6	3	Complete resolution
P4	male	21	MFP	R. Temporal .M. Re	4	3	5	2	Partial improvement
P5	male	23	MFP	L. Angle of M. & TMJ area	8	3	5	2	Partial improvement
P6	male	23	MFP	R. buccinators M. area	4	5	6	1	Complete resolution
P7	male	23	MFP	L. Masseter M. .Re	6	4	6	2	Complete resolution
P8	male	21	MFP	L. cheek area	3	3	5	2	Partial improvement
P9	male	19	Pc	R. lower third molar Re.	8	4	6	2	Complete resolution
P10	male	41	Pulpitis	R. maxillary area; upper 7	10	2	5	3	Partial improvement

DOPBT. Degree of pain before treatment. DOPACT. Degree of pain after complete treatment. MFP: - myofacial pain, Pc :- pericoronitis
.R. right. L. left. M. muscle. Re. region

References

- Larry A. Coldren; Scott W. Corzine; Milan L. Mashanovitch (2 March 2012). *Diode Lasers and Photonic Integrated Circuits*. John Wiley & Sons. ISBN 978-1-118-14817-4.
- Utpal P, Das MK, Bds NM (2013) Versatile diode. *IOSR J Dent Med Sci* 6:1-6
- Walsh LJ (2003) The current status of laser applications in dentistry. *AustDent J* 48: 146-155.
- Maturo P, Perugia C, Docimo R (1939) V 810 d l p d. *Int J Clin Dentistry*. 6.
- Pohlhaus SR (2015) Instruments for the modern practice. *Crest® Oral-B®Dent Contin Educ Course*, pp: 1-29.
- Martens LC (2011) Laser physics and a review of laser applications in dentistry for children. *Eur Arch Paediatr Dent* 12: 61-67.
- Costantini D, Delogu G, Lo Bosco L, Tomasello C, Sarra M. The treatment of cranio-facial pain by electroacupuncture and laser irradiation. *Ann Ital Chir* 1997;68:505-9.
- Pinheiro AL, Cavalcanti ET, Pinheiro TI, Alves MJ, Miranda ER, De Quevedo AS, et al. Low-level laser therapy is an important tool to treat disorders of the maxillofacial region. *J Clin Laser Med Surg* 1998;16:223-6.
- Iijima K, Shimoyama N, Shimoyama M, Yamamoto T, Shimizu T, Mizuguchi T. Effect of repeated irradiation of lowpower He-Ne laser in pain relief from postherpetic neuralgia. *Clin J Pain* 1989;5:271-4.
- Walker J, Akhanjee L, Cooney M, Goldstein J, Tamayoshi S, Segal-Gidan F. Laser therapy for pain of trigeminal neuralgia. *Clin J Pain* 1988;3:183-7.
- Burket's oral medicine, eleventh edition, p 257
- Burket's oral medicine, eleventh edition, p 279
- Cheshire WPJ, Wharen REJ .13Trigeminal neuralgia in a patient with spontaneous intracranial hypotension. *Headache* .3-49:770;2009
- Jainkittivong A, Aneksuk V, Langlais RP .14 Trigeminal neuralgia: a retrospective study of 188 Thai cases. *Gerodontology* 2012;29:e611-7.
- Siddiqui MN, Siddiqui SS, Ranasinghe JS, Furgang FA. Pain management: trigeminal neuralgia. *Hospital Physician* 2003;39:64-70.
- Fromm GH .16Baclofen as an adjuvant analgesic. *J Pain Symptom Manage* 1994;9:500-9.
- Baker KA, Taylor JW, Lilly GE. Treatment of trigeminal neuralgia: use of baclofen in combination with carbamazepine. *Clin Pharm* 1985;4:93-6.
- Cheshire WP. Trigeminal neuralgia: diagnosis and treatment. *Curr Neurol Neurosci Rep* 2005;5:79-85.
- Burket's oral medicine, eleventh edition, p232.
- Burket's oral medicine, eleventh edition, p254.
- Melzac R, Wall P. *Pain Management*, 1st ed. London: Churchill Livingstone; 2003:179-97.
- Bonica J. *The Management of Pain*, 2nd ed. Philadelphia: Lea and Febiger; 1990:687-792.
- Hamid R, Fahimeh A, Jamileh B, Sedigheh B, Zahra N, Firoz P. Review Effect of Low-power Laser on Treatment of Orofacial Pain. *JODDD*, Vol. 4, No. 3 Summer 2010. 2010; 4(3):75-78.
- Brugnera A, Zanin FA, Pecora JD, Cruz FM. Clinical results evaluation of dentinary hypersensitivity patients treated with laser therapy. *SPIE* 1999; 21:66-8.
- Gerchman JA, Ruben J, Gebant N, Eaglemont J. Low level laser therapy for dentinal tooth hypersensitivity. *Aust Dent J* 1994; 39:353-7.
- Corona SA, Nascimento TN, Catrise AB, Lizarelli RF, Dinelli W, Palma Dib RG. Clinical evaluation of low-level laser therapy and fluoride varnish for treating cervical dentinal hypersensitivity. *J Oral Rehabil* 2003; 30: 1183-9.
- Fernando S, Hill CM, Walker R. A randomised double blind comparative study of low-level laser therapy following surgical extraction of lower third molar teeth. *Br J Oral Maxillofac Surg* 1993; 31:170-2.
- Brams JW, Stegnova B, Raghoobar Gm, Roodenburg JL. Treatment with soft laser. The effect on complaints after the removal of wisdom teeth in the mandible. *Ned Tijdschr Tandheelkd* 1994; 101:100-3.
- Marković AB, Todorović L. P Postoperative analgesia after lower third molar surgery: contribution of the use of longacting local anesthetics, low-power laser, and diclofenac. *Oral Surg Oral Med Oral Pathol Oral Radio* 2006;102:e4-8.
- Bjrdal JM, Turner J, Frigo L, Jerde K, et al. A systemic review of postoperative pain relief by low level laser therapy after 3rd molar extraction. *Br J Oral Maxillofacial Surg* 2007; 54:253-6.
- Eckerdal A, Bastin L. Can low reactive-level laser therapy be used in treatment of neurogenic facial pain? A double blind placebo controlled investigation of patients with trigeminal neuralgia. *Laser Therapy* 1996; 247-52.
- Eckerdal A, Bastin L. A double blind placebo controlled investigation of patients with trigeminal neuralgia. *Laser Therapy* 2003; 12:112-20.
- Mel'nichenko EM, Orda EM, Mostovnikov VA, Khokhlov IV, Nechaev SV, Orda VN. [The clinico-experimental validation of the use of low-intensity laser radiation for the treatment of exacerbated recurrent herpetic stomatitis in children]. *Stomatologiiia (Mosk)* 1992;(2):76-8.
- Ohshiro T, Moone K. Double blind cross over trial of low level laser therapy (LLLT) in the treatment of post herpetic neuralgia. *Laser Therapy* 1998; 1:7.
- Dundar U, Ericke D, Samli F, Kavuncu V. The effect of Gallium laser therapy in the management of myofacial pain syndrome. *Clin Rheumathol* 2006; 212:90-4.

36. Bradly P, Heller G. The effect of 830 nm laser on chronic myofascial pain. *Pain* 2006; 124:201-10.
37. Altafini, Catro G, Ambrosio F. Diode laser in myofascial pain. *Clin J Pain* 1998; 5:301-4.
38. Whittaker P. Laser acupuncture: past, present, and future. *Laser in Med* 2004; 19:69-80.
39. Kulokciglu S, Sivriglu K, Ozcan O, Parlok M. Effectiveness of low-level laser therapy in temporomandibular disorder. *Scand J Rheumatol* 2003; 32:114-8.
40. Ribeiro Ms. Clinical evaluation of the low intensity laser anti algic action of Ga Al As in the treatment of the temporomandibular disorder. *Laser Med Surg* 2002; 18:205-7.
41. Iijima K, Shimoyama N, Shimoyama M, Mizuguchi T. Evaluation of analgesic effect of low-power He:Ne laser on postherpetic neuralgia using VAS and modified McGill pain questionnaire. *J Clin Laser Med Surg* 1991;9:121-6.
42. Walker J. Relief from chronic pain by low power laser irradiation. *Neurosci Lett* 1983;43:339-44.
43. Simunovic Z. Low level laser therapy with trigger points technique: a clinical study of 243 patients. *J Clin Laser Med Surg* 1996;14:163-7.
44. Moore K, C., Hira N, Kramer PS, Jayakumar CS, Ohshiro T. Double blind crossover trial of low level laser therapy. *Practica Pain Management* 1988;1-7.
45. Mann SS, Dewan SP, Kaur A, Kumar P, Dhawan AK. Role of laser therapy in post herpetic neuralgia. *Indian J Dermatol Venereol Leprol* 1999;65:134-6.
46. Mittal RR, Jassal JS, Bahl RK. Laser therapy in post herpetic neuralgia. *Indian J Dermatol Venereol Leprol* 1996;62:22930.
47. King CE, Clelland JA, Knowles CJ, Jackson JR. Effect of helium-neon laser auriculotherapy on experimental pain threshold. *Physical therapy* 1990;70:24-30.
48. Bjordal JM, Lopes-Martins RA, Iversen VV. A randomised, placebo controlled trial of low level laser therapy for activated Achilles tendinitis with microdialysis measurement of peritendinous prostaglandin E2 concentrations. *Br J Sports Med* 2006;40:76-80; discussion 76-80.
49. Öz S, Gokcen-Rohlig B, Saruhanoglu A, Tuncer EB. Management of myofascial pain: low-level laser therapy versus occlusal splints. *J Craniofac Surg*. 2010;21(6):1722–1728. doi: 10.1097/SCS.0b013e3181f3c76c conclusion .
50. Dundar U, Evcik D, Samli F, Pusak H, Kavuncu V. The effect of gallium arsenide aluminum laser therapy in the management of cervical myofascial pain syndrome: a double blind, placebo-controlled study. *Clin Rheumatol*. 2007;26(6):930–934. doi: 10.1007/s10067-006-0438-4.
51. Altan L, Bingol U, Aykac M, Yurtkuran M. Investigation of the effect of GaAs laser therapy on cervical myofascial pain syndrome. *Rheumatol Int*. 2005;25(1):23–27. doi: 10.1007/s00296-003-0396-y.
52. Hansen HJ, Thoroe U. Low power laser biostimulation of chronic oro-facial pain A double-blind placebo controlled cross-over study in 40 patients. *Pain*. 1990;43(2):169–179.
53. raman a,srividhya s,kumar m, laxman ,kumar m, kailasam A low level laser therapy: A concise review on its application *J Indian Acad oral med radio* 2013;25:291-3.