

CLINICAL EFFECTS OF FIDELIS III ND:YAG LASER IN PERIODONTAL DISEASE TREATMENT

КЛИНИЧКИ ЕФЕКТИ НА FIDELIS III ND: YAG ЛАСЕРОТ ВО ТРЕТМАН НА ПАРОДОНТАЛНАТА БОЛЕСТ

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Abstract

Experimental studies show that the achieved therapeutic results in patients with clinical manifestation of periodontal disease where laser treatment is used along with standard conventional therapy are significantly better. **Purpose:** The purpose of this study is to see the effect of FIDELIS III ND:YAG LASER optic fiber through clinical studies as an additional therapeutic method to the conventional periodontal procedure and their comparison. **Material and method:** The study included 15 patients of both sexes, aged 28 - 74 years, with diagnosed periodontal disease with at least 18-20 remaining teeth, and at least 2 periodontal pockets with a depth ≥ 5 mm in different quadrants. The clinical studies included: Determining the degree of gingival inflammation through the Loe & Sillnes index, Assessment of periodontal pocket bleeding through Loe & Sillnes bleeding index, Average depth of periodontal pockets (PPD), Determining the level of clinical loss of the periodontal attachment. All clinical studies, as well as the comparison of the conventional and laser treatment of all patient participating in this study was realized at the Clinic of Oral Diseases at the PHO Dental University Clinic and all of them were statistically analyzed. **Results:** After finishing the combined therapeutic procedure (conventional mechanic and laser periodontal treatment), the results showed significant improvement in the clinical manifestation of the chronic periodontal disease, significant reduction of bleeding and gingival inflammation. In comparison, the average depth of the periodontal pocket and the average attachment loss in the test and control teeth after finishing the combined therapeutic procedure show unaltered values. These results are explained by the need of a longer observation period in order to create new fibrose attachment. **Conclusion:** The use of FIDELIS III ND: YAG LASER as an additional therapeutic method to the conventional periodontal treatment reduces recidivism and maintains therapeutic results for a longer time period which allows an efficient quality and modern therapy of periodontal disease. **Key words:** periodontal disease, conventional therapy, laser therapy.

Апстракт

Експерименталните студии говорат дека кај пациентите со клиничка манифестна пародонтопатија кај кои покрај стандардната конвенционална терапија дополнително е користена и ласерска терапија, постигнатите терапевтски резултати се значително подобри. **Цел на трудот:** Целта на овој труд е преку клинички испитувања да се проследи ефектот на Fidelis III Nd: Yag ласерското оптичко влакно како дополнителна терапевтска метода на конвенционалната пародонтолошка процедура и да се компарира со истата. **Материјал и метод:** Во испитувањето беа вклучени 15 пациенти од обата пола на возраст од 28 - 74 години со дијагностицирана хронична пародонтална болест кои имаа најмалку 18 - 20 заби, и најмалку два пародонтални џеба со длабочина ≥ 5 мм во различни квадранти. Клиничките испитувања вклучија: Определување на степенот на гингивалната инфламација преку индексот на Loe & Sillnes, Проценка на присутното крварење на пародонталните џебови при сондирање, преку индексот на крварење по Loe & Sillnes, Проследување на просечна длабочина на пародонталните џебови (PPD), Определување на ниво на клинички губиток на пародонталниот припој. Сите клинички испитувања, како и споредувањето на конвенционалниот и ласерскиот третман на пациентите учесници во оваа студија се реализираше на Клиниката за Болести на уста и пародонтот при ЈЗУ Универзитетски Стоматолошки Клинички Центар и истите подлежат на статистичка обработка и анамнеза. **Резултати:** По спроведената комбинирана терапевтска процедура (конвенционален механички и ласерски пародонтален третман), резултатите покажаа значително подобрување на клиничката слика на хроничната пародонтална болест поточно значително намалување на крварењето и гингивалната инфламација. За разлика од ова, просечната длабочина на пародонталниот џеб и просечниот губиток на припој кај испитуваниот и контролен заб по спроведената комбинирана терапевтска процедура покажаа непроменети и исти вредности. Овие резултати ги појаснуваме со потребата од подолгорочен период на опсервација потребен за создавање на ново сврзоткивен атачмен. **Заклучок:** Примената на Fidelis III Nd: Yag ласерот како дополнителна терапевтска метода на конвенционалниот пародонтолошки третман ги намалува рецидивите и ги одржува терапевтските резултати подолг временски период со што овозможува ефикасна, квалитетна и современа терапија на пародонталната болест. **Клучни зборови:** пародонтална болест, конвенционална терапија, ласерска терапија.

Introduction

Continuous lack of oral care by the patient, such as week and inadequate oral hygiene resulting in increased plaque accumulation is the main reason for clinical manifestation of periodontal disease. The etiol-

ogy of this disease is of multicausal nature, but dental plaque is the most significant etiological factor, which represents a complex ecosystem where a large number of microorganisms exist. The treatment of periodontal disease significantly varies by the type of periodontal disease¹.

The dental plaque that isn't removed from the surface of the tooth for a longer time mineralizes with the help of inorganic materials from the saliva and develops into dental stone which later requires special therapeutic approach.

Mechanical removal of solid tooth plaque is done with the help of ultrasonic instruments, but they cannot completely remove the sub-gingival plaque and concretions in deep periodontal pockets^{2,3}.

Laser technology has been recently increasing in popularity^{4,5}. The versatility of laser technology is in the design, or in its use. There are caries removing lasers and soft tissue lasers which are used mainly because of their haemostatic properties. Their main goal is to replace manual instruments in treatment of sub-gingival surfaces and periodontal pockets^{6,7,8,9}.

Purpose of the study

Motivated by the desire to develop and improve the quality of periodontal disease treatment we decided to analyze the effects of the use of FIDELIS III ND: YAG LASER optic fiber as an additional therapeutic method to the conventional periodontal procedure and make a comparison between them through the clinical studies.

Material and method

The study included 15 patients of both sexes, aged 28 -74 years, with diagnosed periodontal disease with at least 18 - 20 remaining teeth, and at least 2 periodontal pockets with a depth ≥ 5 mm in different quadrants. The diagnosis was determined through clinical exam and x-ray.

The test group was comprised of patients who had conventional periodontal treatment (mechanical debridement) in combination with laser therapy. The control group was comprised of patients who were treated only with conventional periodontal treatment. The clinical studies included:

- Determining the degree of gingival inflammation through the Lóe & Sillnes index
- Assessment of periodontal pocket bleeding through the Lóe & Sillnes bleeding index
- Average depth of periodontal pockets (PPD)
- Determining the level of clinical loss of periodontal attachment

The protocol of the conventional periodontal treatment of chronic periodontal disease was conducted in several stages:

- Supra-gingival removal of all hard and soft plaque with the help of an ultrasound, a brush and an abrasive paste;

- Mechanical debridement of periodontal pockets conducted in several stages, with the use of specially designed Gracey curettes, deep rinse with local antiseptics and application of medicaments and a protective bandage as needed;
- At the end of treatment, patients were motivated to maintain oral hygiene.

The protocol of the laser treatment of periodontal pockets was conducted in the following way:

- The use of a laser optic fiber with thickness of 200 nm, with the power and frequency of the laser beam adjusted on a computer before the intervention (close curettage);
- The laser optic fiber was applied to the deepest point of the pocket, following the tooth axis, with circular movements around the tooth. The procedure was repeated so every periodontal pocket would be treated for at least 30 seconds during one treatment.
- The laser treatment was repeated in a subsequent session during the next two or three days. According to the recommended precautionary measures for working with lasers, all treated patients and doctors wore protective goggles.

The procedure of the periodontal treatments was explained to all patients and instructions for maintaining proper oral hygiene were given. The level of oral hygiene was followed through determining the Lóe & Sillnes plaque index. During this visit, the stage of conventional therapy was started, which includes supragingival removal of hard and soft plaque. At the next visit, the conventional treatment continued with mechanical curettage of the periodontal pockets during which two deepest periodontal pockets from different quadrants were chosen for further studies. One of them was additionally treated with a laser optic fiber after completing the traditional treatment. Three days after the laser treatments, the clinical parameters were measured again.

All clinical studies and both the conventional and the laser treatment were carried out at the Clinic of Oral Diseases at the PHO Dental University Clinic. The collected results were statistically analyzed and shown in a graph.

Results

The average Lóe & Sillnes gingival index in the test and control tooth (which is equal in both) before treatment is 2.2 ± 0.4 , i.e. 2 - moderate inflammation, with bleeding of probing.

The Lóe & Sillnes in the test and control tooth after treatment in average is 2.2 ± 0.4 , i.e. 0 - normal healthy gingival, without bleeding on probing (Table 1).

Table 1. Average value of Lóe & Sillnes gingival inflammation index before and after treatment

Gingival inflammation - Lóe & Sillnes	Number	Average	Minimum	Maximum	Standard deviation
Test tooth before treatment	15	2.2	2.0	3.0	0.414039
Test tooth after treatment	15	0.2	0.0	1.0	0.414039
Control tooth before treatment	15	2.2	2.0	3.0	0.414039
Control tooth after treatment	15	0.2	0.0	1.0	0.414039

	Status
0	Normal, healthy gingival
1	A slight change in color and contour, without bleeding of probing
2	Moderate inflammation, with bleeding of probing
3	Severe inflammation with signs of spontaneous bleeding

Table 2. Periodontal pocket bleeding on probing before and after treatment

Bleeding /tooth	Test tooth Before treatment		Test tooth After treatment		Control tooth Before Treatment		Control tooth After Treatment	
	No.	%	No.	%	No.	%	No.	%
No bleeding			12	80.0			12	80.0
1-minor bleeding on probing	1	6.7	3	20.0	1	6.7	3	20.0
2-moderate bleeding on probing	8	53.3			8	53.3		
3-spontaneous bleeding	6	40.0			6	40.0		
Total	15	100.0	15	100.0	15	100.0	15	100.0

Before the treatment, in both the test and the control tooth, the index of gingival inflammation was registered in 80% i.e. 2 - moderate inflammation, with bleeding of probing and index gingival inflammation in 20% i.e. 3 - Severe inflammation with signs of spontaneous bleeding (Table 1).

Before treatment bleeding was recorded on probing in most cases. After treatment bleeding wasn't recorded on probing – 80% (Table 2).

According to the index of bleeding dynamics from the periodontal pocket on probing 1-light bleeding on probing, an increase of 200% is registered before, between and after the treatment.

The average periodontal pocket depth in the test and control tooth before and after treatment is unchanged at 6.3 ± 0.6 mm, with the minimum at 5.0 mm, and the maximum at 7.0 mm (table 3).

From all measurements taken of the periodontal pocket depth before and after treatment, the depth of 6 mm is most common at 53.3% frequency, followed by depth 7 mm at 40% frequency.

Average clinical attachment loss in the test and control tooth (which is equal and unchanged) before and after treatment is 5.9 ± 1.8 mm, with the minimum at 2.0 mm, and the maximum at 8.0 mm (table 4).

From all measurements taken of the clinical attach-

Table 3. Average value of periodontal pocket depth before and after treatment

Gingival inflammation - Lóe & Sillnes	No.	Average	Minimum	Maximum	Standard deviation
Test tooth before treatment	15	6,3	5,0	7,0	0.617213
Test tooth after treatment	15	6,3	5,0	7,0	0.617213
Control tooth before treatment	15	6,3	5,0	7,0	0.617213
Control tooth after treatment	15	6,3	5,0	7,0	0.617213

Table 4. Average value of clinical attachment loss before and after treatment

Gingival inflammation - Lóe & Sillnes	No.	Average	Minimum	Maximum	Standard deviation
Test tooth before treatment	15	5,9	2,0	8,0	1.751190
Test tooth after treatment	15	5,9	2,0	8,0	1.751190
Control tooth before treatment	15	5,9	2,0	8,0	1.751190
Control tooth after treatment	15	5,9	2,0	8,0	1.751190

ment loss before and after treatment, the most common depth is 7.0 mm at 26.7% frequency, followed by depth of 5.0 mm and 8.0 mm at 20% frequency.

Discussion

The results in Table 1 and 2 show that there is a statistically significant reduction in the gingival inflammation index and bleeding index by Lóe & Sillnes for $p < 0,05$, in the test and control group during the first visit and three days after the last stage of the conservative and combined conservative - laser therapy. Gingival inflammation bleeding in the periodontal pockets was reduced more significantly in the test group.

These obtained results indicate that conservative periodontal treatment with the addition of laser therapy gives a significant improvement of the clinical manifestation of periodontal disease^{10,11,12}, by reducing the quantity of periodontogenic microorganisms responsible for the inflammatory gingival changes. These microorganisms produce enzymes and toxins that stimulate the destructive processes in the periodontal tissues. The results obtained regarding the periodontal pocket depth and the average attachment loss in the test and control group were equal and unchanged before and after the treatment (Table 3 and 4). These results do not concur with those of the referencing authors^{13,14,15}. The results we

obtained can be explained by the reduced re-colonization or re-colonization with less harmful bacteria in lasered pockets, and for that purpose long term studies are necessary for more relevant results of the administered laser therapy.

Conclusion

1. Close curettage of the periodontal pocket with the use of laser optic fiber of the Nd: YAG laser in combination with the conventional mechanical periodontal treatment improves the clinical manifestation of chronic periodontal disease. The significant reduction of bleeding and gingival inflammation confirms the anti - inflammatory and antibacterial effects of the laser.
2. After conducting the combined therapeutic procedure (conventional and laser treatment), the average depth of the periodontal pocket and the average attachment loss in the test and control tooth show unchanged values. These results can be explained by the need of a longer observation period which is necessary for creating a new fiber attachment and formation of a new periodontal attachment, as a result of the bio-stimulating potential of the laser assisted procedure.

3. The use of Nd:YAG laser as an additional therapeutic method to the conventional periodontal treatment reduces recidivism and maintains therapeutic results for a long time. This method has a great potential in antimicrobial control of more aggressive forms of periodontal disease with deep and narrow periodontal pockets.
4. With the use of high energy Fidelis III Nd:YAG laser, patients are offered an efficient, quality and modern therapy of periodontal disease. We hope that the use of this method as an addition to the conventional mechanical treatment of periodontal disease will become a part of everyday dental routine and practice.

Reference

1. Henry Schein. Periodontal Disease and Overall Health: A Clinician's Guide. 2010. USA
2. Maybel Maybel Lages Balata, Lyla Prates de Andrade, David Barros Nunes Santos, Andrea Nóbrega Cavalcanti, Urbino da Rocha Tunes, Érica Del Peloso Ribeiro, Sandro Bittencourt. Photodynamic therapy associated with full-mouth ultrasonic debridement in the treatment of severe chronic periodontitis: a randomized-controlled clinical trial. *J Appl Oral Sci.* 2013 Mar-Apr; 21(2): 208-214.
3. Maria Rosaria Gatto, Marco Montevicchi, Michela Paolucci, Maria Paola Landini, Luigi Checchi. Prevalence of six periodontal pathogens in subgingival samples of Italian patients with chronic periodontitis. *New Microbiologica*, 37, 517-524, 2014.
4. Azarpazhooh A, Shah PS, Tenenbaum HC, Goldberg MB. The effect of photodynamic therapy for periodontitis: a systematic review and meta-analysis. *J Periodontol.* 2010;81:4-14.
5. Debora C. Matthews, DDS, MSc. Seeing the Light - The Truth about Soft Tissue Lasers and Nonsurgical Periodontal Therapy. *J Can Dent Assoc* 2010;76:a30.
6. Davoud Zare, Ahmad Haerian, Reza Molla, and Farzane Vaziri. Evaluation of the Effects of Diode (980 Nm) Laser on Gingival Inflammation after Nonsurgical Periodontal Therapy. *J Lasers Med Sci.* 2014 Winter; 5(1): 27-31.PMCID: PMC4290520.
7. Ishikawa I, Aoki A, Takasaki AA. Potential applications of Erbium:YAG laser in periodontics. *J Periodontal Res.* 2004 Aug;39(4):275-85.
8. Theodoro LH, Silva SP, Pires JR, Soares GH, Pontes AE, Zuza EP, et al. Clinical and microbiological effects of photodynamic therapy associated with nonsurgical periodontal treatmentA 6-month follow-up.*Lasers Med Sci.* 2012;27:687-93.
9. Sanz-Sanchez I, Ortiz-Vigon A, Matos R, Herrera D, Sanz M.Clinical efficacy of subgingival debridement with adjunctive erbium: yttrium - aluminum -garnet laser treatment in patients with chronic periodontitis: a randomized clinical trial.2015 Apr;86(4):527-35.
10. Lu RF, Feng XH, Xu L, Meng HX.Clinical and putative periodontal pathogens' features of different sites with probing depth reduction after non-surgical periodontal treatment of patients with aggressive periodontitis. 2015 Feb 18;47(1):13-8.
11. Frank Y.W. Yung, DDS. The use of an Er:YAG laser inperiodontal surgery: Clinical cases with long-term follow-up. *Academy of Laser Dentistry, Journal of Laser Dentistry* 2009, Volume 17, Issue 1. Its original publication appears in *J Laser Dent* 2009;17(1) 13-20.
12. Milne TJ, Coates DE, Leichter JW, Soo L, Williams SM, Seymour GJ, Cullinan MP.Periodontopathogen levels following the use of an Er:YAG laser in the treatment of chronic periodontitis.2015 Jan 29.
13. Araki AT, Ibraki Y, Kawakami T, Lage-Marques JL. Er:Yag laser irradiation of the microbiological apical biofilm. *Braz Dent J.* 2006;17(4):296-9.
14. De Mendonça A.C. Máximo M.B. Rodrigues J.A. Arrais C.A. De Freitas P.M. Duarte P.M. Er:YAG laser, ultrasonic system, and curette produce different profiles on dentine root surfaces: an in vitro study. *Photomed. Laser Surg.* 2008;26:91-97.
15. Al-Hebshi NN, Al-Alimi A, Taiyeb-Ali T, Jaafar N.Quantitative analysis of classical and new putative periodontal pathogens in subgingival biofilm: a case-control study.2015 Jun;50(3):320-9.