Peri-implant Infection Concomitant with a Flare-up Episode of Chronic Periodontitis: An Unusual Regeneration Following Treatment and a 5-Year Follow-up

Georges Tawil, DDS, D.Sc Od. FICD, FACD
Peter Tawil, DDS, MS, ABP

Chronic periodontitis progression may go through phases of remission and exacerbation. The possibility of periodontal pathogens translocating from infected periodontal sites to peri-implant sites has been reported. Additionally, a history of periodontal disease seems to be a risk factor for peri-implantitis. The present case reports a flare-up of chronic periodontitis concomitant with an episode of peri-implant infection on a documented stable implant site. Periodontal infection was managed nonsurgically by scaling root planing and antibiotic treatment. Peri-implant infection was treated by open-flap debridement and implant surface decontamination. A remarkable regeneration on the peri-implant defect occurred steadily over a 3-year period, leading to a full regeneration of the site relying exclusively on the individual healing resources. Int J Periodontics Restorative Dent 2019;39:415–421. doi: 10.11607/prd.3940
reported in a few clinical studies.\textsuperscript{11–13} Mombelli et al.\textsuperscript{13} studied the presence of periodontal pathogens in peri-implant sulci 3 to 6 months after their exposure to the oral environment of periodontally diseased patients; they concluded that a high prevalence of anaerobic pathogens are present around implants, but the presence of one particular organism around implants and its previous detection in the deepest periodontal pocket in the same patient could not be established. Colonization of periodontal and peri-implant pockets by \textit{Porphyromonas gingivalis} and \textit{Aggregatibacter actinomycetemcomitans} from the same strain was reported in a clinical study on 15 patients,\textsuperscript{14} and it was concluded that the elimination of these pathogens before implant treatment may prevent their colonization and reduce the risk of peri-implantitis. Although better implant survival has been reported in patients without periodontitis compared to periodontally compromised ones,\textsuperscript{15} results from a meta-analysis recommend interpreting results with caution due to uncontrolled confounding factors and lack of randomization.\textsuperscript{16} Regardless, more evidence is needed to determine whether patients treated for periodontitis experience more implant loss and complications than those patients without periodontitis.\textsuperscript{17}

The evolution of periodontal diseases was extensively studied in the 1980s.\textsuperscript{18,19} Periods of remission and exacerbation have been described. However, more recently, little has been reported on the occurrence of periodontal flare-ups on peri-implant stability. Here, the present authors report a case of acute exacerbation of a fairly controlled chronic periodontitis and its influence on a previously stable peri-implant condition.

**Case Report**

A 50-year-old male patient reported to the authors’ office in 2004 for the replacement of his missing mandibular right molars (teeth 46 and 48 [FDI tooth numbering system]). The patient was systemically healthy and was not under any medications at the time of consultation. His dental record showed a history of chronic periodontitis with moderate pocket depth, Miller Class I and II gingival recessions, and a bleeding on probing (BOP) index of 20% that was diagnosed 15 years earlier and treated over time with nonsurgical and surgical therapy. The patient followed several sessions of scaling, root planing, and open-flap debridement and osseous surgery were performed on two quadrants. The patient was not compliant, and his maintenance program was irregular, with few control visits over the follow-up period. Two Brånemark machined-surface implants, an 11.5 $\times$ 3.75 at site 46 and an 8 $\times$ 5 RP-system screw at site 48 (Nobel Biocare), were placed in September 2003. Four months later, Mirus Cone abutments (Nobel Biocare) were connected and the patient’s referring dentist placed a three-unit screw-retained fixed restoration (Fig 1). The patient was under maintenance care by his general dentist and consulted him irregularly for periodontal follow-up. A control radiograph was taken in 2006 that confirmed implant integration and marginal bone stability (Fig 2).

He was seen again by the authors in June 2010 for the replacement of
teeth 15 and 16, lost due to mobility and advanced periodontitis. Two TiUnite implants (Nobel Biocare), 13 × 3.75 mm at site 15 and 10 × 4 mm at site 16, were placed along with an external sinus floor elevation. Multi-unit abutments were connected and two splinted, screw-retained crowns were placed 6 months later. Retroalveolar radiographs were taken in February 2011 to check the stability of the mandibular molar implants (Fig 3). The peri-implant bone was very stable with no significant marginal bone loss. Oral hygiene was reinforced and the patient was urged to follow a more strict periodontal supportive therapy.

In October 2011, two select TiUnite implants (Nobel Biocare), a 10 × 4.3 mm and 10 × 5 mm, were inserted to replace teeth 35 and 36, respectively. In February 2012, abutments were connected and two cemented implant-supported crowns were placed.

The patient returned for consultation in October 2013 for a flare-up of his periodontal condition, predominantly in the maxilla. Severe pocket depth (5 to 7 mm), BOP, and Miller Class II gingival recessions were found at teeth 12, 13, 17, 23, 24, and 27. Limited pocket depth and BOP were observed on mandibular teeth. Bone loss measuring 5 mm was diagnosed at implant site 48 (Fig 4a). All other implants were stable with no significant bone loss (Figs 4b and 4c). The patient was advised on the necessity of a strict periodontal treatment to stabilize his condition and he complied. Four consecutive visits of full-mouth scaling, root planing, and oral hygiene reinforcement were done on a weekly basis. Tooth 17 was extracted because of severe bone loss adjacent to the implant at site 16. A 1-week course of antibiotics (500 mg amoxicillin and 500 mg metronidazole, tid) was prescribed to enhance healing. The condition improved drastically 1 month later. Occlusion was checked and proved to be stable. However, BOP and a 7-mm pocket depth were still present at implant site 48. Open-flap debridement and decontamination of the implant surface were therefore indicated in order to stabilize the condition. A mucoperiosteal flap was raised and the site thoroughly curetted using Gracey periodontal curettes. A 5-mm circumferential defect was observed. Decontamination of the implant surface was done by rubbing the surface for 2 minutes with cotton soaked in Betadine (Mundipharma). The site was washed several times with H₂O₂ 10-volume solution, and the flap was sutured in place using 40 re-sorbable vicryl sutures with no attempt at bone regeneration (Fig 5). A 1-week course of antibiotics was prescribed (500 mg amoxicillin and 500 mg metronidazole, tid). The patient was advised to maintain a strict hygiene regimen and was placed on a 3-month recall program. A 10 × 5 mm TiUnite (Nobel Biocare) implant was placed in site 17 to replace the missing molar. The patient responded very favorably to treatment. No BOP could be seen, and the PD, mobility, and clinical attachment levels improved drastically at previously periodontally involved teeth and were within normal limits following the initial phase of treatment. Because of the patient’s excellent personal care, the maintenance protocol was reduced to one visit every 6 months. Radiographs were taken at these...
visits to monitor the healing, and all parameters of periodontal health were recorded. Peri-implant bone loss at site 48 began to steadily reverse. Bone was seen regenerating at the pace of 1 to 1.5 mm a year. At 4 years post-treatment, a full regeneration of peri-implant bone could be observed (Fig 6). A cone beam computed tomography scan was taken in March 2018 to confirm the full regeneration of the site (Fig 7), and clinical images show stability and absence of inflammation in the treated area (Fig 8).

Fig 5 Late 2013 or early 2014. (a) Open-flap debridement of the infected implant. Note the defect configuration. (b) The flap was sutured following curettage and implant surface decontamination. (c) Radiograph showing the situation following surgery.

Fig 6 Note the progress of bone regeneration over time: (a) 2013; (b) 2014; (c) 2015; (d) 2016; (e) 2017. Bone steadily grew at a rate of 1 to 1.5 mm per year until full regeneration in 2017. Blue arrows point to bone levels.

Fig 7 (left) Cone beam computed tomography scan of the mandible taken in 2018, at 5 years after therapy, confirming full site regeneration.

Fig 8 (right) Clinical situation 4 years after treatment. Note the peri-implant soft tissue level at site 48.
Discussion

Total regeneration of a 5-mm combined peri-implant lesion following an acute infection concomitant to a flare-up of chronic periodontitis is truly unexpected and not reported when an open-flap debridement is only done in the absence of grafting or guided bone regeneration (GBR). In experimental defects created around implants, only four-wall defects resolve completely in healing.20 Open-flap debridement used in conjunction with systemic antibiotics proved to be successful at 12 months in 46.7% of one study’s treated cases, reducing pocket depth (to < 5 mm), bleeding, and suppuration and showing no further bone loss.21 When Jepsen et al22 compared flap debridement to reconstructive surgery in the treatment of peri-implant defects, no significant difference in complete resolution of peri-implantitis (probing depth ≤ 4 mm, no BOP at six implant sites, and no further bone loss) was found. This result was obtained at 30% of implants in the test group and 23% of implants in the control group. Reconstructive surgery using porous titanium granules resulted in significantly enhanced radiographic defect fill compared with flap debridement.22 In another study, no signs of healing were evident in rats, even after an observation period of 22 weeks, in sites where no membrane was used to cover bone defects. The same results were obtained on the rabbit skull, where supra-calvarial soft tissues occupied the defect with no evidence of bone formation at non-covered sites.23

Although it is difficult to prove the causative link between the periodontal and peri-implant infections in the absence of a microbial investigation, the concomitance of those two episodes and the remarkable healing of the periodontal and peri-implant lesions following treatment of the infection may indicate a potential association between them. It is important to note that site 48 in the patient’s mouth was the only one infected while all other implants, a total of seven, placed in different locations in the maxilla and mandible were disease-free. The exceptional healing obtained and the time needed to reach full regeneration of the defect, relying exclusively on the individual healing potential in the absence of any graft, membrane, or device to guide the healing, are worth further investigation. The regenerative process progressed steadily at the rate of 1 to 1.5 mm per year and was complete at 3 years with no clinical intervention besides regular prophylaxis and the patient’s meticulous oral hygiene. The underlying complex biologic healing mechanism; the cells involved in the regenerative process; and the interaction and expression of genes implicated in cell differentiation, extracellular matrix formation, angiogenesis, and osteogenesis need further investigation.

Recent literature recognized the remarkable regeneration potential of the periosteum and its underlying molecular process24; however, its cambium layer atrophies and thins dramatically with age, becoming less responsive to stimulation and having less reparatory potential.25 Spontaneous self-regeneration of the mandible following large resective surgeries has been reported, where periosteum intactness, vascularity, thickness, and activity seem to play a major role.26,27 Periosteal cells, pretreated with basic fibroblast growth factor and subjected to bone morphogenetic protein 2, showed a greater proliferative and osteogenic potential compared to marrow stromal cells28 and can be a highly useful source of bone regeneration. Mesenchymal stem cells deriving from the periosteum or bone marrow demonstrate great osteogenic potential and capacity to regenerate bone.29 A large number of genes encoding for cell differentiation and matrix formation seem to be involved at different time points, and their complex expressions and incompletely elucidated interactions result in defect regeneration.30 Regulators of these processes, such as cytokines, growth factors, transcription factors, and signaling pathways, were also identified. The adjacent marrow multipotent progenitor cells and endosteum cells seem to also be included in the healing mechanism. Their recruitment, differentiation, and the process of osteogenesis and bone remodeling are controlled by pro-inflammatory cytokines, growth factors, and bone-specific transcription factors.21

The effect of bone marrow–derived cells associated with guided bone regeneration on peri-implant dehiscence defects was investigated in a histologic study in dogs.32 Bone-to-implant contact, bone fill within the thread, new bone formation in a zone lateral to the implant,
and new bone height at the bottom of the defect were determined. Aside from bone formation from implant threads, there was no difference in the osteogenic potential presented by bone marrow cells between those associated with GBR and those without.

Periosteum-derived cells appear to have osteogenic potential and produce bone fill when implanted in dehiscence-type peri-implant bone defect in dogs whether or not they are associated with GBR, but higher means of bone area lateral to the implant were obtained when these cells were combined with GBR. Limited regeneration was obtained in the nontreated group.33

In an immunohistochemical study in dogs, Schwartz et al34 demonstrated that angiogenesis, osteocalcin anticity, and new bone formation mainly arose from open bone-marrow spaces at the bottom of the defect and invaded the dehiscence areas along the implant surface and bone grafting material. When a stiff polyactic acid dome was used as a barrier and the defect was filled with blood or deproteinized bone mineral on a calvarial rabbit defect, Schmid et al35 demonstrated that natural bone mineral fill contributed to accelerating initial bone neogenesis but did not contribute to increasing bone volume or height at a later stage of observation.

Most experimental studies on the regenerative potential of mesenchymal stem cells (MSC) selected similar histologic parameters to demonstrate their efficacy: bone-to-implant contact (BIC), new bone formation, bone density, bone height, first BIC height, ratio of reossointegrated bone height, bone fill, and bone width. Autogenous or xenogenous MSC, bone marrow, or periodontal ligament–derived MSCs were used to treat peri-implant defects in dogs. They underwent in vitro osteogenic differentiation before being placed in peri-implant defects. Conflicting results were obtained, with some studies demonstrating higher new-bone apposition compared to scaffolds alone32 while others failed to demonstrate better histologic and tomographic outcomes.36

Conclusions

Based on the current literature, it remains difficult to explain the total regeneration of this peri-implant defect and the time sequence that led to it, though it seems reasonable to assume that periosteum- and marrow-derived mesenchymal stem cells may have been at the origin of this process. The complex healing mechanism that resulted in the full reconstruction of the defect in the absence of any device or chemical mediators remains unclear and needs further investigation.

Acknowledgments

The authors declare no conflicts of interest regarding the publication of this article.

References


