



Photobiomodulation Coadjuvant in the Management of Peri-implantitis in Patient with Overdenture

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Abstract

With the advent of osseointegration promoted by modern implantology, the rehabilitation of edentulous patients has reached a greater number of the world population. The technique of overdenture is the simplest and cheapest in relation to the Branemark protocol, increasing the population of implanted edentulous patients. However, in view of the high rate of prosthetic or implantodontic losses, the failure of the preservation focuses mainly on the involvement of peri-implantitis. The purpose of this article was to present a case of peri-implantitis affecting a patient with overdenture, whose treatment included the application of photobiomodulation coadjuvant to basic periodontal treatment.

Keywords: Lasers; Low-Level Light Laser; Laser Therapy; Peri-Implantitis; Dental Implants

Introduction

With the advent of osseointegration promoted by modern oral implantology, the rehabilitation of edentulous patients has reached a greater number of the world population. However, the failure of the prosthesis cases on implants seems to be a gap in the training of the dental surgeon, given the high rate (ranging from 12 to 43%) of prosthetic or implantodontic losses [1-5].

Most implant losses are due to inflammatory and infectious processes that can affect peri-implant tissues. Analogically, peri-implant diseases can be compared to periodontal diseases, since the etiopathogeny is the same. In this perspective, mucositis is equivalent to the initial stage of inflammation (gingivitis), in which dental biofilm can also cause inflammation of mucous tissues adjacent to the dental implant. Peri-implantitis, in turn, is equivalent to periodontitis, in which the dental biofilm, associated with the

presence of dental calculus, bleeding, suppuration and loss of bone and gingival tissues, affects the dental implant. Additionally, it is worth noting that other factors can influence the loss and failure of dental implants, such as endogenous factors of the patient (systemic diseases, habits and addictions, predisposition to periodontal diseases, level of oral hygiene, etc.) and exogenous (types of prostheses, excessive occlusal load, trauma) [1,3-13].

Several therapeutic modalities are recommended in the treatment of peri-implantitis. Aiming at the maintenance of the prosthesis and the implant (reversibility and re-osseointegration), in a conservative perspective, instruction of oral hygiene, mechanical debridement (scraping and polishing of the implant surface) and surgical (curettage of granulation tissue), institution of pharmacological therapies (antiseptics and antimicrobials), guided tissue regeneration (bone and mucogingival tissue grafting) can be em-

ployed. Ultimately, when it is impossible to maintain the implant in function, explantation (removal of the implant) is recommended [1-3,5-11,13-15].

In recent decades, the use of laser (surgical or therapeutic) has been used in more clinical indications, seeking more conservative and less invasive alternatives to patients. The use of the surgical laser in cases of peri-implantitis looks for the reversibility of the cases, through bacterial decontamination [1,3-5,7-10,13-16]. Or, when there is loss of peri-implant tissues, it aims at stabilizing the alterations or supposedly gain of the lost structures (re-osseointegration) [6,9,12], or even and irreversibly the explantation [2]. The application of low level laser therapeutic (LLLT) in cases of peri-implantitis presents effects on biostimulation and assists in the inflammation and repair of the surgical wound [17]. The term LLLT is a poor and misused descriptor and is currently referred to as photobiomodulation [18].

Purpose of the Study

The purpose of this article was to present a case of peri-implantitis affecting a patient with overdenture, whose treatment included basic periodontal therapy and photobiomodulation coadjutant application.

Case Presentation

A 73-year-old female patient came to the clinic complaining of halitosis. The patient presented superior total prosthesis and inferior overdenture (Figure 1).



Figure 1: Initial clinic aspects: superior total prosthesis and inferior overdenture.

Clinically it was observed the bar over four implants in the mentonian region, performed 12 years ago, with peri-implantitis, presence of calculus and dental biofilm, suppuration and bleeding (Figure 2). However, no implant mobility was observed. The lower total prosthesis (overdenture) is attached by the bar-clip system (Figure 3).



Figure 2: Bar over four implants in the mentonian region, with peri-implantitis, presence of calculus and dental biofilm, suppuration and bleeding.



Figure 3: Lower total prosthesis (overdenture) is attached by the bar-clip system.

Radiographically, generalized bone loss was observed in the upper and lower arches, and the four implants with radiolucent images adjacent to the cervical screws, indicating the presence of bone loss due to peri-implantitis (Figure 4).

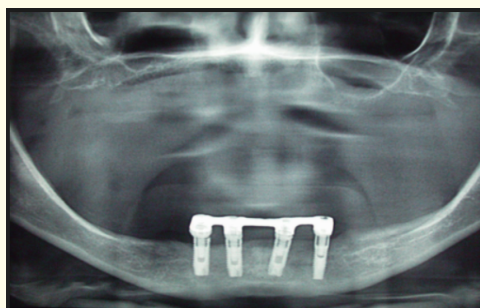


Figure 4: Radiographic aspects showing radiolucent images adjacent to the cervical screws, indicating the presence of bone loss due to peri-implantitis.



Figure 6: Oral hygiene instruction with tuff brush.

The peri-implant treatment of the four implants was proposed, initiated by the oral hygiene instruction consultation. After evidence of plaque (Figure 5), the patient was instructed with the tuff (Figure 6) and interdental (Figure 7) brushes, dental floss (Figure 8) and sponged floss (Figure 9). The internal faces of the upper and lower prostheses were cleaned with a conventional soft brush (Figure 10). In the subsequent consultation, the implants were scraped and debrided using Teflon curettes under local anesthesia. After scraping, photobiomodulation was performed with the use of diode laser (visible red 660 nm and 30 mW power, Biowave™ LLLT, Kondentech, São Carlos, Brazil) (Figure 11). No analgesic, anti-inflammatory or antibiotic drugs were administered.

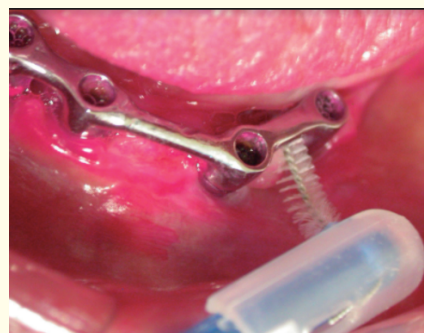


Figure 7: Oral hygiene instruction with interdental brush.



Figure 5: Oral hygiene instruction consultation, after evidence of plaque.

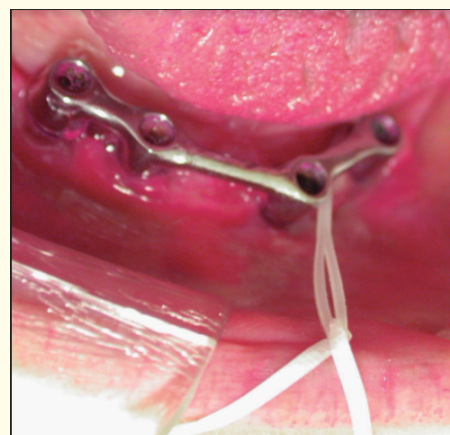


Figure 8: Oral hygiene instruction with dental floss.

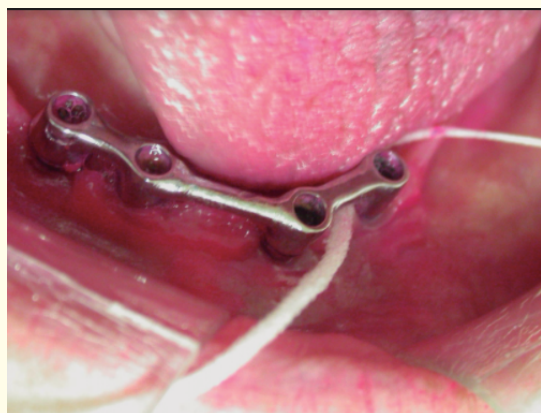


Figure 9: Oral hygiene instruction with sponged floss.



Figure 10: Oral hygiene instruction with conventional soft brush under internal faces of the upper and lower prostheses.

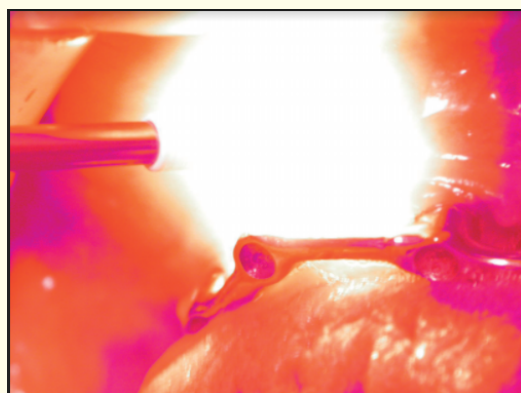


Figure 11: Photobiomodulation performed with the use of diode laser.

In the subsequent consultation, after 7 days, the improvement of mucogingival parameters around the implants was evaluated, as well as an increase in oral hygiene performed by the patient (Figure 12). The photobiomodulation promoted the anti-inflammatory and repairing effects of the applied region. The patient was oriented on the consultations of quarterly evaluations, and has been performing for 3 years.



Figure 12: Improvement of mucogingival parameters (anti-inflammatory and repairing effects) around the implants.

Discussion

The use of some types of lasers is quite widespread in literature, such as Er:YAG [3-5,8-11,15] laser, GaAlAs [6,7,12,13] diode laser and Er:Cr:YSGG laser [2,14,19,20]. However, other types such as CO₂ laser are quite scarce in the literature [1,19].

To optimize the organization, the Discussion was divided according to the type of laser device:

- High intensity laser.
- Er:YAG laser.

Several studies have demonstrated the use of the Er:YAG laser in debridement and decontamination of implant surfaces and adjacent sites contaminated by peri-implantitis. This is due to the fact that the unidirectional laser beam is more efficient than Teflon cures or ultrasound tips. Additionally, the laser beam has no harmful damage to the implant surface. The Er:YAG laser produces a beam with a wavelength of 2.94 μm , being able to eliminate stones and promote bacterial decontamination [3-5,8-11,15,16,19].

The Er:YAG laser, when compared to other treatment modalities, showed positive results. Renvert, *et al.* [5], comparing the Er:YAG laser with air-abrasive polishing, observed reduction in bleeding, suppuration and pocket depth, although there was no statistically significant difference in this latter. Comparing the Er:YAG laser with mechanical debridement with plastic curettes and antiseptic therapy in patients with peri-implantitis, Schwarz, *et al.* [8] observed that the Er:YAG laser (reduction from 83% to 31%) was statistically superior to mechanical debridement and antiseptic (reduction from 80% to 58%) in the reduction of bleeding to the probe, after 6 months of therapy. Schwarz, *et al.* [9] found that the Er:YAG laser was superior to the use of plastic curettes associated with the application of metronidazole gel and ultrasonic device, to promote re-osseointegration. The reduction of *Fusobacterium nucleatum naviforme* and *Fusobacterium nucleatum nucleatum* by the application of Er:YAG laser was reported by Persson, *et al.* [4], when compared to the application of air-abrasive device polishing. This latter showed significant reduction of *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Staphylococcus anaerobius*.

Contrary, other studies presented limited results. According to Schwarz, *et al.* [10], the peri-implant lesions treated by the Er:YAG laser resulted in a significantly higher reduction of bleeding in the probing compared to the group treated by mechanical debridement. However, its efficacy seemed to be limited to the 6-month period, particularly in more advanced lesions. Schwarz, *et al.* [11] concluded that a single application of the Er:YAG laser was not sufficient for the treatment of peri-implantitis. Schwarz, *et al.* [15] observed that after 6 months, the sites treated by the laser did not show higher reductions in the average bleeding to the probing and the level of clinical insertion, when compared to the group treated by plastic curettes followed by the application of saline solution.

Despite the result obtained by Persson, *et al.* (2011) [4] previously mentioned, both treatments (Er:YAG laser and air-abrasive device polishing) failed in bacterial reduction after 6 months. The count of *Porphyromonas gingivalis* was higher in cases of progressive peri-implantitis, which may have been the cause of the failure.

Er,Cr:YSGG Laser

The Er,Cr:YSGG laser presented some characteristics that would classify it as potentially useful in oral implantology. The Er,Cr:YSGG laser has a wavelength of 2,780 nm, using air and water spray, causing the ablation of tissues by a hydrokinetic process

that prevents the temperature from rising. It is highly efficient and effective in removing contaminants on the surface of the implant without any changes in its surface, or its constitution [14,16,19,20]. In the case report presented by Azzeh (2008) [14], the Er,Cr:YSGG laser was used with efficiency in cutting the flap, removing granulation tissue and in performing bone perforations and cleaning and disinfecting the implant surface. Smith and Rose (2010) [2] presented the explantation technique laser-assisted with Er,Cr:YSGG, showing safety and efficiency in the failure generated by peri-implantitis. The technique has proven to be minimally invasive when compared to conventional mechanical surgical explantation.

CO₂ laser

Romanos, *et al.* [1] suggested additional decontamination with CO₂ laser, after removal of the granulation tissue by surgical curettage of the lesion, prior to the grafting technique with bone substitute and absorbable membrane over the peri-implant defect. No structural changes were observed on the implant surface. The authors demonstrated adequate healing and bone neoformation when compared to the initial state. This benefit can be supported by the technique of guided tissue regeneration and bacterial decontamination promoted by the application of the CO₂ laser.

The physical properties of laser energy and its interaction with tissues, such as reflection, scattering, transmission and absorption can explain why the implant surface can be decontaminated in all areas, including more apical regions. Light can induce these antimicrobial effects due to the absorption by the implant and the adjacent tissues, and can also be reflected by the metal surface, causing a slight temperature rise in the tissues. The CO₂ laser produced minimum temperature alteration in continuous mode and energy levels up to 4W and when used in pulsed mode [1,19]. Additionally, the CO₂ laser can be used for rapid removal of soft tissues that can be caused by peri-implantitis, with excellent hemostasis, producing a clean operating field that, in most cases, does not require suturing [19].

Photodynamic therapy with GaAlAs diode laser

The use of GaAlAs diode laser in photodynamic therapy, together with the application of toluidine blue, was reported, raising the disinfection on the implant surfaces and adjacent tissues, favoring the repair and re-osseointegration in peri-implant defects, followed by regenerative techniques (guided bone regeneration and

polytetrafluoroethylene membrane) [6,12,21]. Shibli., *et al.* [12] reported even greater bone height gain in the group treated by photodynamic therapy. The use of photodynamic therapy in peri-implant disinfection, when acting on periodontal and peri-implant microbiota presented some advantages besides the conventional antimicrobial therapy, avoiding the resistance of target microorganisms, with no need for the maintenance of toluidine blue for prolonged periods, as well as the application in specific places in affected sites [6,7,12]. Schär., *et al.* [13] observed a statistically significant reduction in the depth of the pocket for probing, peri-implant retraction and Modified Plate Index and, after 6 months of treatment with photodynamic therapy, the complete resolution of gingival inflammation (in 30% of cases).

Additionally, according to Hayek., *et al.* [7], the use of photodynamic therapy with the GaAlAs diode laser and the application of toluidine blue promoted the reduction of *Prevotella* sp., *Fusobacterium* sp. and *Streptococcus beta-haemolyticus* in peri-implant lesions induced by bandages in dogs. Photodynamic therapy, compared to disinfection by mucoperiosteal flap access to peri-implant surface scraping followed by 0.12% chlorhexidine irrigation, showed statistically similar results, suggesting that this therapeutic modality is a non-invasive effective treatment method to peri-implantitis as a potential alternative to antibiotic therapy [7,13].

Low intensity laser

The application of low intensity laser has been used more frequently in recent years, due to cost reduction and greater access to technology by the dental surgeon. Several effects can be observed in the acceleration of cellular modulation, including increased rate of cellular metabolism and mitochondrial dysfunction [17]. The use of photobiomodulation can improve the osseointegration of the implant based on increased osteocyte viability [18].

Clinically, pain relief, reduction of edema and hyperemia in inflammatory processes and acceleration of wound repair can be observed. In oral implantology, it has been used in the stimulation of repair processes, by the analgesic and anti-inflammatory action, and accelerating the process of osseointegration of implants, through the proliferation of osteogenic cells. It was also suggested the use in bone defects, observed in peri-implantitis [17,18].

According to Friggi., *et al.* [17], the low intensity laser most used for this purpose is the gallium aluminum arsenide laser (AsGaAl), with wavelength ranging between 660 and 980 nm, with power variation between 40 and 100 mW and energy density or creep recommended to biostimulate peri-implant bone tissue is 16J, distributed in four application points. It was recommended that the time between these applications is 48 hours, starting in the immediate post-surgical and lasting up to 30 days.

The systematic review performed by Albaker., *et al.* [22] showed inconclusive results to show the effect of photodynamic therapy or low intensity laser in the treatment of peri-implantitis due to methodological heterogeneity, such as non-standard control groups, laser parameters and short follow-up period. Photodynamic therapy can be considered an effective method for bacterial reduction on implant surfaces. The irradiation with a single laser, without the association of the dye, was less efficient than photodynamic therapy, according to Marotti., *et al.* [23]. However, in the study by Birang., *et al.* [21], statistically significant improvements were observed in the clinical indexes (bleeding on probing, probing pocket depth and modified plaque index) and microbiological parameters (*Aggregatibacter actinomycetemcomitans*, *Tannerella forsythia* and *Porphyromonas gingivalis*), with the use of low intensity laser (laser diode beams at a wavelength of 810 nm) and photodynamic therapy. The results showed that both procedures have significant short-term benefits in the treatment of peri-implantitis. In the present report, the improvement of clinical parameters (analgesic, anti-inflammatory and reparative effects) was observed, coadjuvant to the periodontal basic procedures.

Conclusion

The use of laser in cases of peri-implantitis is a therapeutic proposal, in most cases, minimally invasive. This modality may cause no damage to the patient or implant. However, high power lasers can promote an undesirable increase in temperature. Another disadvantage is the high cost of the equipment. The dental surgeon must be skilled in safety procedures and knowledge about laser-tissue interactions and characteristics of each device. Several clinical, radiographic and microbiological benefits have been reported. Other studies are needed to confirm the benefits of using laser in the therapy of peri-implantitis.

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