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NONSURGICAL PERIODONTAL MANAGEMENT OF IATROGENIC PERI-IMPLANTITIS: A CLINICAL REPORT

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Dental implants have emerged as a first line of treatment to replace missing teeth for both the edentulous and partially dentate patients. The anticipated high degree of success is somewhat challenged by the onset of peri-implantitis. Peri-implant diseases are a cluster of "contemporary" oral infections in humans; they are characterized by the inflammatory destruction of the implant-supporting tissues, as a result of biofilm formation on the implant surface. It is still not clear how the roles of its etiologic agents work. A history of periodontitis, poor oral hygiene, and smoking are considered as risk factors for peri-implant diseases. Occasionally failing implants are associated with iatrogenic factors, that, only recently, have been acknowledged as direct cause of peri-implant complications, i.e.: non-parallel adjacent implants or the presence of a gap, between fixture and prosthetic components. The use both of traditional protocols of nonsurgical periodontal therapy and the diode laser seems to be an effective alternative treatment modality for peri-implantitis. By the application of laser-assisted non-surgical peri-implant therapy the periodontal pocket depth was reduced. Intraoral periapical radiographs, taken at 6 months and 1 year post nonsurgical treatment, seemed to provide evidence of some improvement of the bone level. The present article illustrates the nonsurgical management of one case, where failure to remove residual cement, from an implant-supported dental prosthesis, seemed to cause peri-implant inflammation.

The biological complications of restored dental implants and associated supra-structures share similarities with the biofilm infections of natural dentition (1). Cement-retained fixed implant-supported restorations involve the risk of excess cement, which can associate peri-implantitis (2). Excess cement, retained in the peri-implant sulcus, despite careful clinical control, can become the basis of colonization by oral microorganisms. As a result of the biofilm formation, peri-mucositis or peri-implantitis may develop (3).

MATERIALS AND METHODS

A 57-year-old man in good general health who presented with a main complaint of pain and swelling at a maxillary right implant site was referred by a his dental practitioner to our periodontal department

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DISCLOSURE: ALL AUTHORS REPORT NO CONFLICTS OF INTEREST RELEVANT TO THIS ARTICLE.

for consultation. Clinical examination revealed 9 mm probing depth (PD) and bleeding on probing BoP (Fig. 1A) with suppuration, buccally, and 8 mm PD (Fig. 2A), BoP positive palato-distally, bucco-mesially, associated with purulent exudate. On periapical radiograph, an extensive radiopaque area is visible distally to the most posterior maxillary right implant (Fig. 1C). A significant bone loss is visible around both implants (Fig. 1C). Either calculus deposit or residual cement could be suspected for the radiopaque mass, detected on X-ray (Fig. 1C). The patient did not take any medication and does not smoke. No oclusal trauma or parafuctional habits were detected. In the presence of such a deep pocket, surgical approach is more indicated. However, non-surgical management is the initial treatment modality.

The patient was scheduled for causal therapy, to treat the inflammatory lesion, by removing the bacterial biofilm and alleviating pain via the use of a diode 980 nm laser (Fibre: 0.300 mm; Power: 2.5 W, Modality: pulsed (pw) ton = 30 µs, toff = 70 µs; mean, 0.7 W; 10 kHz; with a Fluence of 120 J/cm2, for a total energy of: 20,000 mJ, at a frequency of 10 Hz. (Wiser, Doctor Smile, Lambda S.p.A.,Vi, Italy). The treatment in each site takes 30", preceded and followed by Hydrogen peroxide 3% or 10 Volumes irrigation. The same procedure is replicated in each pocket for 3 times.

After insertion of the optical fiber (0.3 mm) into the peri-implant sulcus, 1 mm from the most apical portion of the pocket, the diode insert was moved in an apico-coronal and mesio-distal direction for 30 sec at each inflamed implant site. Non-surgical periodontal instrumentation was performed by hand (Fig. 2C), utilizing a titan curette and piezoelectric ultrasonic device with plastic fused to a metal insert, as needed. Finally a Silver-Chlorex Gel containing 0.2% Chlorexidine and 0.005% Silver cations supported anionic silica particles was delivered into the pocket, with a disposable syringe and a blunt needle. At the end of the prophylaxis appointment, a cotton pellet soaked in the same gel was applied (Fig. 2D).

The same diode laser 980 nm was used with a specific handpiece for biostimulation, with an output lens of about 1 cm in diameter, characterised by a defocalized beam, at a power of 0.7 Watt, in continuous wave (cw), for 60 sec in duplicate, at each site for a total of 3600 seconds, producing a fluence 1 J/cm2, equivalent to 6.000 mJ, with a frequency of 20 Hz. The handpiece was kept perpendicular to the gingival tissue and in slow motion, in contact with the mucous membrane, drawing small circles (Fig. 3A). These procedures were repeated the next day. The area was checked for plaque removal and home care evaluation for the first month on a weekly basis and followed by routine supportive periodontal therapy with a periodicity of 3 months. The diode laser was used if signs of inflammation were detected and to prevent peri-implant disease recurrence at the 6th month recall appointment. The entire oral cavity was treated as needed,

At a subsequent appointment, the peri-implant tissue appeared to be significantly less inflamed and the patient refererred that all symptoms were regressed.

Periodontal indices were documented and intraoral periapical radiographs were carried out at the 6-month (Fig. 1D) and 1-year (Fig. 3B) follow-up appointments.

RESULTS

Satisfactory results were obtained by the application of laser-assisted non-surgical peri-implant therapy. Periodontal pocket depth was reduced from 9 to 3 mm (Fig. 1A and Fig. 1B) probing depth with no bleeding on probing. Intraoral periapical radiographs, taken at 6 months (Fig. 1D), and 1 year (Fig. 3B) post nonsurgical treatment, provided evidence of some improvement of the bone level.

In the second X-ray, six months after the initial one, taken to evaluate the effective removal of residual cement, the calcified deposits were no longer present (Fig. 1D), indicating the non-surgical periodontal instrumentation had proven effective. It also seemed that the quality of bone support had improved, even after such a short period of time.

The reduction of periodontal pockets is probably due to re-epithelialization, with formation of a long junctional epithelial attachment (4, 5).

DISCUSSION

The success of dental implants depends on many factors, among which the diagnosis, clinical severity and treatment of peri-implant diseases play a key

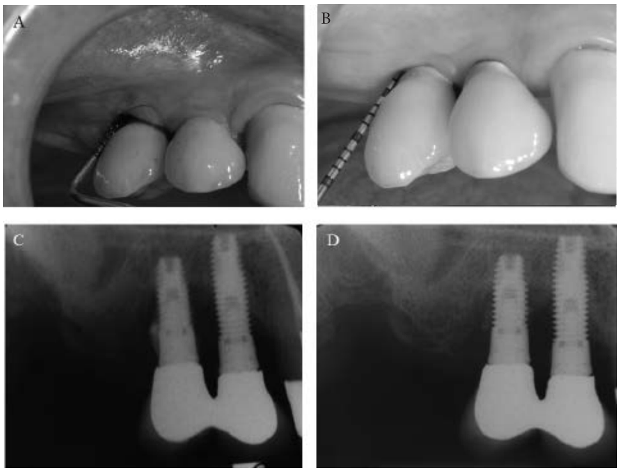

Fig. 1. ***A****) Buccally, probing depth (PD) is about 10 mm in the distal site of the most posterior maxillary implant, BoP positive and exudate is present.* ***B****) The same site 6 months later. The peridontal probe measures 2 mm PD. The tissue surrounding the implant seems to offer better clinical stability, compared to initial evaluation.* ***C****) On the periapical radiograph, residual cement is visible distally to the most posterior maxillary right implant. A significant bone loss is detectable around both implants.* ***D****) Periapical radiograph, six months later.*

role (6). There is no reliable evidence indicating which could be the most effective intervention for treating peri-implantitis (7). This is not to say that currently used interventions are not effective. The outcome of nonsurgical treatment of peri-implantitis (NSPT) is unpredictable (8, 9), due to possible re-infection related to the inability to completely remove bacterial deposits from titanium implant surfaces, thus interfering with a new histological bone-to-implant contact (10). The primary objective of NSPT is the biofilm removal and decontamination to resolve the inflammatory lesion (11). Nonsurgical periodontics may be the treatment of choice in cases of peri-implant mucositis or if the patient has medical contraindications or refuses to consent to more appropriate treatment (8, 12).

It is always imperative to stress the importance of giving correct oral hygiene instructions to patients who are rehabilitated with a dental implant and with proper prosthetic constructions, that allow accessibility for oral hygiene around implants (13). A strict periodontal control offers predictable long-term results; nevertheless, patients with a history of periodontitis, who did not fully adhere to individually designed maintenance programs, presented a statistically significant higher number of sites that required additional surgical and/or antibiotic treatment (12).

Laser treatment may serve as an alternative or adjunctive treatment to conventional periodontal mechanical therapy of peri-implantitis (11, 13-19). Clinical application of lasers for the treatment of periodontal disease has continued to expand but remains controversial (20). Diode lasers have a bactericidal effect, due to a localized increase in temperature, *verified in vivo* by using DNA probes that detect periodontal pathogens (21). Threaded implants have different morphology compared to root surfaces, therefore debridement instruments might be different. Laser could be a valuable tool to detoxify implant surfaces. A significant bacteria reduction should justify a more satisfactory recovery (22). It is possible to point the diode laser insert towards the wall of the ulcerated pocket epithelium in order to kill some virulent periodontal pathogens. Vaporization of granulation tissue seems to result in a more favorable effect compare to solo instrumentation (18, 21). The diode laser detoxifies root and implant surfaces by inactivating bacterial endotoxins, as it is hemostatic and produces no smear layer (21). The thermal effect weakens calculus chemical adhesion to root and/or implant, facilitating its removal by curettes or ultrasonic devices (23). Diode laser triggers fibroblast and osteoblast bio-stimulation (24), which in turn causes increased production of RNA messenger (25), leading to a significant collagen creation during periodontal tissue healing. The patient experienced no postoperative discomfort and he was able to comply with debridement, whereas home care results often more difficult after oral surgery. Any post-treatment discomfort affects patient compliance, so the patient feels uncomfortable performing the recommended home care protocols and might avoid correct plaque control, therefore impairing healing.

Important changes were also detected: bleeding, a marker of inflammation with a high prognostic value: compared to time 1, one year after laser-assisted periodontal therapy, was significantly

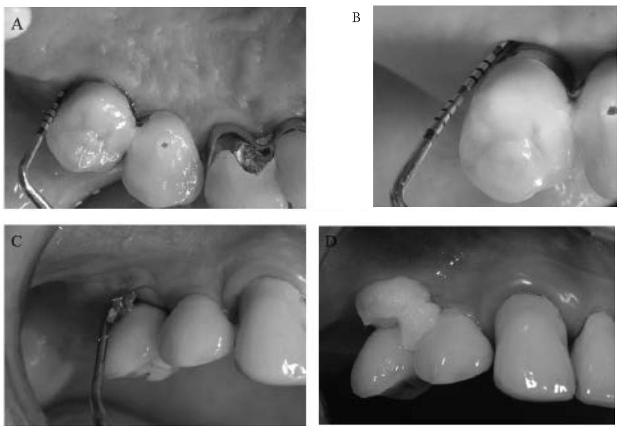

Fig. 2. ***A****) The periodontal probe detects about 8 mm PD, palato-distally to the most posterior maxillary right implant, BoP*$^{+}$*.* ***B****) 4 mm probing (PD) at first re-evaluation, 1 year post treatment.* ***C****) The image illustrates the clinical effectiveness of a titan universal curette, while removing abundant deposits at the distal site. It can be assumed that it is residual cement.* ***D****) At the end of the prophylaxis appointment, a cotton pellet, soaked in 2% silver oxide solution was applied.*

reduced to values below 20%.

Besides laser therapy, two other therapeutic interventions, manual application of a Silver-Chlorex gel, ultrasonic and manual scaling were used, all of these could have contributed to healing.

Anatase is one of the most common crystalline forms of TiO_2, and is normally produced by oxidation of titanium via thermal oxidation or anodization. This crystalline form shows photocatalytic activity when irradiated with UV-A light. This photocatalytic activity produces decomposition of several organic compounds. Recently, it has been demonstrated that coating of healing screws with a derivate of anatase (i.e., Bactercline) produced a lower quantity of bacteria on the surface of these screws (26). Then in a clinical trial, anatase coated implant was performed and no adverse effect on osteointegration was detected (27). Here a different device, a Silver-Chlorex gel, was used to control bacterial activity on the implant surface. It has higher antibacterial activity and no side effect on oral mucosa and bone. It seems to be ideal to be used in the treating of peri-implantitis or in combination with other devices and instruments.

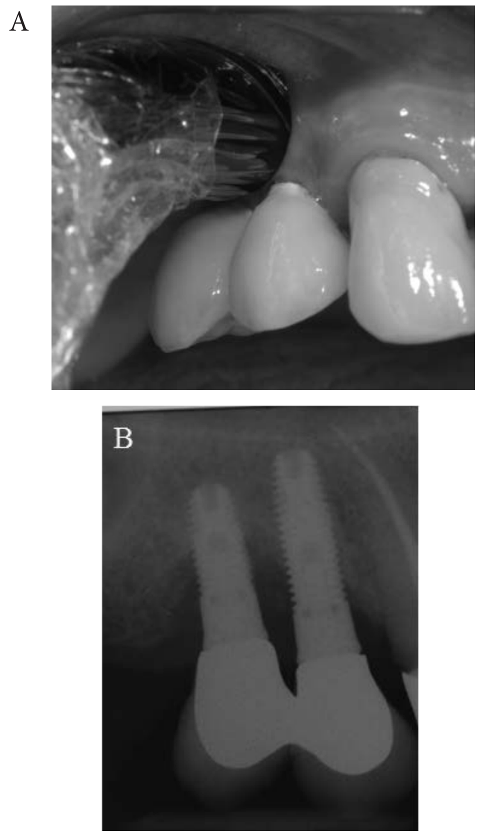

Fig. 3. A*) The same diode laser 980 nm was used with a specific handpiece for biostimulation, with an output lens of about 1 cm in diameter, characterised by a defocalized beam, at a power of 0.7 Watt, in continuous wave (cw), for 60 sec in duplicate, at each site for a total of 3600 seconds, producing a fluence 1 J/cm2, equivalent to 6.000 mJ, with a frequency of 20 Hz. The handpiece was kept perpendicular to the gingival tissue and in slow motion, in contact with the mucous membrane, drawing small circles.* ***B****) Periapical radiograph after 1 year follow-up***.**

It is therefore impossible to isolate one modality more effective than the others. However, it has been proven that laser alone cannot be resolute (28). Laser for many periodontal applications has to be used as additional tool, but it does not replace conventional nonsurgical treatment, which remains necessary, and irreplaceable, as much as correct home care instruction and adequate patient compliance (18, 19, 28). The absence of attached gingiva may have been a factor in the development of gingiva peri-implantitis. The issue is quite controversial.

The prevention of cement extrusion during the restoration process beyond the restorative cement margins cannot be underestimated; however, this may be more difficult than it appears (29).

Traditional protocols of nonsurgical periodontal therapy, in conjunction with the use of 810 nm diode laser seems to be an effective alternative treatment modality for peri-implantitis, associated with iatrogenic factors, such as failure to remove residual cement, from implant-supported dental prosthesis. Other treatment options may successfully enhance resolution of the peri-implant soft and hard tissues, and bone regeneration as well as preserving periodontal health longitudinally. Nevertheless, correctly performed supportive periodontal therapy is a key factor in enhancing the long-term outcome of implant therapy. The prevention of cement extrusion, beyond the restorative cement margins, during the restoration process should be emphasized.

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