Peri-implantitis: from the diagnosis to the treatment

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Peri-implant disease diagnosis is as fundamental as controversial. Although the progress made during the last decades, it’s still hard to find universal definitions and unambiguous diagnostic criteria.1-5 The parameters used to define peri-implant disease usually are: Probing Depth (PD), Crestal Bone Loss (CBL), Bleeding on Probing (BOP) and presence of suppurative and/or fistula.6 Peri-implant mucositis is characterised by soft tissues inflammation witnessed by BOP with or without PD deepening but no effects on the crestal bone while peri-implantitis is characterised by CBL, BOP alone or in conjunction with pus, with or without PD deepening. Figures 1, 2 and 3 display the diagnostic steps of a case of peri-implantitis. While mucositis allows a complete healing, peri-implantitis is not reversible.6 PD sets the first controversial point in diagnosis: the sulcus around implants can be considered surgically created since it will correspond to the depth of implant positioning, the quantity of soft tissues and to the length of the abutments. Given that, we cannot easily put a line between “health” and “disease”. PD as we do for natural elements6 it’s reasonable to register baseline PD to detect any possible change, since the deepening of PD has proved to be a predictive factor of disease development.4-6

Crestal Bone Loss sets another ambiguous point because an adaptive change of the marginal bone level is known to occur after implant placement and restoration.1 It’s necessary to agree on a baseline for the radiographic evaluation of bone level changes and set an acceptable bone loss rate basing on longitudinal clinical studies, it’s rational to choose the time of prosthesis installation as a reference from which the change can be diagnosed and followed.5 Basling on Allanbekov and Zarb review, 0.25mm of bone loss in the first year and less than 0.2mm annually are considered success criteria. A CBL exceeding this rate testifies the risk of implant failure. Don’t forget that intra-oral x-rays allow to evaluate the interproximal bone level only, missing an appropriate vision of the buccal/lingual sides, where probing becomes essential. Basling on Probing is the key parameter for peri-implant disease diagnosis.6 Presence of BOP can be found in 91% of implants with peri-implantitis and its absence is regarded as a reliable predictive parameter of implant health.2 An appropriate diagnosis can be set only if a proper probing is possible. Malpositioning, implant and abutment design (e.g. platform switching), lack of surface smoothness, de- sign, overcontouring and extension of suprastructures makes probing difficult and puts the risk of underestimation.6,7 Underestimation of PD can lead to underestimation of CBL.8,9 Undiagnosed, peri-implantitis may lead to complete failure of osseointegration and implant loss.10,11 The epidemiology is not comforting; a recent systematic review the authors concluded that 43% of the implants included in the meta-analysis were affected by mucositis, whereas the prevalence of peri-implantitis was estimated to be 22%.4 Peri-implantitis lesions are different from periodontal ones, both in their extent and composition of the inflammatory infiltrate.12 Peri-implantitis is known to progress faster than periodontal lesions13 and has a more uncertain response to both surgical and non-surgical treatments.14 This is enough to affirm that prevention is of major importance for the success of implant restorations. The prevention starts with patients framing into risk categories14 Subjects with a history of periodontitis are at greater risk to develop MB and peri-implantitis.15 This risk is increased in case of rough implants, poor oral hygiene, smoke habits, diabetes and poor metabolic control.16,17 The clinician must be able to diagnose and treat periodontal disease and have the duty to work on patients’ habits, giving them support in a change that can bring benefits not only to the implant therapy but to their health as well.18

Second step of prevention can be carried out during the surgical phase: a correct positioning of the fixture can help the technician in constructing a correct prosthesis and, consequent- ly, the periodontologist in checking the implant health, the hygiene in cleaning effectively the peri-implant area and the patient to keeping an high standard home-care. An infective care leads to the development of inflammatory reactions that can be kept hidden under the prosthesis and be unveiled until their removal. (Fig.4) Particular attention should be given to reach an appropriate amount of keratinized peri-implant tissue: its presence can be beneficial for the maintenance of an adequate oral hygiene.19 Long abutments and implant placement at sub-mucosal level cannot be considered a good choice from the periodontal point of view since they may create a deep probing depth, since the very beginning of the implant-born restorations life.13

Third milestone of the peri-implantitis prevention is Supportive Periodontal Therapy (SPT): the lack of a regular and effective SPT is a risk factor for the development of peri-implantitis.20 Every recall should be accompanied by a proper examination and probing21 to detect and effectively treat any case of peri-implant mucositis, since it can early progress to peri-implantitis.22 Sometimes it might be necessary to remove the overlying biofilm in order to achieve a more effective treatment and, in some cases, a better resolution of the inflammatory disease. (Fig.5)

The objective of the SPT should be the absence of peri-implant inflammation witnessed by absence of BOP.23

But what should we do in case peri-implantitis diagnosis? Being an infective pathology, biofilm and calculus removal is the key of peri-implant treatment.4 A gold standard non-surgical treatment still does not exists.24 Up to now no clinically relevant advantage of one treatment over the other can be found25 and only limited improve- ments accompanied by a tendency for recurrency have been reported.26 What has been happening during the last decades is the transposition of periodontal therapy strategies and technologies to the implant world. The use of curettes and me- chanical devices can be reasonable since it’s proved that peri-implant diseases are caused by a complex biofilm that has to be disrupted27 but becomes disputable given the structural differences between a tooth and a implant. Scaling and Root Planing makes little sense on a titanium surface with its particular micro and macro structure. An implant should not be plated but detoxified and decontaminated without alteration of its smooth and rough surfaces and with recovery of the biocompat- ibility.28 Erosion with liberation of ions and metal particles is an under- estimated issue in dentistry. Wear
debris have been described to be one of the responsible factors for aseptic loosening of orthopedic implants. They can be phagocyted by macrophages, inducing the expression of pro-inflammatory cytokines activating osteoclasts maturation. On the surface of titanium implants we can find a self-repairing layer of TiO2 that shows an high chemical stability and prevent the diffusion of metallic ions. Scratching of the implant or abutment surface could lead to the temporary removal of the TiO2 layer and to release of metal ions. Scratching of the implant biocompatibility.

In order to overcome these limitations, coadjuvants and new technologies have been introduced and combined. Air-polishing devices aim to an easier and more efficient biofilm removal. Abrasive powders are expected to be more efficient in reaching the inner part of the threads and the smallest anfractuosities other than being respectful of oral soft tissues. Good in-vitro results are reported: glycine seems to be effective in removing bacteria from both smooth and rough surfaces. Repeated use of glycine powder was not associated with any surface alterations, making its use feasible for life-long implant maintenance. Schmage et al. proved glycine powder to be as effective as ultrasonic instruments with PEEK tip in cleaning both smooth and structured surfaces. Drago et al. analysed the in-vitro effect of erythritol powder finding that it shows an even stronger antimicrobial and antibacterial activity than glycine. The detoxifying erythritol powder has a lower granularity although the abrasive power is high. This may help reaching the micro-anfractuosities of the implant and, in conjunction with the antimicrobial activity, help detoxifying the surface. Schmidt et al. analysed the effects of different instrumentations (stainless steel and plastic curettes, ultrasound devices).

Fig. 18: Case 2. Internal pocket line curet- tage

Fig. 19: Case 2. Second application of dox- yccline 2%  

Fig. 20: Case 2. 12 months healing. PPD reduction and BOP absence are notice- able

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stainless steel and plastic coated ultrasonic devices, two-types of glycine powders and one of erythritol on implant necks through a scanning electron microscope. They found out that air-polishing treatment resulted in the least surface modifications. Amongst the powders tested, the erythritol was proven to be the most respectful of the implant surface. Furthermore, the introduction of specifically designed flexible nozzles able to reach the deeper portion of the pockets has increased the decontamination power of this kind of device. Ronay et al.24 in a in-vitro study showed that air-polishing treatment resulted in the least surface modifications. The major advantage of the sub-gingival nozzles is the flexibility that easing the access to the peri-implant pockets and to the implant surfaces, mostly when the access is hindered and the removal of the prosthesis is not possible.

Even if the in-vitro results are encouraging, in-vivo evidence is still insufficient. Sahm et al.19 in a randomized controlled clinical trial showed that the treatment of initial/mild peri-implant disease is possible for an air-abrasive device with glycine powder to achieve the same PD reduction of carbon curettes and chlorhexidine gel. It could also achieve a significantly higher BOP reduction. Randomized controlled clinical trials are required to assess the clinical efficacy of air-polishing devices for the resolution of peri-implantitis, focusing on severe cases.

Antibacterial and antiseptic molecules have been proposed to boost the bacterial elimination and to help decontaminating the implant porous surface. Chlorhexidine has shown to be ineffective in peri-implant lesions decontamination. Porras et al.20 could not find any PD reduction and only a limited BOP reduction after additional use of local 0.2% chlorhexidine irrigation and gel plus 30 days of 0.22% chlorhexidine mouth rinse. Antibiotics constitute an additional option. Since peri-implantitis is a very localized disease, we wouldn’t take into consideration systemic antibiotic therapy with all the side effects it can bring. It’s important to notice that, to date, there are no controlled clinical trials evaluating the effects of any systemic antibiotic therapy. Locally delivered antibiotics can be released in a high dose for many days, killing the bacteria in the un-removed biofilm. Tetacyclines have been widely investigated in periodontology given their broad action spectrum. Mombelli et al.14 tested locally delivered 25% tetracycline as monolistic ethylene vinyl acetate fibers to be located around implants after a scaling phase with plastic curette and to be removed 10 days after. Clinical, radiographic and microbiological parameters improved in a good part of the subjects. Unfortunately, the lack of control group does not allow to understand the real magnitude of the antibiotic action. Amongst the difficulties met by the authors, it’s notable the struggle in assuring a contact between the fibers and all the implant surface, in particular in narrow and deep pockets. The use of different biodegradable carriers can give a better and easier contact with the implant structure and can cut out the need for fiber removal. Røver et al.15 tested a single dose of locally delivered minocycline as a coadjuvant of manual debridement with curettes, compared to chlorhexidine gel application. The additional effect of minocycline was small but significantly higher both on PD and BOP. Butcher et al.16 investigated biodegradable slow-release 8.5% doxycycline as an adjuvant to debridement with plastic curettes plus mechanical and oral hygiene instructions. The results were promising showing a significantly greater gain in mean attachment level, PD and BOP improvement for the doxycycline group. However, minocycline seems to be the most effective local antibiotic available.

So far, there is no scientific evidence supporting the efficacy of the coadjuvant. The tested protocol consists of a Multiple Anti Infection Non Surgical Therapy (MAINST) that involves the use topical 14% doxycycline to solve the peri-implantitis acute phase and, after 7 days, a session of Full Mouth Air Polishing Therapy (FM-APPT) through the use of glycine powder and a controlled release 14% doxycycline hyclate (Li- gena®).

The home-care maintenance is fundamental for the maintenance of the treatment results. The facilities given to the patients include: sonic and PEEK curettes, compared to chlorhexidine gel application. The additional effect of minocycline was small but significantly higher both on PD and BOP. The results were promising showing a significantly greater gain in mean attachment level, PD and BOP improvement for the doxycycline group. However, minocycline seems to be the most effective local antibiotic available. A strict home care maintenance protocol is mandatory for the resolution of the acute phase of peri-implantitis.

- A decontamination and detoxification phase through erythritol powder and preelectric device that covers the entire oral cavity (FM-APPT).
- A strict professional maintenance protocol based on FM-APPT.
- A strict home care maintenance protocol.

The home-care maintenance is fundamental for the maintenance of the treatment results. The facilities given to the patients include: sonic tooth brush, interdental bristles, floss and air floss (Philips Sonicare Airfloss Ultra).

References


The references list is available from the publisher.