

## THE USE OF Er,Cr: YAG IN THE TREATMENT OF PERI-IMPLANTITIS

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### Abstract

40 patients with implant-prosthetic restorations and diagnosed with at least one implant affected by moderate or severe peri-implantitis were selected from Learning Centre “M.Kogalniceanu” of Dental Medicine Faculty, U.M.F.”Grigore T.Popa” Iasi and a private practice. Patients were randomly divided in test group (laser-assisted treatment, flap procedure) and control (mechanical debridement, flap procedure). In the test group, the conventional treatment protocol was assisted by laser therapy (2940nm Er,Cr:YAG laser) . It was recorded (for 7 days post-operatively) the evolution of the next clinical parameters: VAS indices (pain intensity); patients’ discomfort; healing time. Results. In the laser-irradiated group, VAS indices decreased from 2,8 (T0), to 2,4 at 24 h post-operatively, and 0,6 at 48 hours post-operatively. The mean values of healing time are significantly lower (6,5 days) comparing with control (8,5 days). Conclusion. Laser bio-stimulation in peri-implantitis has positive effects on inflammatory processes in peri-implant tissues and accelerate healing processes.

**Key words:** implant-prosthetic restorations, Laser bio-stimulation, healing processes

### Introduction

As dental implants have revolutionized the dental treatments and implant-prosthetic restorations became widespread worldwide, it has increased the interest of the practitioners to reduce failure rate as well as to improve the postoperative evolution and to maintain long term peri-implant health. In the laser-irradiated group, VAS indices decreased from 2,8 (T0), to 2,4 at T1 (24 h post-operatively), 0,6 at T2 (48 hours post-operatively) and. Also discomfort of patients was almost entirely reduced.

The main condition for the peri-implant tissues health is to obtain implants

osseointegration, which is defined as “functional bone adherence where new bone is laid down directly on the implant surface and the implant exhibits mechanical stability, also known as primary stability (resistance to destabilization by mechanical agitation or shear forces)” (1). The second condition for the long-term peri-implant tissues health is the avoidance of peri-implantitis onset, a progressive and irreversible disease of implant-surrounding hard and soft tissues and is accompanied with bone resorption, decreased osseointegration, increased pocket formation and purulence (2). Because of the spectacular increase in

the number of dental implants inserted in patients requiring implant-prosthetic rehabilitation, it is reasonable to consider a progressive increase in the prevalence of peri-implantitis (3).

Inflammatory processes that occur in the case of periodontitis and in the case of peri-implantitis have similar characteristics, both having as a defining element bone loss. Long-term studies aiming to obtain the prevalence of peri-implantitis and its association with risk factors, revealed the existence of risk indicators such as age of implants, age, periodontal status, and oral hygiene. In these conditions, the loss of dental implants has serious consequences on systemic, financial and even legal status (3). The treatment of peri-implantitis must be focused on infection control, detoxification of implant surfaces, regeneration of lost tissues as well as plaque control by using mechanical debridement with raising flap or in non-surgical procedures (4). However, there is no reliable evidence suggesting which could be the most effective interventions for treating peri-implantitis (4). For a predictive management of peri-implantitis, the decision-making process on the therapeutic approach of peri-implantitis should be based on logical algorithms and on evidence base provided by scientific

data (5). Complete implant surface decontamination is recommended because decontamination eliminates the microbial biofilm from the surface of implants, yielding a surface compatible with health and allowing re-osseointegration (5). Different research groups aimed to respond to the challenges of peri-implantitis therapy by investigating various additional tools, including dental lasers. The action of the dental lasers in peri-implantitis is due to the bio-stimulation effect that ensure the acceleration of tissues healing, the decrease of postoperative pain, the stimulation of collagen deposition and anti-inflammatory effect (6).

#### **Materials and method.**

40 patients with implant-prosthetic restorations and diagnosed with at least one implant affected by moderate or severe peri-implantitis were selected from Learning Centre “M.Kogalniceanu” of Dental Medicine Faculty, U.M.F.”Grigore T.Popa” Iasi and a private practice. Written consent was obtained from all patients. Patients were randomly divided in test group (laser-assisted treatment, flap procedure) and control (mechanical debridement, flap procedure). In the test group, the conventional treatment protocol was assisted by laser therapy. Both groups were submitted to bone guided

regeneration using xenograft Cerabone and collagen membrane Jason.

The treatment of peri-implantitis was performed using open flap procedure. Implant surface decontamination was performed using sterile saline and a laser session with Er:YAG laser K.E.I. (2940nm) (KaVO). The tissues incision and vaporization of pathological tissues were performed using mode pulsatile (frequency 25Hz), and output power 100mJ, while implant decontamination was performed in mode pulsatile (frequency 30Hz) and output power 30mJ. The laser tip (500  $\mu$ m diameter) was placed perpendicular to the implant surface and 5 mm away from the implant surface. Each laser irradiation occurred approximately for 2 minutes. The flap was repositioned and sutured, without tension. The patients were prescribed amoxicillin 500 mg three times daily for a week, and analgics as needed for pain management, as well as 0.12% chlorhexidine oral rinse twice daily. The patients were monitorized

at each 2 weeks, until the suture removal in 4 weeks. After the initial phase of healing, the patient returned monthly, for the next 6 months, for the clinical and radiographic evaluation of site. For control groups implant decontamination was performed using curettes and irrigation with sterile saline following flap raising.

The postoperative evolution was recorded after 24 hours (**T1**), 3 days (**T2**) and 7 days (**T3**) and was compared with **T0** (first hours after surgical procedure). It was recorded the evolution of the next clinical parameters: **VAS indices (pain intensity); patients' discomfort; healing time.**

Statistical tests Mann-Whitney and Wilcoxon were performed to compare the results in the laser-assisted group and control.

## Results

Figure 1 present stages of laser-assisted peri-implantitis therapy and guided bone regeneration.

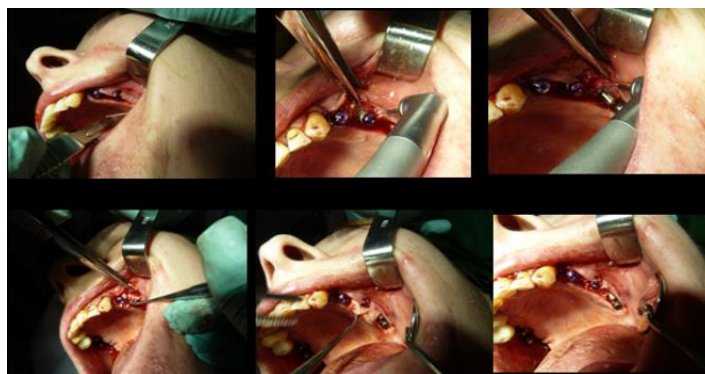


Figure 1. Stages of laser-assisted peri-implantitis therapy with guided bone regeneration

Figure 2 presents a graph that compare the evolution of postoperative VAS indices (pain intensity) between test group and control. Both groups present the decrease of indices during 7 days postoperatively, with significantly lower mean values after day 3 (T2). In the laser-irradiated group, VAS indices decreased from 2,8 (T0), to 2,4 at T1 (24 h post-operatively), 0.6 at T2 (448 hours post-operatively) and. Also

discomfort of patients was almost entirely reduced.

Figure 3 presents a graph that compare the healing times between test group and control. Both groups present the decrease of indices for 7 days, with significantly lower mean values. The mean value of laser-irradiated (6,5 days) is significantly lower comparing with control (8,5 days).

Figure 4. presents statistical test that compare the healing time between groups

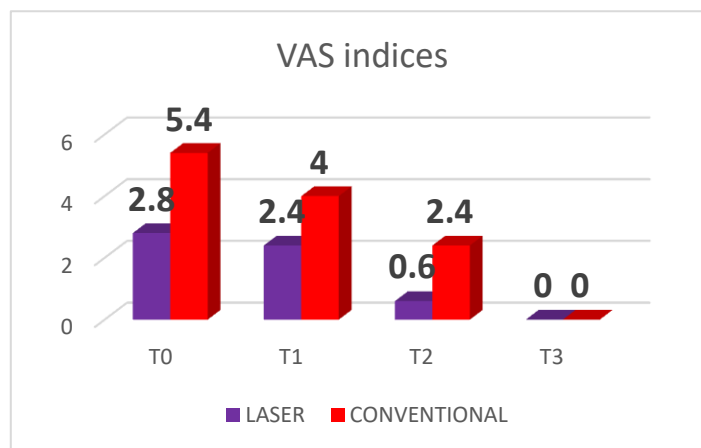


Figure 1. The evolution of VAS indices

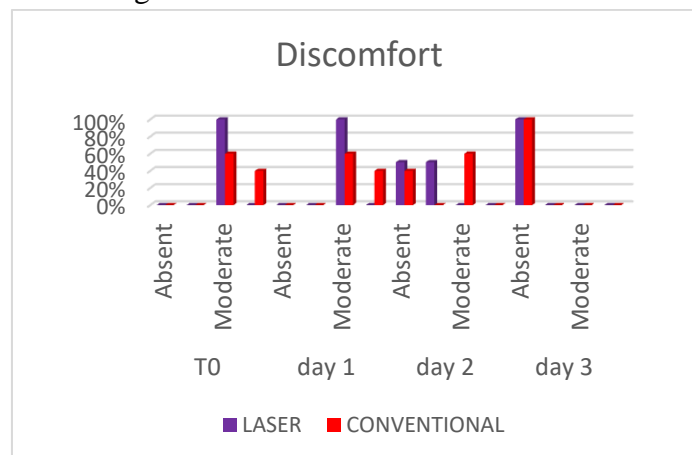


Figure 2. Discomfort post-operatively

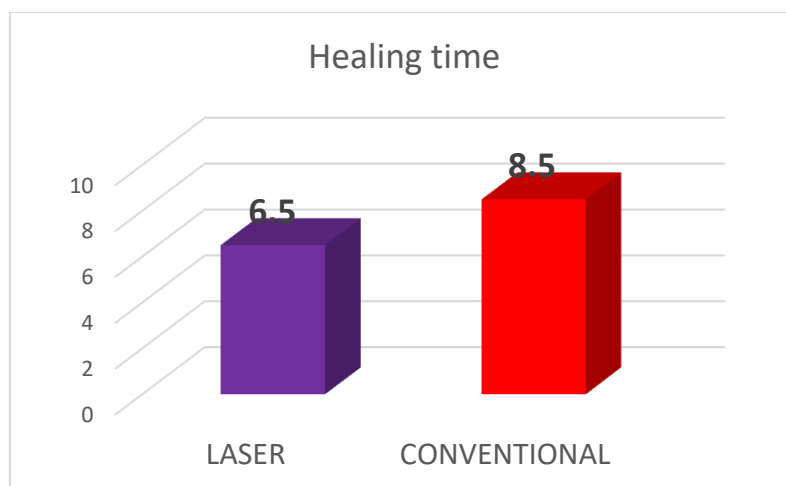


Figure 3. Healing time

Mann-Whitney U	32.000
Wilcoxon W	242.000
Z	-4.683
Asymp. Sig. (2-tailed)	<b>.000</b>
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>

a. Grouping Variable: LOT

b. Not corrected for ties.

Figure 4. Statistical test comparing healing time between groups

### Discussions

The objective of peri-implantitis therapy is to achieve inflammation resolution by decontaminating the implant surface, while preserving the implant-supporting tissues (7). The implant decontamination methods include mechanical debridement, chemical therapy (applications of root conditioners, disinfectants, and local and systemic antibiotic therapy) (8). In moderate and severe peri-implantitis are recommended surgical procedures aiming to remove bacteria and to smooth, decontaminate, and detoxify the implant surface (9). A

review found the importance of peri-mucositis detection and supportive therapy in patients with peri-implant mucositis (10). The patient-administered mechanical plaque control (with manual or powered toothbrushes) has been shown to be an effective preventive measure, while professional cleaning comprising oral hygiene instructions and mechanical debridement is associated with a reduction in clinical signs of inflammation. The adjunctive measures (antiseptics, local and systemic antibiotics, air-abrasive devices) were not found to improve the efficacy of professionally administered plaque

removal in reducing peri-implant inflammation. The surgical approach allows the access to the necessary areas for mechanical debridement and implant surface decontamination, to reconstruct anatomic conditions suitable for improving plaque control, and to eliminate pathological peri-implant pockets (11). In moderate and severe defects it is recommended the use of guided bone regeneration, a technique that remake the bone support for a good osseointegration of dental implant (12). However, the surgical approach is followed by moderate or severe inflammatory processes associated to postoperative pain and patients' discomfort.

The reason for the use of lasers in peri-implantitis therapy is related both to their effects on postoperative healing evolution and the unsatisfactory results obtained by conventional antibacterial and anti-inflammatory therapy, especially in non-surgical therapy.

## References

- 1.Schroeder A, Sutter E, Krekeler G (eds). Oral Implantology: The ITI Hollow-Cylinder System. Stuttgart: Thieme, 1991.
- 2.Smeets R, Henningsen A, Jung O, Heiland M, Hammächer C, Stein JM. Definition, etiology, prevention and treatment of peri-implantitis – a review. *Head Face Med.* 2014; 10: 34.
3. Prathapachandran J, Suresh N. Management of peri-implantitis. *Dent Res J (Isfahan).* 2012 SepOct; 9(5): 516–521.
4. Bartok F. Managementul periimplantitei. Teza doctorat. UMF « Gr.T.Popa » Iasi.2018.
5. Esposito M, Grusovin MG, Worthington HV. Treatment of peri-implantitis: what interventions are effective? A Cochrane systematic review. *Eur J Oral Implantol.* 2012;5 Suppl:S21-41.
- 6.Fornaini C, Roca JP. Oral Laserology. EDLearning.2015.
- 7.Mombelli A, Lang NP. Microbial aspects of implant dentistry. *Periodontol* 2000. 1994 Feb; 4():74-80.
- 8.Jepsen S, Berglundh T, Genco R, Aass AM, Demirel K, Derks J, Figuero E, Giovannoli JL, Goldstein M, Lambert F, Ortiz-Vigon A, Polyzois I, Salvi GE, Schwarz F, Serino G, Tomasi C, Zitzmann NU. Primary

In our study, the role of laser therapy was proved by the decrease of VAS indices and discomfort (comparing with control) as well as by significantly shorter healing time. The results of our study support literature data (13,14,15) Considering that most studies of peri-implantitis therapy report a follow-up period of only 6-12 months, larger well-designed randomized-controlled studies with follow-ups longer than 1 year are needed.

## Conclusions

-Laser bio-stimulation in peri-implantitis has inflammatory effects in peri-implant tissues.

-Laser-assisted procedures conduct to better postoperative evolution of patients affected by peri-implantitis.

-Laser-assisted procedures in peri-implantitis are associated to significantly shorter healing time comparing with control.

prevention of peri-implantitis: managing peri-implant mucositis. *J Clin Periodontol.* 2015 Apr;42 Suppl 16:S152-7

9.Heitz-Mayfield LJA, Salvi GE, Mombelli A, Faddy M, Lang NP. Anti-infective surgical therapy of peri-implantitis. A 12-month prospective clinical study.*Clin Oral Implants Res.* 2012 Feb; 23(2):205-210.

10.Schwarz F, Hegewald A, John G, Sahm N, Becker J Four-year follow-up of combined surgical therapy of advanced peri-implantitis evaluating two methods of surface decontamination.*J Clin Periodontol.* 2013 Oct; 40(10):962-7.

11.Roos-Jansåker AM, Persson GR, Lindahl C, Renvert S. Surgical treatment of peri-implantitis using a bone substitute with or without a resorbable membrane: a 5-year follow-up.*J Clin Periodontol.* 2014 Nov; 41(11):1108-14.

12.Forna D., Fornal NC., Earar K., Popescu E. Postoperative Clinical Evolution of Edentulous Patients Treated by Guided Bone Regeneration Using Xenograft Bone Substitute and Collagen Membrane. *Materiale Plastice*, 2017; 54(2): 312-315.

13. Lin GH, Suárez López Del Amo F, Wang HL. Laser therapy for treatment of peri-implant mucositis and peri-implantitis: An American Academy of Periodontology best evidence review.*J Periodontol.* 2018 Jul;89(7):766-782.

14. Zegan G., Carausu E.M., Golovcenco L., et al., Nanoparticles deposition on mini-implants for osseointegration and antibacterial properties improvement, *Revista de Chimie*,68(12), 2017, pg.2929-2931

15 Birang E, Talebi Ardekani MR, Rajabzadeh M, Sarmadi G, Birang R, Gutknecht N.

Evaluation of Effectiveness of Photodynamic Therapy With Low-level Diode Laser in Nonsurgical Treatment of Peri-implantitis.*J Lasers Med Sci.* 2017 Summer;8(3):136-142.