Matilde N Hernandez Gonzalez, DDS, MS, MBA

Manage Patients in Peri-Implant Health

Upon completion of reading these articles, the clinician will be able to:

1. Use adjunctive therapies to enhance dental implant maintenance
2. Review treatment modalities used for peri-implant mucositis and peri-implantitis
3. Recognize the importance of establishing implant care protocols in the dental practice
As more and more patients are opting for dental implant treatment, it is essential that both the general dentist and hygienist understand how to properly maintain the health of the peri-implant tissue. It is estimated that more than three million Americans have dental implants with half a million more added each year (http://www.aaid.com/about/Press_Room/Dental_Implants_FAQ.html).

Although the success rate for dental implants is high, the dental implant and peri-implant tissues are susceptible to inflammatory lesions similar to those that occur on natural teeth. A recent systematic review in 2012 by Albrektsson T, & Donos N., has determined the 5 and 10 year implant survival rate to be 97.7% and 92.8%, respectively.

Among the peri-implant diseases, peri-implant mucositis is a reversible inflammatory reaction of mucosa that occurs in about 80% of patients and in about 50% of implant sites and is analogous to gingivitis around natural teeth (Zitzmann & Berglundh 2008).

Pocket probing and depth documentation is a routine part of monitoring the health of the soft tissue around natural teeth at the dental office, recording pocket depths around dental implants cannot be performed in the same way as recording pocket depths around natural teeth. Dental implants do not have a cementum layer covering the surface, and thus, a soft tissue attachment similar to natural teeth does not exist. What exists instead is a peri-implant soft tissue seal. In this seal, the junctional epithelium still attaches to the implant surface via hemidesmosomes, but the gingival fibers do not insert into the implant. Although collagen fibers bundles are present, they originate from the bone surfaces and run vertically and parallel to the implant surface (Berglundh 1991; Listgarten 1992).

**Peri Implant Health**

During the evaluation of the health of a dental implant, very gentle probing can be made without damaging the peri-implant seal. Unlike natural teeth, evaluating the health of a dental implant is not based primarily on pocket depths. A 6mm pocket could be present because plaque has caused the tissue to become inflammed, generating an implant pseudo-pocket similar to the pseudo-pockets seen around natural teeth. Alternately, this pocket may have been created purposefully when the implant fixture was placed. In the absence of plaque, bone loss, and associated inflammation, there is no need for any treatment, but to keep and reinforce good oral health habits (Ellen, 1998).

Inflammation is another critical factor that determines whether any treatment will be required. If there is inflammation, then the aetiology that is causing the inflammation needs to be addressed. Mucosa around implants becomes inflamed by plaque biofilm similar to that found on gingiva in natural teeth. The composition of these biofilms is similar to the subgingival bacteria of chronic periodontitis, dominated by Gram-negative bacteria. Notably, studies have generally reported Porphorymonas gingivalis and other red complex bacteria at higher frequencies in periimplantitis sites than healthy sites.

In healthy implants with stable probing depths of 5mm or less the flora is characterized by gram-positive cocci and small number of gram-negative species, brushing with regular fluoride
toothpaste may not control bacteria, so implant patients need effective long-lasting antibacterial protection against the regrowth of plaque biofilm.

Therefore, the question is: how can we best maintain dental implants based on evidence? The objective of a 6-month clinical study (Ramberg et al. 2009), was to compare the effects of the use of a dentifrice containing triclosan/copolymer and a regular fluoride dentifrice on peri-implant mucositis in subjects that had been restored with dental implants. Fifty-nine subjects with a mean age of 57 years (± 8 yrs) completed the clinical trial. Subjects who used the test toothpaste exhibited significantly less inflammation than those who used the regular fluoride dentifrice. Mean bleeding on probing (BoP) scores in the test group were significantly (p<0.001) reduced at both 3 months (-30.9%) and 6 month (-24.7%) compared to the baseline, whereas the control group showed no significant change. Furthermore, the mean change in BoP in the test group between baseline and 6 months was significantly different from the change in the control group (Fig. 1).

![Bleeding on Probing](image)

**Fig. 1:** Mean percentage of implant sites with bleeding on probing (BoP) at baseline (BL), 3 months and 6 months, and mean change between baseline and 6 months. Mean changes between BL and 3 months and BL and BL and 6 months were statistically significant in the group using Colgate Total® (* p<0.001). The mean BoP change in the test group between BL and 6 months was significantly different from the change in the control group (+ p<0.001).

The results show that Colgate Total® containing triclosan/copolymer and sodium fluoride reduced bleeding on probing at implant sites both over a 6-month period significantly better than a regular fluoride toothpaste.

Another implant study that demonstrated the importance of twice daily use of a triclosan/copolymer dentifrice, and concludes that Colgate Total® may enhance dental implant maintenance by reducing dental plaque and GI is the investigation conducted by Sreenivasan et al in 2010. The study objective was to evaluate the clinical and microbiological effects of routine oral hygiene with a triclosan/copolymer toothpaste on dental implants and natural teeth compared with a fluoride control toothpaste. In this 6-month, double-blind, two-treatment,
parallel group study, 60 subjects were randomly assigned to a triclosan/copolymer dentifrice group, and 60 subjects to a fluoride dentifrice control group. Subjects were provided a soft-bristled toothbrush and instructed to brush twice daily with their assigned toothpaste for the next 6 months. At baseline, 3, and 6 months, a calibrated dentist examined subjects for dental plaque, gingival index, and bleeding on probing and collected supragingival plaque from both the dental implants and contra-lateral natural teeth for laboratory testing. Analysis of the clinical variables was conducted on an “intention-to-treat” (ITT) basis with the subject as the statistical unit. ITT included all measured sites from all 120 subjects enrolled in the study with analyses conducted in accordance with randomized treatment assignment and statistical significance reported at p<0.05. Primary outcomes were clinical measures of plaque and gingival inflammation and secondary outcomes were microbiological changes.

The study was completed by 105 subjects. Subjects in the triclosan/copolymer dentifrice group demonstrated significantly lower levels of dental plaque and gingival inflammation at 3 and 6 months for both the dental implants and contra-lateral natural teeth compared with the fluoride dentifrice group (p<0.05), as shown in the following chart (figure 2).

A triclosan/copolymer with fluoride toothpaste reduces gingival index around dental implants:

![Chart showing reduction in gingival index](chart.png)

In addition, the substantially greater antimicrobial effects by the triclosan/ copolymer dentifrice were similar regardless of the surface evaluated, i.e. teeth or implants. Multiple comparison analysis in a reduced model determined effects for each microorganism on the implants or teeth. These analyses demonstrated significant effects on pathogenic microorganisms including A. actinomycetemcomitans, C. rectus, E. saburreum, F. nucleatum, P. melaninogenica, and T. forsythia, in addition to Streptococci and Veillonella sp (p 0.003).

**Peri-Implant Mucositis: Non-Surgical Management**

The non-surgical management of peri-implant condition focused on the reduction of inflammation by control of biofilm and reinforcing it with an everyday, at home treatment. Customized hygiene strategies (recommendation of specific brushes or interproximal devices) should consider the prosthetic supra-structure and the patient’s manual dexterity. The patient’s ability to perform regular and effective oral hygiene has an impact on the long-term success of implants. (Louropoulou, Slot, van der Weijden, Mechanical Self-Performed Oral Hygiene of Implant Supported Restorations: A Systematic Review).
In the dental office, mechanical therapy, typically involves the use of curettes for supra and subgingival biofilm removal. The implant literature describes the use of resin, carbon or titanium curettes and special tips for ultrasonic instrumentation; the principle is that the implant should be cleaned with material less hard than titanium. Other devices used in mechanical approaches include rubber cup/polishing brushes and air powder flow devices. Air abrasive powder systems, originally used for removal of bacterial biofilm on teeth, have been applied to the treatment of peri-implantitis. Variants of this technique use a slurry of water/sodium bicarbonate or glycine powder delivered by pressurized air and water. A proper angulation of the tip, away from the implant surrounding gingival tissue, is critical to avoid unwanted damage.

With regard to peri-implant mucositis, anti-infective therapy in the form of mechanical debridement, with or without local/systemic antibiotics, has been shown to be effective during in vivo studies of both humans and animals. Trejo et al., showed that mechanical debridement with or without the adjunctive use of chlorhexidine resolved mucosal inflammation in monkeys affected by peri-implant mucositis, both clinically and histologically. A study of 25 patients Mombelli et al 2001, in which successful treatment was defined as implant survival with no mean pocket depths greater than 5 mm and no further bone loss, reported that 84% of participants treated with nonsurgical mechanical debridement and an adjunctive tetracycline fiber had successful treatment outcomes 12 months post-therapy.

The most important determinants of successful outcomes when using nonsurgical mechanical debridement to treat peri-implant lesions are the initial depth of the lesions, the amount of bone loss associated with the lesions, and the ability to fully debride implant surfaces. Nonsurgical therapy appears most effective when the lesion is confined solely to the soft tissue at sites with no bone loss. A consensus has not been achieved with regard to nonsurgical therapy when bone loss has occurred. Schwarz et al. 2006 study suggest that nonsurgical interventions are effective when bone loss is present, but only when it is less than 25% of the implant length.

Determining the etiology of the lesion is the first step in developing a treatment plan for peri-implant mucositis. When plaque biofilm is the definitive cause, a diagnosis can be made according to the classification of the peri-implantitis lesions published by Froum and Rosen in 2012. The authors defined a treatment protocol as follows: If a lesion is confined to the soft tissue without bone loss and complete implant surface decontamination is possible, needle-free sulcular anesthesia is administered with a combination of benzocaine/butamben/tetracaine. Mechanical debridement with appropriate titanium curets is then performed. Doses of 1 mg minocycline spheres are placed on the mesial and distal of the implant lesion. The patient is also prescribed systemic antibiotics for 10 days, consisting of 500 mg of metronidazole and 500 mg of amoxicillin twice daily. Follow up is performed at 2-week and 4-week intervals. This protocol has proven successful in resolving inflammation, although there are still exceptions.

When gingival recession is present at both the 4-week and 12-month intervals. Patients must be advised about this possible sequelae prior to receiving treatment. If, however, the inflammation has not resolved after 1-month of nonsurgical therapy, surgical intervention may be deemed necessary (flap surgery, with or without regenerative therapy).
Peri-Implantitis Surgical Management

When implant associated probing depth and bone loss is advanced or persists, despite the initial non-surgical treatment provided, a surgical intervention of peri-implantitis is required. The surgeon (a referral to a periodontist is recommended) managing peri-implantitis will rely upon approaches analogous to periodontal surgical approaches, ranging from resection to regeneration.

Surface decontamination strategies used in nonsurgical approaches may be applied now with the benefit of open access, created by an elevated gingival flap. Also, the removal of diseased granulation tissue and access to underlying bony architecture is facilitated. Bone morphology guides the selection and composition of the surgical procedure. With only mild horizontal bone loss around implant(s), an apically positioned flap coupled with implantoplasty is suggested. In implantoplasty, high quality diamond burs and adequate irrigation/evacuation are used to smooth the roughened implant surface to become less plaque retentive, thus reducing the progression of peri-implant bone loss.

A summary of current major implant surface decontamination strategies is presented. Photodynamic therapy (PDT), though not commonly employed in private practice, has a growing body of clinical investigations into its use as an implant decontamination strategy. PDT employs a photo-sensitizer dye that reacts to low intensity visible light, between 660 nm and 905 nm, that forms a cytotoxic species in the presence of oxygen. DNA or cytoplasmic membrane damage of bacteria are likely mechanisms of PDT.

Mechanical means

- Implantoplasty with rotary instrumentation
- Air powder abrasives
- Curettes (e.g., resin, carbon-fiber)
- Power instrumentation with specialized plastic tips

Chemical means

- Saline
- Hydrogen peroxide
- Chlorhexidine
- Citric acid
- Tetracycline
- Lasers
- Photodynamic therapy
Surgical access will usually involve a full-thickness flap to allow access and cleaning of the contaminated implant surface. Here, the goal is to remove biofilm and create a theoretically compatible surface for re-osseointegration. Literature supports the use of various agents (e.g., saline, abrasive pumice, citric acid, chlorhexidine, and hydrogen peroxide) in surface decontamination as adjunct to surgical debridement. While these supplements had favorable influence on re-osseointegration, no agent was found to be superior. Lasers have also been used to decontaminate peri-implant sites once surgical access has been established. Human clinical studies have investigated CO2 and Er:YAG lasers used as a surgical adjunct in decontamination; currently, it is difficult to conclude what additional benefit or contribution laser decontamination provides to surgical access.

Regenerative approaches can be used in conjunction with surgical access, drawing upon the paradigms used in managing periodontal defects associated with teeth. Containable bony defects—walled defects associated with the implant—should be more amenable by grafting to favorable gains in bone fill and reductions in probing depth. Debridement and implant surface decontamination are still essential prior to regenerative treatment, as the infection must be completely eliminated before application of bone graft. Patient risk factors, such as smoking, poorly controlled diabetes, and unsatisfactory oral hygiene, may hamper the success of peri-implant defect regeneration.

At present, heterogeneity of study designs and study quality prevent strong conclusions on the efficacy of regeneration in treating peri-implantitis. Still, there is promise in surgical studies demonstrating the maintenance of probing depth improvements or bone fill at almost three years out. Notably in these studies, implant maintenance was a crucial component of periimplantitis treatment, which presumably played a part in achieving the aforementioned results. Most recently, Chan and colleagues in 2014, conducted a systematic review and meta-analysis on the efficacy of surgical treatments for peri-implantitis. While the use of grafting and membranes tended to yield greater improvements in probing depth and defect fill, the authors cite the need for higher quality and longer-term investigations.

Radiographic assessment is important in identifying bone loss associated with peri-implantitis. Again, in conjunction with probing, radiographs aid in developing a proper picture of the underlying osseous topography of putative peri-implantitis cases. In the progression of the peri-implantitis, severe bone lesions and crater-like defects may form. Comparisons should be made to a baseline radiograph from the time of prosthetic ‘connection’ to the implant. Thus, stability confirmed by serial radiographs taken on an annual basis during implant maintenance would be congruent with a clinician’s diagnosis of health or peri-implant mucositis.

Mobility of an implant is a terminal clinical sign, removal of the failed implant is warranted. The osseointegrated dental implant does not have any connective tissue fiber attachments between the bone and the implant. As a result, mobility is a concerning finding suggesting the loss of direct bone-implant contact that leads to the loss of stability. There is minimal clinical science at this time indicating any ability to achieve a stable long-term therapeutic outcome from treating implant mobility.
Conclusion

As the number of patients with dental implants increases and with the prospect of dental implant therapy assuming a greater role in dental practice, clinical investigations have focused on the prevention and management of diseases of successfully osseointegrated dental implants (Klinge et al. 2005).

The purpose of this article was to discuss the special attention required for dental implants and their prosthetics, and to highlight their need maintenance protocols at home. There are several items that should be documented during the maintenance appointment and some actions that should be taken at home, one of them, includes the use of a sustained antibacterial toothpaste containing triclosan/copolymer. Colgate Total is the only toothpaste clinically proven to reduce plaque bacteria for up to 12 hours to help treat peri-implant mucositis.

Given the greater clinical success achievable in managing periimplant mucositis compared to the compromised osseointegration of peri-implantitis, the contemporary dental practice must establish protocols to assess restored implants and associated peri-implant tissues. Prevention and early interception of etiology and contributing factors associated with peri-implant disease should be emphasized.
References


