

The Effects of Low Power Lasers in Healing of Oral Ulcers

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Abstract:

It is the output power and density of the lasers which determine whether a laser is a low or high-power one. If the density is less than $670\text{mW}/\text{cm}^2$, the laser is called a low power one. The output power of these lasers is usually less than 250mW. They use different mechanisms to accelerate wound healing such as: cellular biostimulation, improvement of circulation, vasodilation, analgesic and anti-inflammatory effects. They don't contribute to any drug resistance, therefore, several studies have been conducted on the application of these lasers for the curing of acute, chronic and recurrent ulcers such as mucositis, aphthous ulcers, herpetic lesions and lichen planus. In this article we will survey the effects of low-power lasers in the healing of oral ulcers.

Keyword: low power laser therapy; oral ulcers; healing

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Introduction

Oral ulcers are usually classified based on the number of lesions (single or multiple), the duration of the ulcers (acute or chronic), the presence of disease in the past (primary or recurrent). Based on the causes, a good treatment is selected. In most cases, a symptomatic treatment (viscous lidocaine, liquid diphenhydramine, diclonine hydrochloride, benzydamine, systemic analgesia) is necessary against pain to permit nutrition, hydration and good speech. Recently laser therapies have been used for treatment of oral ulcers(1).

A Light source treatment that produces a single light wavelength is Low Level Laser therapy (LLLT). LLLT does not effect through emitting heat, sound or vibration, but it can act via photobiologic or biostimulation which are nonthermal and photochemical reactions in the cells. It is the output power and density of the lasers which

determine if the laser is a low or high-power one. If the density is less than $670\text{mW}/\text{cm}^2$, the laser is called a low power one. The output power of these lasers is usually less than 250 mW (2,3). Low level lasers are usually settled in wave length of 650-1200 nm. potassium-titanyl-phosphate (KTP) (532 nm), Ruby (694 nm), Alexandrite(755 nm), Neodymium-Doped Yttrium Aluminium Garnet (Nd:YAG) (1064 nm), Ti:Sapphire(700-900 nm), In-Ga-Al-P(630-685 nm), Ga-Al-As(780-820-870 nm), Ga-As (904-905 nm), Rhodamine(560-650 nm), Excimer (193-248-308 nm), Argon(305-512 nm), Copper Vapour(578 nm) and He-Ne (633 nm) are different types of Low level lasres (2).

Laser radiation and monochromatic light may alter cell and tissue function. Laboratory studies suggest that irradiation stimulates collagen production, alters DNA synthesis, and improves the function of damaged neurological tissue (Figure1).

Different mechanisms have been suggested for the

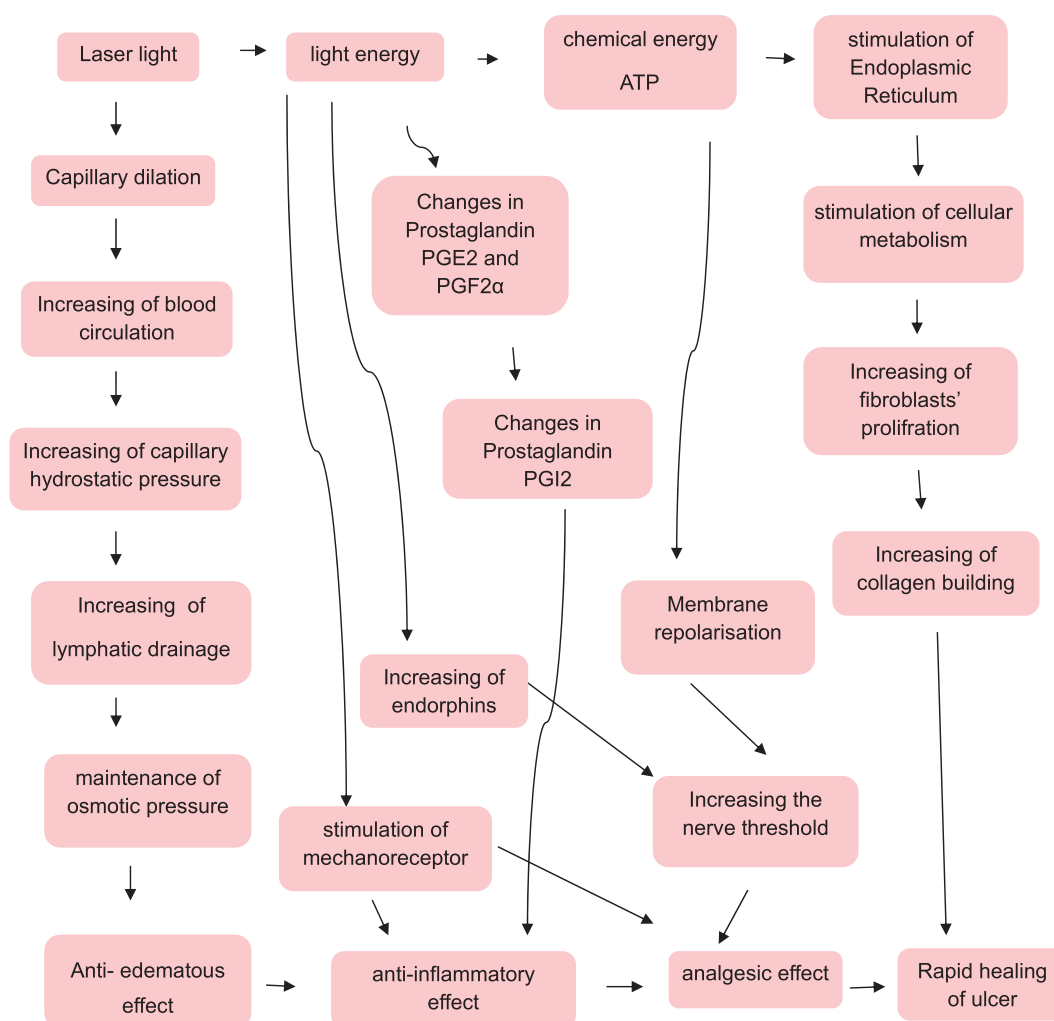


Figure 1. Schematic representation of the effect of low level laser on wound healing (2)

main therapeutic effects with LLLT, some of these theories are as follow; the mitochondria produces more ATP and cellular oxygen consumption is decreased, the serotonin and endorphins are increased, prostaglandin synthesis is decreased, expression of cytokines and growth factors is induced and inflammation will be decreased then wound healing occurs. In cases like neuralgia and diabetes mellitus the blood circulation to the skin is improved, the permeability of the nerve cells membranes for Na/K is decreased and results in hyperpolarisation and lymphatic flow is increased so the edema will decrease (4, 5).

Effect of low level laser on oral Lichen planus (OLP)

High-potency topical corticosteroids yet is

the most consistent and effective treatment for the erosive type of oral lichen planus, but even there is the possibility of adverse effects by short courses of treatment. Unfortunately, some patients are unresponsive even to systemic corticosteroid, therefore, low level laser therapy can be used in association with conventional therapy (6,7,8). Jajarm HH et al (2011) showed that the use of 630nm wavelength diode laser is as effective as topical corticosteroid therapy in reducing the pain and severity of lesions without any adverse effects, and it may be considered as an alternative treatment for erosive-atrophic OLP in the future (9). It must be also noted that high level lasers have been used in the treatment of OLP. Van der Hem PS et al (2008) investigated the effect of CO_2 laser evaporation on oral lichen planus. They expressed that, in patients whose condition does

not response to topical corticosteroids, CO₂ laser evaporation can cause long-term remission of symptoms, and may even be the choice treatment in patients suffering from painful OLP(10). Wackernagel A et al (2007) evaluated the short and long-term therapeutic efficacy of psoralen plus UVA (PUVA) vs. UVB-311 nm in the treatment of patients with disseminated lichen planus. They reported that even though oral PUVA produces a better initial clinical response rate, both oral PUVA and UVB-311 nm are useful treatments for lichen planus that produce similar long-term outcomes (11). Trehan M and Taylor CR (2004) reported that Low-dose treatment with the excimer 308-nm laser (at an initial dose of 100 mJ/cm² once a week) can be very effective in treating symptomatic, and especially erosive OLP, an otherwise notoriously difficult to control disease (12). Cafaro A et al (2003) suggested that LLLT could be a possible treatment for patients with unresponsive OLP. 13 patients affected by OLP, received biostimulation with a pulsed diode laser (GaAs). The Patients were exposed to a 904-nm pulsed infrared laser (4 J/cm² energy density per minute; spot size, 0.8 cm). They reported significant reduction in lesion size and in reported pain (8). Köllner K et al (2003) examined eight patients with OLP using the 308-nm UVB excimer laser. Clinical improvement was achieved in six patients. Two patients showed complete remission, of which one patient showed recurrence of the lesions after 4 weeks (13).

Effect of low level laser on Aphthous ulcer

Laser therapy has been reported to provide pain relief and lesion resolution for isolated lesions, but there is controversy about affecting episodic recurrence (14,15). De Souza TO et al (2010) reported that LLLT [InGaAlP diode laser with wavelength of 670 nm, 50 mW, 3 J/cm² per point in daily sessions (once per day)] can cause reduction in pain and a total regression of the lesion after 4 days(16). Khademi H et al (2009) in a double blind clinical trial treated 12 patients with minor Recurrent Aphthous Stomatitis (RAS) using diode laser (660 nm, 3 J/cm², continuous mode). The results were compared with the control group (12 patients), and it was reported that low level laser can decrease the healing time, pain intensity and

also decrease the time of pain relief in patients with aphtae (17).

Zand N et al (2009) showed a low-intensity, non-thermal, single-session of CO₂ laser (1 W of power in de-focused continuous mode) irradiation reduced pain in minor aphthous stomatitis immediately and dramatically, with no visible side effects (18).

Effect of low level laser on herpetic lesion

Several studies have shown that Low level laser has been used to treat infections of HSV (herpes simplex viruses) which includes HSV-1 and HSV-2 (19). It can increase the interval between infections, without contributing in viral resistance. Ferreira Dc et al (2011) described two clinical cases with recurrent labial herpes for which LLLT (30J/cm², with 660nm,100mW, 8s, 5 session) was used. Following treatment, both patients remained symptom-free during the 17 months clinical follow up period and supported that low level laser therapy (LLLT) has shown promising clinical results as a longer lasting suppressive therapy (20). De Carvalho RR et al (2010) reported a significant decrease in dimension of herpes labialis lesions and inflammatory edema using low level laser therapy. The reduction in pain level and monthly recurrences did not reach statistical significance (21).

Effect of low level laser on post surgical wound healing

Several studies support that low level laser therapy provides more comfortable and faster post operative recovery for patients after several kinds of surgery, such as tooth removal, maxillary sinus augmentation, and labial frenectomy (22,23). Alipanah Y et al (2011) used a low level pulsed Ga-Al-As laser on buccal gingival maxilla of sixteen rabbits in which full thickness flap was used bilaterally. They found that LLLT using optimal parameters can accelerate full thickness wound healing (24). Parirokh et al (2006) reported that HE-NE lasers had beneficial effect on incisional wound healing particularly at five-day intervals (25). Jovanović G et al (2011) applied low level laser in 30 extraction wounds with a total of eight sessions of radiation. They found that extraction wound healing in the study group was more successful and faster than the control

group in which extraction wounds were dressed with zinc oxide eugenol paste (26).

Effect of low level laser on multiple chronic ulcers

In cases of multiple chronic ulcers, such as mucous membrane pemphigoid, Epidermolysis bullosa (EB) only case studies have been conducted (27,28), but it has been reported that cases of pemphigus vulgaris had been treated with carbon dioxide laser (29,30).

Conclusion

We can apply Low Level Laser therapy simultanously with conventional therapy especially in patients who do not respond to conventional treatment or suffering from painful lesions. Laser therapy has also been applied in diabetic patients for their slow-to heal wounds. By LLLT the course of wound healing is decreased with afew or most often no adverse side effects. In spite of publishing a large number of studies about laser photostimulation, the literatures are often conflicting and can not report exat treatment protocols accuratly. There are a large number of parameters in the application of LLLT including treatment dosage, wavelenght, irradiance, contact or noncontact application, exposure time, tissue type, physiological condition and optical properties of the tissue. The treatment protocols must be based on the results of randomized controled clinical trials. As well as cost effectiveness and the resource availability, the selection of laser treatment depends on the number, location and the size of lesions. More researchs are required to define on which stage of HSV replication cycle LLLT acts(19). Although the proven effectiveness of Low Level Laser in improving oral ulcers, yet because of the need for several appointments in most cases and the modernity and accuracy of the procedure, its application has not been widespread.

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