Dental lasers against peri-implantitis

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Background

The replacement of lost teeth with dental implants represents a modern approach in restorative dentistry. Among various complications, including bleeding from the implant site, infection, and pain are early signs of problems. Severe complications may result in peri-implant mucositis and peri-implantitis, which are infectious bacterial diseases with inflammatory processes that are similar to gingivitis and periodontitis.[1–3] Peri-implant mucositis is defined as a reversible inflammatory reaction in the soft tissue surrounding the implant, and peri-implantitis is associated with pathological pocket formation and loss of supporting bone around the implant, resulting in implant failure.[1,2,4]

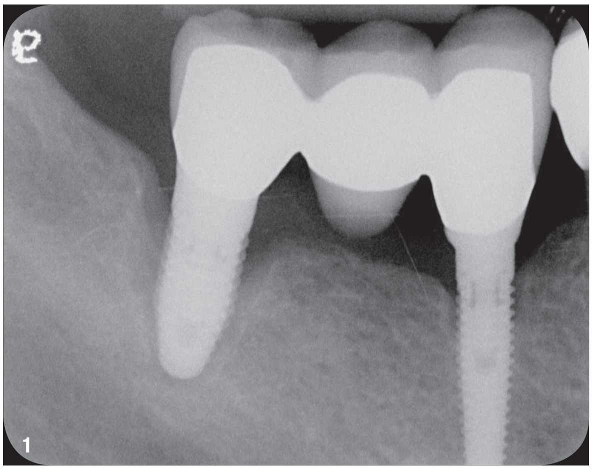

Fig. 1: Pre-op radiograph.

Bacterial biofilm plays a major role in peri-implant disease and implant failure.[5–8] Modern dental implants have a structure with a rough surface that facilitates microbial colonisation and enhances the formation of biofilm, which is not easy to remove.[9] Several methods have been proposed for the prevention and treatment of peri-implant disease (e.g. the use of chemical agents and mechanical debridement with curettes, ultrasonic devices, air abrasion and laser therapy), but no approved therapeutic protocol has been established.[10,11] Owing to the major role of microorganisms in the formation of peri-implant disease, the primary goal of any treatment is to remove the biofilm from the implant surface. The results of using different techniques for biofilm removal suggest that none of the currently used methods is sufficiently effective or superior to the others.[12–14] The limited effectiveness observed of these methods is most likely due to directly inaccessible sites during the therapy. The inaccessible implant micrograph facilitates microbial colonisation and accelerates biofilm formation.[15] In recent years, lasers have shown a promising effect in the treatment of peri-implantitis, producing many positive treatment outcomes.

Medical, dental and social anamnesis

The patient was a 64-year-old male in good health with no significant medical issues and took no medication other than vitamin supplements. He was a smoker, smoking approximately three to four cigarettes per day. He maintained good oral health, but had a history of oral neglect and was on a three-month hygiene recall. He had been wearing a complete maxillary denture for ten years. He was missing teeth #47, 46, 45, 36 and 37. He had undergone implant treatment on the mandibular arch five years previously. The temporomandibular joints showed no significant findings. He had a Class I occlusion.

Diagnosis

After the implant placement, the patient had started to smoke, which he had been recommended to stop. It was noticed there was a slight alveolar breakdown of the areas around implants #47 and 45. Regular hygiene visits and the cessation of the smoking were tried to arrest the breakdown of the alveolar bone. Radiographic examination determined that these measures were not achieving the desired results, and more extensive periodontal treatment was required (Fig. 1). It was determined that deep cleaning of the infected area was needed to remove the pathogens, in a minimally invasive manner for patient comfort. After the patient stopped smoking, which is known to affect the integrity of implants, further treatment was considered.

Treatment plan

A dual-wavelength laser procedure using Er:YAG and Nd:YAG (Fotona) was selected, considering the benefits of the treatment over traditional periodontal flap surgery. The erbium laser would be used to clean the surface of the implant photo-thermally, creating no heat on the titanium surface. The laser energy would be absorbed by the water of the surrounding tissue, vaporising the infected tissue and removing it as well. This laser energy would be best for cleaning the implant surface, which was fluted.

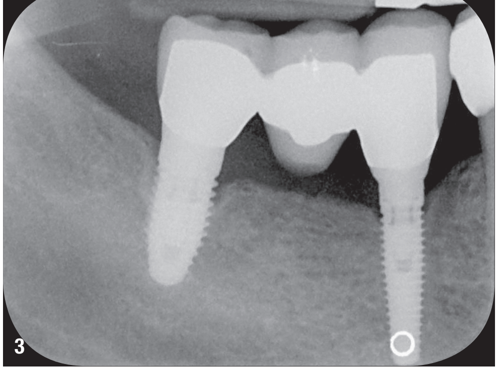

Fig. 2: Degranulation using the Er:YAG laser. **Fig. 3:** Radiograph taken at the nine-month follow-up, showing bone healing. **Fig. 4:** Clinical situation at the nine-month follow-up.

Treatment and laser parameters

Anaesthesia was administered using articaine with 1:100,000 adrenaline (two carpules). For initial access, the Varian 600/14 (600 µ) tip (Fotona) was used in the Er:YAG HC14-N handpiece (Fotona) at 160 mJ and 20 Hz in MSP mode with a 5/4 water–air spray and a sweeping motion to remove the granulation tissue and calculus from the bone to the base of the pocket as well as to decorticate the alveolar bone at the pocket base with firm pressure of the tip to stimulate bleeding for bone regeneration (Fig. 2). Furthermore, the outer epithelium was de-epithelialised by approximately 5 mm to prevent early ingrowth into the sulcus, which can prevent healing of the sulcus. We know that fibroblasts and osteoblasts can only regenerate and reattach to the implant surface at 0.5 mm in ten days. The invasion of the outer epithelium migrates at 1–2 mm in ten days. No conventional instrument can access this surface adequately. Tip selection is important for the implant surface and the Er:YAG XPulse 600/14 tip (now named RadialSWEEPS; Fotona) was used for its photoacoustic properties. Implant surface cleaning was performed at 60 mJ and 10 Hz in MSP mode with a 5/4 water–air spray. Water was maintained at this higher setting throughout the procedure to ensure that no heat was generated. The movement of the tip in the pocket provided a final sulcular debridement of the inner epithelial wall and the implant surface.

Disinfection of the implant at the surgical site is best done with the Nd:YAG. For this purpose, the R21-C3 handpiece (Fotona) was used at 2 W and 20 Hz and in MSP mode. Thereafter, the setting was changed to 3.5 W, 20 Hz and VLP mode to initiate fibrin clot formation, which in turn would initiate bone formation in the surgical site. Biomodulation was done with the Nd:YAG laser to reduce inflammation for more efficient healing of the area. Special care should be taken not to overheat the area. The R30 handpiece (Fotona) was used with a 8 mm spot size, at 25 ms and 2 W for 1 minute. The patient was then scheduled for a follow-up biomodulation treatment in one week. After that, the patient booked a follow-up and biomodulation treatment again after three weeks. The total laser procedure time was 15 minutes. Initially a large amount of infected tissue was removed during the process. The procedure in the area was performed until the infected tissue had been eliminated. PeriAcryl (GluStitch) was placed to stabilise the tissue.

Results and discussion

There was no swelling after the treatment and the patient took no pain medication. Bleeding was controlled by the clot formation and mild pressure. One week after the procedure, the tissue looked healthy and had minimal redness. The patient underwent a periodontal maintenance protocol at a three-month interval. No probing took place in the first six months. After nine months, radiographic examination showed osseous regeneration (Fig. 3) and no bleeding on probing. The pocket depth was 3 mm, the tissue was firm and pink, and there was 4 mm of attached gingiva around the implant (Fig. 4).

Conclusion

The use of the Er:YAG and the Nd:YAG laser is a predictable and safe procedure for treating peri-implantitis in its early stages without having to elevate a flap in the area. The two wavelengths work in conjunction with one another to achieve osseous regeneration in a diseased pocket. The Nd:YAG is the optimal wavelength for disinfection and osteoblast regrowth stimulation. The Er:YAG absorption results in a mechanical disruption of the diseased tissue and removes the granulation tissue and biofilm from the surface of the implant, optimising osseous cells to attach to the implant surface. The use of laser energy has been shown to be the most effective way to clean the implant surface over mechanical methods. This can be done with minimal trauma to the patient, both physically and financially. This should be the standard of care. As Albert Einstein said, “We cannot solve our problems with the same thinking we used when we created them.” This truly is the case with peri-implantitis.

about the author

Dr Brad Labrecque, DMD, MSc, is a general dentist whose focus is on incorporating laser technology in the modern dental practice. He is passionate about training dental practitioners in the use of dental lasers in all clinical procedures. Dr Labrecque has completed hundreds of hours of continuing education, and his practical experience makes him an international authority on laser dentistry.

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Literature