



## Review article

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## BIOSTIMULATIVE LASER THERAPY: BASE FOR FAVORIZED AND ACCENTED RESULTS IN DENTISTRY

## SUMMARY

Laser therapy is a standard therapeutic procedure, with unambiguous indications and contraindications. Among the reasons for this are: positive clinical experiences, scientifically verified objective changes in tissue equilibrium caused by laser, and above all, better understanding of the mechanisms of laser effects. Clinical and experimental experience shows that laser therapy has its greatest effects on cells/tissue/organs affected by a generally deteriorated condition with the pH value lower than normal. Biostimulation has been demonstrated with doses of laser emission from as low as 0,001J/cm<sup>2</sup> to 10J/cm<sup>2</sup>, with cytostatic effect above 240J/cm<sup>2</sup>. There were no macroscopic and microscopic damages to the tissue when recommended doses were used, which confirmed the safety of laser therapy. There are many indications for the laser use in oral pathology and periodontology, such as cheilitis exfoliativa sicca, gingivitis, gingivitis desquamativa, and periodontitis.

Taking into consideration the effects of the laser treatment, such as activation of microcirculation, production of new capillaries and thickening of the capillary net, anti-inflammatory, analgesic effect, stimulated growth and regeneration of cells, and accelerated bone consolidation, following the need for incorporating non-invasive methods for minimizing the pain and discomfort either during or after dental treatment, we consider that the use of biostimulation laser therapy is an excellent treatment option.

**Key words:** laser therapy, oral disorders, periodontitis

## INTRODUCTION

A decade ago, laser therapy was absolute novelty in Macedonian dentistry, a little bit futuristic, promising, but still controversial. Today, it is a standard dentistry procedure with clearly defined (determined) indications and contraindications, which has lost the label of experimental medical procedure. Some countries has accepted this modality as routine procedure (Japan since 1987, Norway since 2001 and the USA since 2002) and included it in their legislative (1). In Netherlands, about 10%, and in Hungary more than 30% of the dentists use laser therapy in their dental practices.

Reasons for this expansion are not just broad positive clinical experiences, but much more scientifically verified objective changes caused by laser in tissue equilibrium, and above all, understanding of mechanisms of laser therapy. Knowledge about mechanisms of laser therapy allows us to separate the primary and secondary mechanisms. The primary mechanisms relate to the interaction between photons and molecules in the tissue, while the secondary mechanisms relate to the effect of the chemical changes induced by primary effects. After diffuse penetration of the laser bundle in the tissue, there is absorption of polarized light in cytochrome molecules (e.g. porphyrines), the electrical field

across the cell membrane creates a dipole moment on the bar shaped lipids, and finally local differences in intensity creates temperature and pressure gradients across cell membranes (1). The singled oxygen is "free radical" increasing the ATP, which is cell fuel and energy depo. At the same time, the affected permeability of the cell membranes affects Ca, Na, and K, as well as the proton gradient over the mitochondria membranes. This influences the oxidative processes resulting in favorized epiteliza-tion, acceleration of the inflammatory process, as well as reduction of the perception of pain(1). The device for low level laser therapy is shown in *Figure 1*.

Clinical and experimental experience show that laser therapy has its greatest effects on cells/tissues/organs affected by a generally deteriorated condition with lower ph values. Biostimulative doses recommended in literature range between  $0,001\text{J}/\text{cm}^2$ - $10\text{J}/\text{cm}^2$  and cytostatic effects were registered above  $240\text{J}/\text{cm}^2$ . There are confirmed assurances that there are no macroscopic and microscopic damage to tissue when recommended doses are used.

Can low level laser therapy cause cancer? The answer is no! No mutational effects have been observed resulting from light with wavelengths in the red or infrared range in doses used within laser therapy. Dental laser therapy has been in use for over 30 years and more than 90% of the available literature report positive effects. Sometimes, it is used as a part of the therapy, and sometimes, as monotherapy. In general, 80% of patients respond to laser therapy. If a patient does not respond positively to the treatment, you should know that the degree of success of the laser treatment is sublimate of a number of parameters. A poor result can occur due to a low dosage, too high dosage, wrong diagnosis, insufficient number of treatment sessions, unsuitable frequency, etc.

The low level laser light is characterized by a wide range of therapeutic possibilities in oral medicine and periodontology. Positive low level laser therapeutic effects in the treatment of Herpes simplex recurrences and glossitis has been reported in the literature by Georgieva(2). Popovska et al. (3) conclude that therapy of Cheilitis exfoliativa sicca complemented with laser therapy results in complete consolidation. Reduction of pain and size of lesions as well as faster epithelization in therapy of ulcera decubitalis compared to aphtous lesions were also reported (4). Other reports in literature confirmed that low level laser therapy has effects not only in the tretament of acute herpes zoster, but also in the treatment of post-herpetic neuralgia (5,6).

Additionally, laser therapy in acute phase of this disease probably reduces the risk of post herpetic neuralgia. Low level laser therapy relieves

symptoms in patients with cancer that take medications and/or radiation therapy, which gives oral side effects-mucositis (7,8). Laser therapy can be used as palliative method in patients with cancer in terminal stage. It is necessary to accent that this therapy is only a supplement and it is not the only treatment protocol in the treatment of gingivitis. Nakova et al. (9) has noted significant reduction of gingival inflammation, which is the result of anti-inflammatory, anti-edematous laser activity, as well as intensifying of hummoral and cellular immunity and acceleration of reparatory and regenerative capabilities.



*Figure 1. Device for low level laser therapy*

Using low level laser therapy as complementary treatment until complete clinical remission of chronic desquamative gingivitis was achieved, and there were no clinical recurrences or exacerbation of disease in the next 6 months (10).

In our clinical trial on low level laser therapy effects, in the treatment of initial periodontitis affection (11), greater clinical improvement objectified by accented local immunological reactions and depression of salivary elastase level were verified. Despite these results, we consider that low level laser therapy is an accessory modality, which still requires solid conventional periodontal treatment as a base for achieving maximum positive results in the complex modern treatment of initial periodontitis. Despite statistically insignificant results, a relatively accented therapeutical effect in combined (classical complemented with laser) therapy of periodontitis in patients with Diabetes mellitus were considered to be a reflection of the laser effects on tissue metabolism, followed by possible normalization of leukocyte hemotaxis, improved functional granulocyte capacities and optimisation of hematoprotective characteristics in diabetics (12).

Clinical experiences (13) pointed that teeth with high sensitivity treated with low level laser therapy remarkably responded to this treatment, with rapid reduction of pain in 86.6% patients against

reduction of pain in 26.6% of patients treated with topical fluorid application.

Clinical trial about laser therapy participation in adaptation of periodontal complex to trauma caused by application of fixed orthodontic apparatus (Figure 2), demonstrated a positive effect of the low level laser on pain, resulting in significant decrease of the pain intensity after the treatment (14).

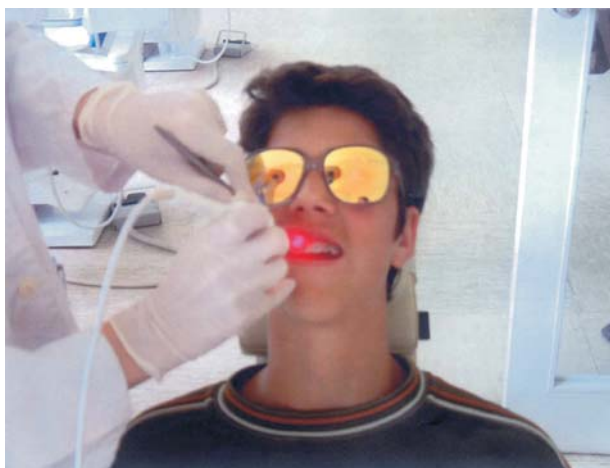


Figure 2. Treatment with low level laser after application of orthodontic fixed apparatus

The combination of suitable dye-photosensitizer and low level laser light has potential bactericidal effect, indicating the therapeutic potential in periodontology(1).

Finally, additional laser therapy after periodontal surgery is justified because of decrease in postoperative pain, better coagulation, increased tension force of the wound and accelerated angiogenesis (15). Kim et al. (16) reported that reduction of fast epithelial proliferation after flap operation by laser therapy is possible, which is very important.

Low level laser therapy has demonstrated potentially multiple treatment outcome effects such as activation of microcirculation, formation of new capillaries and thickening of capillaries, anti-inflammatory and analgesic effects, stimulation of cell growth and regeneration, as well as accented bone consolidation. Today, there is also a trend for incorporating more non-invasive methods, which will minimize pain during intervention procedures in dentistry. With this in mind, we consider that application of biostimulative lasers is a remarkable therapeutic option. Undoubtedly, laser is not a revolutionary invention that is universal solution for everything, but in accordance to the human behavioral concept in dentistry and attempts to minimize discomfort during dental treatment, we recommend application of biostimulative laser as a method that has exceptional effects in modern treatment of oral problems. Of course, it is a challenge for everyone in the whole dentistry community to explore and use benefits of this treatment option.

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## **BIOSTIMULATIVNA TERAPIJA LASEROM: OSNOVA ZA OČEKIVANE I POTENCIRANE REZULTATE U STOMATOLOGIJI**

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### **SAŽETAK**

Laser terapija je standardni stomatološki postupak sa jasno definisanim indikacijama i kontraindikacijama koji nema više epitet eksperimentalne medicinske procedure. Razlog za ovu široku primenu nisu samo bogata i pozitivna klinička iskustva, već, još više, naučno verifikovane, objektivne promene uslovljene laserom u tkivnom ekvilibrijumu i, pre svega, rasvetljavanje mehanizama delovanja laser terapije. Kliničko-eksperimentalna iskustva potvrđuju da laser terapija pokazuje najveće efekte na ćelije/tkiva/organe, koji su afektirani generalno poremećenim stanjem, sa nižim ph vrednostima od normalnog. Činjenice da se biostimulativne doze, koje su preporučene u literaturi, kreću u rasponu od 0.001 J/cm<sup>2</sup> do 10 J/cm<sup>2</sup>, a citotoksični efekti se pojavljuju iznad 240 J/cm<sup>2</sup>. Verifikovana sigurnost da nema makroskopskih i mikroskopskih oštećenja u tkivu prilikom primene preporučenih doza govori o bezbednosti biostimulativnih lasera. Postoje mnoge indikacije za laser terapiju na polju oralne patologije i parodontologije, kao što su Ch. exfoliativa sicca, Ginivitis, Gingivitis desquamativa, parodontopatije. Uzimajući u obzir laserske efekte, pre svega, aktivaciju mikrocirkulacije, produkciju novih kapilara i zgušnjavanje kapilarne mreže, antiinflamatorni, analgetski efekat, stimulaciju rasta i regeneraciju ćelija, kao i akcentovanu koštanu konsolidaciju, u isto vreme, prateći potrebu za inkorporiranjem što neinvazivnijih metoda, koje će minimizirati bol pri stomatološkim intervencijama, smatramo da je primena biostimulativnih lasera izvanredna terapijska opcija.

***Ključne reči:*** laser terapija, oralna oboljenja, parodontopatija