Peri-implantitis:
from the diagnosis to the treatment

By Dr Magda Mensi, Italy
Dr Annamaria Sordillo, Australia

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. The parameters used to define peri-implant disease usually are: Probing Depth (PD), Crestal Bone Loss (CBL), Bleeding on Probing (BOP) and presence of suppuration and/or fistula. 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. 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 elements. 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. Crestal Bone Loss sets another ambiguous point because an adaptive change of the marginal bone level is known to occur after implant placement and restorations. 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 prosthetic installation as a reference from which the PD can be diagnosed and followed. Bas- ing on Albrektsson and Zarb review, 3.5mm 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. Bleeding on Probing is the key parameter for peri-implant disease diagnosis. Presence of BOP can be found in 9% of implants with peri-implantitis and its absence is regarded as a reliable predictive parameter of implant health. 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, des- sign, overcontouring and extension of suprastructure may make probing difficult and puts the risk of underestimation. Underestimation of PD can lead to underestimation of CBL. If undiagnosed, peri-implantitis may lead to complete failure of osseointegration and implant loss. The epidemiology is not comforting; in 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%. Peri-implantitis lesions are different from periodontal ones, both in their extent and composition of the inflammatory infiltrate. Peri-implantitis is known to progress faster than periodontal lesions and has a more uncertain response to both surgical and non-surgical treatments. This is enough to affirm that prevention is of major importance for the suc- cess of implant restorations. The pre- vention starts with patients framing into risk categories. Subjects with a history of periodontitis are at greater risk to develop MBL and peri-implantitis. This risk is increased in case of rough implants, poor oral hygiene, smoke habits, diabetes and poor metabolic control. The clinician must be able to diagnose and treat periodontal disease and have the duty to work on patients’ habits, giving them support and a change that can bring benefits not only to the im- plant therapy but to their health as well. Second step of prevention can be car- ried 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 infec- tive care leads to the development of inflammatory reactions that can be kept hidden under the prostheses and be unwillingly until their removal. Particular atten- tion 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. Long abutments and implant placement at sub-mucosal level cannot be con- sidered a good choice from the peri- odontal point of view since they may create a deep probing depth since the very beginning of the implant born restorations life. Third milestone of the peri-implan- titis prevention is Supportive Peri- odontal Therapy (SPT): the lack of a regular and effective SPT is a risk factor for the development of peri-implantitis. Every recall should be accompanied by a proper ex- amination and probing to detect and effectively treat any case of peri-implant mucositis, since it can early progress to peri-implantitis. Sometimes it might be necessary to remove the overlying prostheses in order to achieve a more effective treatment and, in some cases, a better resolution of the inflammatory disease. Every recall should be accompanied by a proper examination and probing to detect and effectively treat any case of peri-implant mucositis, since it can early progress to peri-implantitis. Sometimes it might be necessary to remove the overlying prostheses in order to achieve a more effective treatment and, in some cases, a better resolution of the inflammatory disease. Every recall should be accompanied by a proper examination and probing to detect and effectively treat any case of peri-implant mucositis, since it can early progress to peri-implantitis. Sometimes it might be necessary to remove the overlying prostheses in order to achieve a more effective treatment and, in some cases, a better resolution of the inflammatory disease.

**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. A gold standard non-surgical treatment still does not exist. Up to now no clinically relevant advantage of one treatment over the other can be found and only limited improve- ments accompanied by a tendency for recurrence have been reported. 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 disrupted but becomes disputable given the struc- tural differences between a tooth and a implant. Scaling and Root Plan- ing makes little sense on a titanium surface with its particular micro- and macro-structure. An implant should not be planed but detoxified and decontaminated without alteration of its smooth and rough surfaces and with recovery of the biocompat- ibility. Erosion with liberation of ions and metallic 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 phagocytized by macrophages, inducing the expression of pro-inflammatory cytokines activating osteoclasts maturation. On the surface of titanium implants we can find a self-repairable layer of TiO2 that shows a 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 particles. Frenquent et al. 18 analysed biopptic samples of bone and soft tissues from patients with severe peri-implantitis. In 75% of the biopsies it was possible to detect titanium accompanied by pro-inflammatory macrophages. Furthermore, the alteration of the oxide layer and the contamination of the surface by instrument’s debris result in an impaired cell adhesion and implant biocompatibility. In some in vitro studies, implant surfaces treated with stainless-steel curettes show a significantly lower number of attached fibroblast compared to untreated controls. Ultrasonic scalers with metal tips are effective in removing plaque from implant surfaces but cause damages mostly to the smooth surfaces, increasing the roughness and the possibility of new biofilm formation.

This is the reason why different materials curettes made have been introduced to not damage the implant surface (titanium-coated, carbon fibre, teflon, plastic). Same happened with ultrasonic devices: ehrhertone-coated tips have been proposed as an efficient scaling mean. Fox et al. 10 showed that plastic and titanium-allow curette produce significantly lower roughness on titanium surface compared to steel ones. Unfortunately, the softer the material, the more limited is the debridment power. Different non-metal curettes were found to be ineffective in removing bacteria and calcified deposits from smooth as well as rough titanium surfaces. They also show lack of flexibility which prevents an accurate cleaning of the threads.

Ultrasonic scalers with non-metal tips seem to be effective in removing bacteria from smooth surfaces but show controversial results with rough surfaces. 16

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 anfractuosit y other than being respectful of the metal surface. Sodium bicarbonate is proved to be highly effective in removing bacteria, in particular from rough implant surfaces and to be more efficient than plastic manual and mechanical instruments, independent of the surface characteristics. 11 The downside is that sodium bicarbonate can be harmful for soft tissues and can increase roughness of smooth surfaces. 12 This problem has been overcome thanks to low-abrasiveness powders such as glycine and erythritol, proven to be respectful of oral soft tissues. 13 Good in-vitro results are reported: glycine seems to be effective in removing bacteria from both smooth and rough surfaces. 14 Repeated use of glycine powder was not associated with any surface alterations, 15 making its use feasible for life-long implant maintenance. Schmage et al. 16 proved glycine powder to be as effective as ultrasonic instruments with PEEK tip in cleaning both smooth and structured surfaces. Drago et al. 17 analysed the in-vitro effect of erythritol powder finding that it shows even a 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. 18 analysed the effects of different instrumentations (stainless steel and plastic curettes, sodium bicarbonate and ultrasonic instruments) on the clinical parameters of prosthesis and implants, with particular attention on the efficiency of the method in removing the subgingival plaque and reducing the amount of the bacteria in the peri-implant area. No significant differences were found among the three different procedures. In the first group (non-surgical) it was possible to reduce the level of bacteria related to periodontal pathogens and to decrease the number of yeast and Gram negative bacteria; in the second (surgical) it was possible to reduce the level of bacteria related to perimplantitis and to decrease the number of yeast and Gram positive bacteria.

Fig. 17: Case 2. Implant surface debridement with piezo-ceramic device and PEEK tip.

Fig. 18: Case 2. Internal pocket line curette.

Fig. 19: Case 2. Second application of doxycycline 24h.

Fig. 20: Case 2. 12 months healing. PPD reduction and BOP absence are noticeable.

Fig. 21: Case 2. 12 months radiographic check.

Make Class II’s Count

Class II restorations are more important to your practice that you may think – they account for nearly half of all direct restorations. Getting them right the first time is the key to happy patients and profitability. Dentsply Sirona’s Class II Solution™ offers a portfolio of products designed to work together to deliver success at the most vulnerable interface – the floor of the proximal box – and achieve esthetic results. Make your Class II’s count with Dentsply Sirona’s Class II Solution™. www.dentsply.com

Our Class II Solution™ for a tight marginal seal and efficient esthetics
stainless steel and plastic-coated ul-
trasonic devices, two types of glycine
powders and one of erythritol) on
implants with simulated biofilm and
defect morphologies around rough
tooth surfaces and periimplantitis.
Sahm et al.22 studied the cleaning ef-
efficiency of the implant surface.
We obtained the in vitro results en-
couraging, in vivo evidence is still
insufficient. Sanders et al.23 ran a ran-
domized controlled clinical trial that
showed no significant differences in
cleaning efficacy of air-polishing
devices for the resolution of peri-
implantitis, specifically in severe cases.
Antibacterial and antiseptic mol-
edules have been proposed to boost
two or more systems, aiming to
destroy the microorganisms that
may be resistant to a single system.
Antibacterials and antiseptics such as
ciprofloxacin and chlorhexidine have
demonstrated in periodontology given their
broad-spectrum activity against the most
common commensal bacteria. Systemic
antibiotics such as tetracyclines were
widely investigated for their efficacy in
periimplantitis, focusing on severe cases.
A meta-analysis showed that tetracycline
in combination with local delivery was
effective for the treatment of initial/
moderate periimplantitis, and a recent
case-control study showed that a single
dose of locally delivered minocycline
was as effective as a 4-week course of
systemic antibiotic therapy with all
classes of tetracyclines. Doxycycline as a
local antibiotic has been used as an
adjunct to mechanical debridement allow
to achieve a higher BOP reduction over
mechanical debridement alone. So far,
there is no scientific evidence support-
ing the efficacy of the drug used.
Ernst et al.24 investigated the use of
erythritol as an alternative to glycine
powder and showed that the treatment
of initial/moderate periimplantitis with
erthyritol was proven to be the most
effective in assuring a contact between the
fibers and all the implant surface,
in particular in narrow and deep
pockets and to the implant surfaces,
easing the access to the periimplant
areas. Spongy, fibrous, and even bone
and cementum have been found in peri-
implantitis lesions decontamination.
Chlorexidine has been recommended in
clinical trials to effectively reduce the
bacterial elimination and to help
decolorizing the implant porous surface.
Chlorhexidine has shown to be ineffective in peri-
implant lesions decontamination. Pumma et al.25
could not find any PD reduction and only a limited BOP re-
duction after additional use of local 0.12% chlorhexidine irrigation and gel
plus 10 days of 0.12% chlorhexidine mouth rinse. Antibiotics constitute an additional option. Since peri-im-
plantitis is a very localized disease, we wouldn’t take into consideration systemic antibiotic therapy with all
the side effects it can bring. It’s im-
partant to notice that, to date, there
are no controlled clinical trials eval-
uating the effects of any systemic an-
tibiotic therapy. Locally delivered antibiotics can be released in a high
dose for many days, killing the bac-
teria in the un-removed biofilm. Tet-
racyclines have been widely investi-
gated in periodontology given their
broad-spectrum activity. Mombelli et
al.26 tested locally delivered 25% teta-
cycline as monolithic vinyl acetate fibers to be located around implants after a scaling phase with
plastic curettes and to be removed 10 days after. Clinical, radiographic
and microbiological parameters im-
poved 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 strug-
gle in assuring a contact between the
fibers and all the implant surface,
in particular in narrow and deep
defects. The use of different biode-
gradable carriers can give a better
and easier contact with the implant
structure and cut cut out the need
of internal pocket lining. Renvvers et al.27 tested a single dose of locally delivered mi-
nocycline as a coadjuvant of manual
dentition with curettes, compared
to chlorhexidine gel application. The
additional use of minocycline was
small but significantly higher both on PD and BOP. Butcher et al.18 inves-
tigated biological response to slow-release 8.5% doxycycline as an adjuvant to
debridment with plastic curettes plus mechanical oral hygiene instructions. The results were prom-
ising showing a significantly greater gain in mean attachment level PD and BOP improvement for the doxy-
cycline group. Minocycline seems to be the most effective local antibiotic available.

References:
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
- Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants. A revi-
sion and re-evaluation of the clinical impor-
...