

PRIMENA NISKOENERGETSKOG LASERA U TERAPIJI HIPERSENZITIVNOG DENTINA

APPLICATION OF LOW LEVEL LASERS IN TREATMENT OF HYPERSENSITIVE DENTINE

Radmila Živković¹, Ljiljana Kesić¹, Nikola Burić², Goran Jovanović²

¹ KLINIKA ZA STOMATOLOGIJU – ODELJENJE ZA PARADONTOLOGIJU I ORALNU MEDICINU,

² KLINIKA ZA STOMATOLOGIJU – ODELJENJE ZA ORALNU HIRURGIJU, MEDICINSKI FAKULTET, NIŠ,
SRBIJA, SRBIJA I CRNA GORA

¹ CLINIC OF STOMATOLOGY – DEP. OF PERIODONTOLGY AND ORAL DISEASE,

² CLINIC OF STOMATOLOGY – DEP. OF ORAL SURGERY, MEDICAL FACULTY,
NIŠ, SERBIA, SERBIA AND MONTENEGRO

Kratak sadržaj

Terapija laserom poseduje mnogobrojne pozitivne biološke efekte: stimuliše ćelijski rast, ima antiinflamatorni, antiedematozni i analgetski efekat. Zahvaljujući svom analgetskom efektu oni nalaze primenu u terapiji bolnih stanja, pa i u terapiji hipersenzitivnog dentina.

Cilj ove studije je da ispita efikasnost NEL-a u terapiji hipersenzitivnog dentina.

Materijal i metode: U ovom istraživanju učestvovalo je 50 pacijenata. 25 pacijenata (I grupa) je tretirano medikamentom za impregnaciju dentina, a preostalih 25 pacijenata (II grupa) je podvrgnuto dejstvu laseroterapije. Protokol laseroterapije je bio: HeNe laser (Scorpión 25mW, Sofija, Bugarska) snaga 6mW; frekfencija 700Hz; trajanje aplikacije 4 minuta/dnevno; 4 uzastopna dana. Dentin je impregniran pastom Emoform Actisens (Byk Gulden, Nemačka), svaki dan 4 uzastopna dana. Od početka terapije meren je intenzitet bola kod svakog pacijenta uz pomoć vizuelnoj analogne skale.

Rezultati: Efikasnost laseroterapije bila je veća u odnosu na terapiju impregnacijom dentina. U grupi I našli smo sledeće rezultate: nakon prve aplikacije izmerena je srednja vrednost bola 48,40 a nakon druge 38,80. Posle treće aplikacije 88% pacijenta je bilo zadovoljno postignutim rezultatima. Tri pacijenta nisu uočila smanjenje bola nakon 4 aplikacije. U grupi II našli smo sledeće rezultate: nakon prve aplikacije izmerena je srednja vrednost bola 36,40 a nakon druge 18,40. Jedan pacijent nije imao poboljšanje stanja ni nakon četvrte terapeutiske procedure. Pozitivni terapeutiski rezultati uočeni su kod 96% pacijenata podvrgnutih dejstvu NEL-a.

Zaključak: Na osnovu izloženih rezultata možemo zaključiti da se NEL pokazao efikasnim u terapiji hipersenzitivnog dentina. Prema tome, preporučujemo terapiju NEL-om kao efikasnu terapeutsku proceduru u lečenju hipersenzitivnog dentina.

Ključne reči: hipersenzitivni dentin, NEL, HeNe laser, vizuelno-analogna skala

Abstract

Laser therapy has numerous positive biological effects. It stimulates cell growth, has an antiinflamative, antiedemous and analgesic effect. Because of analgesic effect, laser therapy is used in the treatment of painful conditions, and can be applied in the treatment of hypersensitive dentine.

The aim of this study is to establish the efficiency of LLLT in treatment of hypersensitive dentine.

Material and methods: 50 patients participated in this research. 25 patients (I group) were treated medicaments for dentine impregnation, and the rest of 25 patients (II group) were treated with beneficial effects of laser therapy. Protocol for laser therapy was: HeNe laser (Scorpión 25mW, Sofia, Bulgaria) power of 0.6mW; duration of each laser application 4 minutes/per day; frequency of 700 Hz; 4 applications. Dentine was impregnated by the application of the paste Emoform Actisens (Byk Gulden, Germany), every day during the period of 4 days. From the beginning of the treatment, the pain was measured in each patient's case by the use of Visual Analog Pain Scale (VAS) Test.

Results: The results showed greater efficiency of laser therapy than dentine-impregnation techniques. In the I group we have found the following results: after the first application of the paste average pain score showed the value 48,40 and after the second application it was 38,80. After the third application 88% patients were satisfied with achieved results. Three patients had no improvement of sensations not even after 4 treatments. In the II group we have found the following results: after the first laser treatment average pain score showed the value 36,40 and after the second application it was 18,40. One patient had no improvement nor after the fourth treatment. The positive therapeutic results were observed in 96% patients who were treated with LLLT.

Conclusion: On the base of present results we can conclude that LLLT has shown its efficiency in therapy of hypersensitive dentine. Therefore, we recommend soft laser therapy as an efficient therapy method in the treatment of hypersensitive dentine.

Key words: dentine hypersensitivity, LLLT, HeNe laser, Visual Analog Scale Test

Uvod

Hipersenzitivni dentin česta je pojava u stomatološkoj praksi.¹ To je patološko stanje kod kojeg je eksponirani dentin vitalnog zuba osetljiv na mehaničke, osmotske, hemijske ili termičke nadražaje.^{2,3} Naučna istraživanja hipersenzitivnog dentina datiraju još iz 1860-ih godina, međutim odgovarajuća terapija još uvek nije otkrivena, pa razumevanje i tretman hipersenzitivnih zuba predstavlja problem kako za pacijente tako i za stomatologe. Ekspozicija dentina može biti posledica gubitka gleđi usled dejstva okluzionih sila, parafunkcija ili erozija izazvanih kiselom ishranom. Sa druge strane, gingivalna recesija, parodontopatija ili neadekvatno pranje zuba tvrdom četkicom može izazvati ogoljavanje korena zuba i izazvati gubitak tankog cementnog sloja (prosečne debljine 20–50Fm).⁴⁻⁶ U svim ovim situacijama ogoljeno dentinsko tkivo osetljivo je usled nadražaja eksponiranih odontoblastičnih produžetaka. Nadražajem dolazi do pomeranja dentinskog fluida unutar dentinskih kanalića prema unutra i upolje čime dolazi do nadražaja nervnih završetaka na pulpo-dentinskom međuspoju i javlja se bol⁷ (hidrodinamska teorija Brännströma koja je i najprihvatljivije objašnjenje mehanizma nastanka hipersenzitivnog dentina). Bol je kratkotrajan i oštar.⁸⁻¹⁰

Do sada se u terapiji hipersenzitivnog dentina pokušalo sa primenom različitih medikamenata, ali uspeh je bio diskutabilan. Najčešće korišćena sredstva mogu se podeliti u tri glavne grupe: antiinflamatorna sredstva; sredstva koja promovišu parcijalno ili totalno zatvaranje dentinskih kanalića i sredstva koja imaju efekat na depolarizaciju nervnih završetaka.¹¹ Najčešće korišćena sredstva koja izazivaju parcijalno ili totalno zatvaranje dentinskih kanalića su oksalati^{10,11}, formule sa Na jonima ili abrazivne zubne paste. Ova sredstva deluju na izloženu senzitivnu zonu tako što smanjuju broj otvorenih dentinskih kanalića ili njihov prečnik. Posledica ovih zbivanja je minimalno kretanje dentinske tečnosti. Direktna posledica je smanjenje bolne simptomatologije.¹¹

Ipak, terapeutski efekti su kratkotrajnog veka, jer rastvori za ispiranje usta i paste za premazivanje zuba imaju terapeutsko dejstvo čiji se efekat povećava sa povećanjem vremena njihovog dejstva.¹² Međutim, ova sredstva se

Introduction

Tooth hypersensitivity is very frequent condition in everyday practice.¹ It has been defined as the state at which the exposed dentin of a vital tooth is responsive to mechanical, chemical, and thermal stimuli.^{2,3} Scientific investigations of hypersensitive dentine began in the 1860s but an appropriate treatment has not been found, the understanding and treatment of hypersensitive dentine still represent problem for patients, as well as for dentist. The dentin exposure can result from loss of enamel by attrition from occlusal wear, parafunctional habits or erosion from acidic diet. On the other hand, gingival recession, periodontal disease and also improper tooth brushing can expose root surfaces and the thin recovering cement layer (with approximately 20–50Fm) is easily lost.⁴⁻⁶ In all these situations, the underlying sensitive dentinal tissue – containing numerous tubules with the odontoblast processes - is exposed to a great sort of external sources of irritation. This various stimuli displace the fluid in dentinal tubules toward the in- and outside, activating the nerve endings at the pulp-dentin interface and causing pain⁷ (the hydrodynamic theory by Brännström, which is the most widely accepted). The pain is short and sharp.⁸⁻¹⁰

So far, many substances have been tried with discutable success in the treatment of hypersensitive dentine. The most commonly used products may be assigned to three main groups: the antiinflammatory, the therapeutic tubule occlusive agents and those with effect on the depolarisation of nerve endings¹¹ the products which promote partial or total closure of dentinal tubules, such as oxalates^{10,11}, formulations containing potassium ions or abrasive dentifrices. These agents interfere with the hydrodynamic mechanism, as they act on the exposed sensitive area so as to reduce the number of open dentinal tubules or decrease their diameter thereby minimizing the movement of dentinal fluid. The direct results is the relief of painful symptomatology.¹¹

However, the attempt to provide tubule closure or narrowing is relatively short-lived because the varnish and the paste have a gradual therapeutic action (progressive in time).¹² They can be easily removed during tooth brushing, before its desensitizing effect may be achieved.¹³

mogu odstraniti intenzivnim pranjem zuba tvrđom četkicom i pre nego što ostvare svoj desenzibilizući efekat.¹³

Otkriće lasera predstavlja novu terapeutsku mogućnost lečenja dentinskog hipersenzitiviteta.¹⁴ Iako mehanizam dejstva niskoenergetskega lasera (NEL-a) nije u potpunosti razjašnjen, smatra se da se apsorbovana energija lasera transformiše u fotohemiske, fototermičke, photomehaničke i fotoelektrične efekte, posebno u kompromitovanim ćelijama i tkivima.¹⁵ Na ovaj način laseri ostvaruju biostimulativni (stimulišu cirkulaciju, ćelijski metabolizam), antiinflamatorni, antiedematozni i analgetički efekat.¹⁶ Zahvaljujući ovom analgetičkom efektu, laseri se primenjuju u terapiji mnogobrojnih bolnih stanja, pa i u terapiji hipersenzitivnog dentina.^{17,18} Smatra se da terapija NEL-om stimuliše nervne ćelije i utiče na polaritet njihove ćelijske membrane tako što povećava amplitudu akcionog potencijala ćelijske membrane, i na ovaj način blokira prenošenje bolnog stimulusa u hipersenzitivnom dentinu.¹⁹ Smatra se da laseri ostvaruju analgetski efekat depresijom prenošenja signala kod nervnih ćelija.²⁰ Takođe, biostimulativno dejstvo lasera povećava fiziološku aktivnost tkiva i ovim putem stimuliše ozdravljenje i umanjuje bol. Nama dostupnoj literaturi nailazimo na različita mišljenja, jer neki autori ističu ovaj efekat, ali ga drugi u potpunosti poriču.²¹

The advent of dental lasers has raised another possible treatment option for dentine hypersensitivity.¹⁴ Although the mechanism of low level laser therapy (LLLT) is not completely known, it is believed that the energy absorbed from the photons is transformed into photochemical, photothermal, photomechanical, and photoelectric effects, especially in compromised cells and tissues.¹⁵ In this way lasers have biostimulative (they stimulate circulation and cell metabolism), antiinflamative, antiedemous and analgesic effects.¹⁶ Because of laser's analgesic effect, laser therapy is used in the treatment of many painful conditions, and it can be applied in the treatment of hypersensitive dentine.^{17,18} It is believed that LLLT stimulate nerve cells, interfering with the polarity of cell membranes by increasing the amplitude of the action potentials of cellular membranes, thus blocking the transmission of pain stimuli in hypersensitive dentine.¹⁹ It seems that the low output lasers mediate analgesic effects due to depressed nerve transmission.²⁰ In addition to analgesic effect, biostimulation induced by low-level lasers increases the physiologic activity of tissues, thus enhancing healing processes and minimizing pain. In literature there could be found adverse opinions; some authors emphasize this effect, but the others completely deny it.²¹

The aim of the study

The aim of this study is to establish the efficiency of LLLT in therapy of hypersensitive dentine.

Cilj rada

Cilj ovog istraživanja je utvrditi efikasnost NEL-a u terapiji hipersenzitivnog dentina.

Materijal i metod rada

U ovom istraživanju učestvovalo je 50 pacijenata sa Klinike za stomatologiju u Nišu. Svi pacijenti su se javili u kliniku zbog tegoba uzrokovanih hipersenzitivnim dentinom. Ispitanici su bili starosti od 17 do 57 godina.

Pacijenti su nasumice podeljeni u dve grupe. U svakoj grupi je bilo po 25 pacijenata. Prva grupa (I) je bila kontrolna. Pacijenti su tretirani

Fifty patients of the Dental Clinic participated in this research. All patients came to clinic because of pain caused by hypersensitive dentine. The group of participants included 50 patients, aged in range of 17 to 57.

Patients were randomized into two groups. In each group there were 25 patients. The first group (I) was the control one. Participants were treated with medicament for dentine impregna-

medikamentom za impregnaciju dentina – pastom Emoform Actisens (Byk Gulden, Nemačka). Dentin je impregniran svaki dan, za vreme perioda od 4 dana (prema preporuci proizvođača), na sledeći način: posle sušenja hipersenzitivnog dentina, vaticom natopljenom u navedenu pastu premazivan je hipersenzitivni dentin. Posle jednog minuta pacijent je mogao da zatvori usta.

Druga grupa (II) je bila studijska. Pacijenti ove grupe podvrgnuti su dejstvu HeNe soft lasera (Scorpion 25mW, Sofija, Bugarska). Protokol terapije laserom bio je sledeći: snaga 6mW; trajanje svake aplikacije 4 minuta; frekfencija 700 Hz; svaki dan, za vreme perioda od 4 dana.

Od početka terapije, praćen je i meren intenzitet bola kod svakog pacijenta uz pomoć Vizuelno-analogne skale za bol. Primenjena je sledeća procedura: pacijenti su upoznati sa karakteristikama Vizuelno-analogne skale (VAS) od 100 mm, i od njih zatraženo je da svakog dana "izmere" jačinu bola koji osećaju:

100mm
0 = stanje bez bola 100 = najjači bol

Nula je predstavljala stanje bez bola, a vrednost 100 najjači bol. Okvirna vrednost bola dobijena je merenjem milimetarskog rastojanja od nulte tačke do određene bolne tačke. Upo-ređivane su prosečne srednje dnevne vrednosti pretrpljenog bola koje su brojčano određene uz pomoć VAS. Rezultati su statistički obrađeni. Korišćen je t test i srednja vrednost.

Rezultati

U ovom ispitivanju učestvovalo je 50 pacijenata (23 muškog i 27 ženskog pola) starosti od 17 do 57 godina (tabela 1, grafikon 1).

Tabela 1. Starosna struktura pacijenata / Table 1. Patients structure by the age

Uzrast (god) / Age (year)	n	(%)
17-20	8	16,00%
21-30	10	20,00%
31-40	17	34,00%
41-50	15	20,00%
Ukupno / Total	50	100,00%

tion – paste Emoform Actisens (Byk Gulden, Germany). Dentine was impregnated every day, during the period of 4 days (by the propositions of factory).

The second group (II) was the experimental one. Patients were submitted to low power HeNe laser irradiation (Scorpion 25mW, Sofia, Bulgaria). Protocol for laser therapy: HeNe laser Scorpion 25mW, the power of 6mW; frequency of 700 Hz, duration of each laser seance 4 minutes every day, during the period of 4 days.

From the beginning of treatment, the pain was overlooked and measured in each patient's case by the use of Visual Analog Scale (VAS) Test. The following procedure was applied: patients were introduced with a continuous Visual Analog Scale (VAS) Test of 100 mm, and were asked to "measure" the pain severity as perceived by them each day:

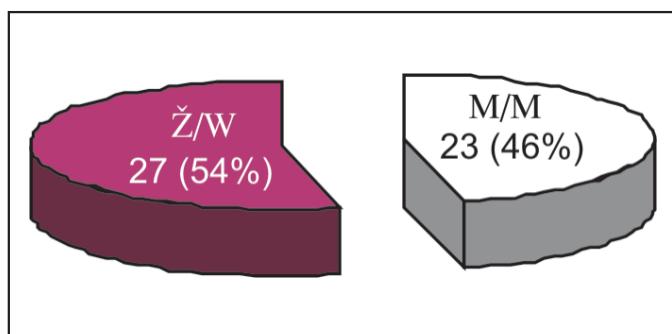
100mm
0 = no pain a 100 = greatest pain

Zero presented no pain and 100 the most severe pain. The approximate intensity of pain was obtained by measuring the millimeter distance from the zero mark to the indicated point. Daily mean values of experienced pain scored on the VAS were compared. We used t test and mean value for statistical analysis.

Results

Out of 50 patients 23 were male and 27 female, aged 17 to 57 (table 1, graph 1).

In the first group (I) participants (25) were treated with medicament for dentine impregnation, and we have found the following results:



Grafikon 1. Polna struktura pacijenata
Graph 1. Patients structure by the sex

U prvoj grupi (I) u kojoj su ispitanici (25) tretirani sredstvom za impregnaciju dentina uočeni su sledeći rezultati: nakon prve aplikacije medikamentne paste uz pomoć VAS izmerena srednja vrednost bola imala je vrednost 48,40 a nakon druge 38,80. Nakon treće aplikacije 22 pacijenta (88%) je bilo zadovoljno rezultatima terapije. Tri pacijenta (13%) nije uočilo smanjenje bolnih simptoma niti nakon 4 aplikacije.

U drugoj grupi (II) u kojoj su ispitanici (25) podvrgnuti dejству NEL-a dobili smo sledeće rezultate: nakon prve aplikacije laseroterapije izmerena srednja vrednost bola imala je vrednost 36,40 a nakon druge 18,40. Jedan pacijent (4%) nije uočio poboljšanje stanja ni nakon četvrte aplikacije (slika 1, 2).



Slika 1. Gingivalna recessija sa izraženim hipersenzitivnim dentinom
Figure 1. Gingival recession with distinguished hypersensitive dentine

Pozitivni terapijski rezultati su uočeni kod 96% pacijenata koji su podvrgnuti dejству niskoenergetskog lasera. Rezultati su pokazali veću efikasnost terapije laserom u odnosu na terapeutsku proceduru aplikacije paste za impregnaciju dentina, odnosno niže vrednosti jačine bola svakog pojedinačnog dana i brže smanjenje intenziteta bola kod grupe podvrgnute dejству lasera (grafikon 2, tabela 2).

after the first application of the medicament paste average pain score showed the value 48,40 and after the second application it was 38,80. After the third application 22 patients (88%) were satisfied with the results of treatment. Three patients (13%) had no improvement of sensations not even after 4 treatments.

In the second group (II) participants (25) were treated with LLLT, and we have found the following results: after the first laser treatment average pain score showed the value 36,40 and after the second laser application it was 18,40. One patient (4%) had no improvement nor after the fourth treatment (Figures 1, 2).

The positive therapeutic results were observed in 96% patients who were treated with



Slika 2. Laseroterapija hipersenzitivnog dentina
Figure 2. Laser therapy of hypersensitive dentine

LLL therapy. This treatment method showed greater efficiency than the standard therapy methods which apply dentine – impregnation pastes. Each day, there were lower daily mean values of experienced pain and faster decrease of pain intensity. (Graph 2, Table 2).

After the forth treatment with the LLLT we found statistical significance $p<0,001$ in accordance to the group with impregnation of dentine (Table 2).

Grafikon 2. Srednje vrednosti bola izmerenog uz pomoć VAS u toku terapije
Graph 2. Average pain scores measured by VAS during the therapy

Graph 2. Average pain scores measured by VAS during the therapy

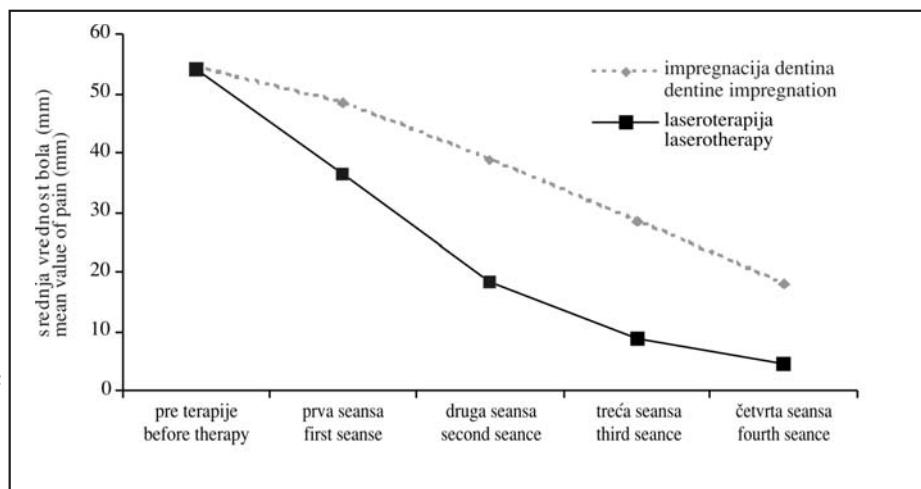


Tabela 2. Srednje vrednosti bola izmerene uz pomoć VAS (mm) u toku terapije
Table 2. Average pain scores measured by VAS (mm) during the therapy

	impregnacija dentina/ dentine impregnation	laseroterapija/ laserotherapy	p
pre terapije / before therapy	$54,40 \pm 11,81$	$54,00 \pm 11,42$	n.s.
prva seansa / first seance	$48,40 \pm 10,58$	$36,40 \pm 10,83$	<0,001
druga seansa / second seance	$38,84 \pm 12,23$	$18,40 \pm 11,58$	<0,001
treća seansa / third seance	$28,40 \pm 13,93$	$8,80 \pm 10,26$	<0,001
četvrta seansa / fourth seance	$18,00 \pm 16,07$	$4,40 \pm 9,73$	<0,001
ukupno (prosek) / total (mean value)	$37,61 \pm 12,13$	$24,40 \pm 8,86$	<0,001

Posle četvrte seanse grupa pacijenata kod koje je korišćen NEL pokazala je statistički značajnu razliku $p<0,001$ u odnosu na grupu kod koje je rađena impregnacija dentina (tabela 2).

Diskusija

Hipersenzitivni dentin često se sreće u stomatološkoj praksi.²² Naučno istraživanje ovog problema započeto je još davnih 1860-ih godina. Međutim, pošto nije otkrivena efikasna terapeutska procedura, razumevanje i terapija hipersenzitivnog dentina predstavlja i dalje problem kako za pacijenta, tako i za terapeutu.² Još su davne 1935. godine postavljeni visoki standardi koje terapija hipersenzitivnog dentina treba da ispunjava: ona ne sme iritirati pulpu; ne sme prebojavati zube; treba biti relativno bezbolna; jednostavna za izvođenje; brzog dejstva i efikasna kroz duži vremenski period. Do danas, većina terapijskih procedura nije uspela da zadovolji jedan ili više od ovih kriterijuma. Smatra se da su NEL najbliži ispunjenju ovih visokih standarda.²³

Discussion

Tooth hypersensitivity is very frequent condition in everyday practice.²² Scientific research of this problem began in the 1860s but, because an appropriate and predictive treatment has not been found, the understanding and treatment of hypersensitive dentine still represents problems for patients and dentists.² In early 1935, a number of requirements for treatment of tooth hypersensitivity have been claimed: therapy should be non-irritant to the pulp; without staining effects; relatively painless on application; easily carried out; rapid in action and effective for a long period. To date, most of therapies have failed to satisfy one or more of these criteria. LLLT are thought to be the closest to satisfy these high criteria.²³

Scientists claim that HeNe soft laser therapy has no adverse effects.²⁴ It is painful, non-invasive technique which does not affect the enamel or dentine surface morphologically,

Naučnici smatraju da je terapija HeNe soft laserima nema sporedne efekate.²⁴ Ona je bezbolna, neinvazivna tehnika koja ne utiče na morfologiju gledi ili dentina, dok stimuliše fiziološki potencijal pulpnog tkiva.^{15,19,20,25} Kod upotrebe lasera male snage ne postoji opasnost od izazivanja opeketina ili oštećenja ćelija, što je prednost ovih lasera u odnosu na visokoenergetski laser (VEL) koji se takođe koriste u terapiji hipersenzitivnog dentina.²⁴⁻³³

Postignuti analgetički efekat nakon aplikacije lasera nije u potpunosti razjašnjen. Nama dostupnoj literaturi postoji nekoliko aktuelnih stanovišta. Smatra se da laserska svetlost ima uticaja na prostaglandine, periferne receptore za bol i na stabilizaciju ćelijskih membrana. Prostaglandini pripadaju grupi najznačajnijih hiperalgezičnih medijatora u zapaljenjskim reakcijama. Lasersko zračenje stimuliše formiranje β -endorfina i blokira funkciju prostaglandina. Anti-inflamatorni mehanizam laserskog zračenja se takođe povezuje sa stabilizacijom ćelijskih membrana, posebno ćelijskih membrana mastocita. Serotonin (5-hidroksitriptamin), jedan od medijatora inflamacije izaziva stvaranje histamina u mastocitima. Na ovaj način, stabilizacijom membrana mastocita sprečava se oslobođanje histamina u toku inflamacije, a samim tim i pojava bola.³⁴ Prema fiziološkim eksperimentima, zračenje HeNe laserom utiče na električnu aktivnost ćelija (akcioni potencijal ćelija).³⁵ Smatra se da je ovo uzrok dugotrajnog efekta laserskog zračenja, koji uzrokuje povećanje veličine akcionog potencijala ćelija u vremenu dužem od osam meseci nakon lasiranja.³⁶

Nama dostupnoj literaturi nailazimo na postojanje razlika u efikasnosti laseroterapije. Ove razlike mogu se objasniti korišćenjem različitih vrsta lasera i različitih protokola terapije (odabir pacijenata, postupak istraživanja, placebo efekat, različite primenjene metode za procenu dentinskog bola). Treba istaći da je bol subjektivni osećaj i da ga je teško objektivno izmeriti što delimično objašnjava kontradiktorne rezultate u literaturi. Ipak, u većini dostupnih literaturnih podataka uočeno je smanjenje intenziteta bola nakon terapije NEL-om. Kod terapije HeNe laserom smanjenje bola je bilo u rasponu od 5.2% do 100%, 1, 9 a to je u skladu sa rezultatima ovog rada.

Očigledno je da su još uvek nerazjašnjeni mnogi aspekti laseroterapije hipersenzitivnog

while stimulates physiological potential of pulp tissue.^{15,19,20,25} With low output power lasers, there is no danger of causing burns or damaging cells. This is the advantage of these lasers over the high energy lasers which are used in therapy of hypersensitive dentin.²⁴⁻³³

Achieved analgesic effect after laser treatment is not completely explained. In current available literature there are some actual viewpoints. It is thought that lasers have beneficial effect on prostaglandins, peripheral pain receptors and stabilization of cell membranes. Prostaglandins belong to group of the most important hyperalgesic mediators in inflammatory reactions. Laser beam stimulates forming of β -endorphin and blocks functions of prostaglandins. Anti-inflammatory mechanism is also connected with stabilization of cell membranes, especially cell membranes of mast cells. Serotonin (5-hydroxytryptamine) is one of the inflammatory mediators which cause production of histamine in mast cells. In this way, through the stabilization of cell membranes lasers prevent release of histamine during inflammation and prevent pain.³⁴ According to physiological experiments, HeNe laser irradiation affects cell electric activity (action potential).³⁵ This was found to be a long-lasting effect, inducing an increase in the size of nerves action potential for more than eight months after cessation of irradiation.³⁶

In current available literature there are differences in the effectiveness between laser treatments. They can be explained by diverse types of laser and irradiation parameters applied (patient selection, different study designs, the placebo effect, various evaluation methods used to assess dentinal pain). Since dentin hypersensitivity per se is a subjective condition, it is rather difficult to objectively assess symptoms, which partly accounts for the contradictory results found in the literature. However, most studies have reported decrease of pain after LLLT. Positive outcomes after HeNe laser irradiation was in the range from 5.2% to 100%, 1, 9 and these results were confirmed in our study.

It is obvious that many aspects regarding laser therapy for hypersensitive dentin are still not clear. Further investigations are necessary to clearly determine the effectiveness of laser in reducing pain and to determine the duration of

dentina. Neophodna su dalja ispitivanja kako bi se precizno odredio stepen efikasnosti lasera u smanjenju bola i trajnost postignutih rezultata.^{9,24} Takođe, veliki stimulans daljem unapređenju ove tehnike pruža i činjenica da sve veći broj autora ističe pored povećane efikasnosti i ekonomičnost terapije NEL-om u odnosu na terapiju hipersenzitivnog dentina uz pomoć sredstava za impregnaciju dentina.

Zaključak

Na osnovu izloženih rezultata možemo zaključiti da je NEL pokazao veliku efikasnost u terapiji hipersenzitivnog dentina. Pozitivni terapeutski rezultati uočeni su kod 96% pacijenata koji su podvrgnuti dejstvu NEL-a. Prema tome, terapiju NEL-om preporučujemo kao efikasnu terapeutsku proceduru u lečenju hipersenzitivnog dentina.

results.^{9,24} Many investigators point out the efficiency and economical advantage of LLL in dentin hypersensitivity treatment comparing with other treatment methods. This gives great stimulus to further development of this technique.

Conclusion

On the base of present results we can conclude that LLLT has shown its efficiency in therapy of hypersensitive dentine. The positive therapeutic results were observed in 96% patients who were treated with LLLT. Therefore, we recommend LLLT as an efficient therapy method in the treatment of hypersensitive dentine.

LITERATURA / REFERENCES

1. Benetti AR, Franco EB, Franco EJ, Pereira JC. "Laser Therapy for Dentin Hypersensitivity: A Critical Appraisal" *JOLA* 2004;4:271–278.
2. Addy M, Mostafa P, Absi EG, Adams D. Crevical dentin hypersensitivity. Etiology and management with particular reference to dentifrices. In: N. H. Rowe, ed. *Proceedings of Symposium on Hypersensitive Dentin. Origin and Management*, University of Michigan, 1985: 43–64.
3. Holland GR, Narhi MN, Addy M, Gangarosa L, Orchardson R. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. *J Clin Periodontol* 1997; 24: 808–813.
4. Brännström M, Linden LA, Astrom A. The hydrodynamics of dentine and pulp fluid: its significance in relation to dental pain. *Caries Research* 1967;1:310.
5. Schuurs AHB, Wesswlink PR, Eijkman MAJ, Duivenvoorden HJ. Dentists' views on cervical hypersensitivity and their knowledge of its treatment. *Endodontics & Dental Traumatology* 1995;11:240-244
6. Renton - Harper P, Midda M. Nd:YAG laser treatment of dental hypersensitivity. *Br Dent J* 1992; 172: 13–16.
7. Branstrom M, Linden LA, Astrom A. The hydrodynamics of the dental tubule and of pulp fluid: a discussion of its significance in relation to dentinal sensitivity. *Caries Res* 1967;1:310–317.
8. Brannstrom M. Etiology of dentin hypersensitivity. *Proceedings of the Finnish Dental Society* 1992;88 (Suppl.1): 7–13.
9. Kimura Y, Wilder-Smith P, Matsumoto K. Treatment of dentine hypersensitivity by lasers: a review. *J Clin Periodontol* 2000;27: 715–722.
10. Wichgers TG, Emert RL. Dentin hypersensitivity. *General Dentistry* 1996;44: 225.
11. Gedalia I, Brayer L, Kalter N, Richter M, Stabholz A. The effect of fluoride and strontium application on dentine: in vivo and in vitro studies. *J Periodontol* 1978; 49: 269–272.
12. Goodis HE, White JM, Marshall Jr GW, Yee K, Fuller N, Gee L, Marshall SJ. Effects of Nd: and Ho: Yttrium-Aluminium-Garnet lasers on human dentine fluid flow and dental pulp chamber temperature in vitro. *Arch Oral Biol* 1997;42:845–854.
13. Lan WH, Liu HC, Lin CP. The combined occluding effect of sodium fluoride varnish and Nd:YAG laser irradiation on human dentinal tubules. *Journal of Endodontics* 1999;25: 424.
14. Moritz A, Gutknecht N, Schoop U, Goharkhay K, Ebrahim D, Wernisch J et al. The advantage of CO₂ treated dental necks, in comparison with a standard method: results of an in vivo study. *J Clin Laser Med Surg* 1996; 14: 27–32.

15. Miserendino LJ, Levy G, Miserendino CA. Laser interaction with biological tissues. In: Miserendino LJ, Pick RM. Lasers in Dentistry. Chicago: Quintessence, 1995:39–56.
16. Gerschman JA, Ruben J, Gebart-Eaglemont J. Low-level laser therapy for dentinal tooth hypersensitivity. Australian Dental Journal 1994;39: 353.
17. Cernavin I, Pugatschew A, Boer N, Tyas MJ. Laser applications in dentistry: A review of the literature. Australian Dent J 1994; 39: 28–32.
18. Meste E. The biomedical effects of laser application. Lasers in Surgery and Medicine 1985; 5: 31–39.
19. Gilliam DG, Mordan NJ, Newman HN. The dentin disc surface: a plausible model for dentin physiology and dentin sensitivity evaluation. Adv Dent Res 1997;11:487–501.
20. Zang C, Matsumoto K, Kimura Y, Harashima T, Takeda HT, Zhou H. Effects of CO₂ laser in treatment of crevical dentinal hypersensitivity. J Endod 1998; 24: 595–597.
21. Cekic-Arambasin A, Đurđević-Maćic A, Mravak-Stipetić M, Bilic A. "The efficiency of low power laser in treatment of oral symptoms". Acta Stomatol Croatica 1990; 24: 281–288.
22. Flynn J, Galloway R, Orchardson R. The incidence of hypersensitive teeth in the West of Scotland. Journal of Dentistry 1985;13: 230–236.
23. Grossman LI. Asysthetic method for the treatment of hypersensitive dentin. JADA 1935;22: 592–602.
24. Gerschman JA, Ruben J, Gerbart-Eaglemont J. Low level laser therapy for dentinal tooth hypersensitivity. Am Dent J 1994;39:353–357.
25. Watanabe H. A study of He-Ne laser transmission through the enamel and dentine. Journal of Japanese Society for Laser Dentistry 1993;4: 53–62.
26. Senda A, Gomi A, Tani T, Yoshino H, Narita T, Hasegawa J. A clinical study on "Soft Laser 632", a HeNe low energy medical laser. Aichi-Gakuin Journal of Dental Science 1985;23:773–780.
27. Midda M. The use of lasers in periodontology Curr Opin Dent 1992; 2: 104–108.
28. Position Paper. Lasers in periodontics J Periodontol 1996; 67: 826–830.
29. Strang R, Moseley H, Carmichael A. Soft lasers-Have they a place in dentistry? Br Dent Journal 1988;165: 221–225.
30. Kimura Y, Wilder-Smith P, Yonaga K, Matsumoto K. Treatment of dentine hypersensitivity by lasers: a review. J Clin Periodontol 2000;715–721.
31. Lier BB, Rosing CK, Aass AM, Gjermo P. Treatment of dentin hypersensitivity by Nd:YAG laser. J Clin Periodontol 2002;29:501–506.
32. Corona SAM, DoNaschimento TN, Catrise ABE, Lizarelli RFZ, Dinelli W, Palma-Dibb R.G. Clinical evaluation of low-level laser therapy and fluoride varnish for treating cervical dentin hypersensitivity. Journal of Oral Rehabilitation 2003;30:1183–1189.
33. Schwarz F, Arweiler N, Georg T, Reich E. Desensitizing effects of an Er:YAG laser on hypersensitive dentine. A controlled, prospective clinical study. J Clin Periodontol 2002;29:211–215.
34. Cooper S. Treating acute pain:do's and dont's, pros and cons. J Endod 1990; 16: 85–91.
35. Jarvis D, Bruce MacIver M, Tanelian DL. Electrophysiologic recording and thermodynamic modeling demonstrate that helium-neon laser irradiation does not affect peripheral A^α- or C-fiber nociceptors. Pain 1990;43: 235–242.
36. Rochkind S, Nissan M, Razon N, Schwartz M, Bartal A. Response of peripheral nerve to He-Ne laser: experimental studies. Lasers in Surgery and Medicine 1987;7: 441–443.

Adresa za korespondenciju:

dr Radmila Živković
Bulevar Nikole Tesle 45/19
18000 Niš, Srbija, Srbija i Crna Gora
br.tel.: 064/2359595; 018/589285

Address for correspondence:

Radmila Živković, D.D.S.
45/19 Bvld Nikole Tesle
18000 Niš, Serbia, Srbija and Montenegro
phone numb.: 064/2359595; 018/589285

E-mail address: rada@firma.co.yu