Peri-implantitis: A Concern for Implant Failure

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ABSTRACT

Peri-implantitis is a site-specific inflammatory destructive disease that affects both soft and hard tissues around an osseointegrated implant in function. It leads to the formation of peri-implant pocket formation, which subsequently leads to loss of surrounding bone and ultimately implant failure. Implant failure can also be associated with improper surgical placement of implant, occlusal overload, or wrong prosthetic design. Loss of crestal peri-implant bone is associated with either bacterial infection or biomechanical factors related to implant overloading. Bacterial infection of surrounding peri-implant bone can be managed either by nonsurgical or by surgical intervention. Nonsurgical treatment methods are unpredictable and have limitations. Detoxification of implant surface with various periodontal regenerative procedures have shown a good result. The purpose of this paper is to review the literature with regard to etiology, diagnosis, prevention, and management of peri-implantitis.

Keywords: Implant failure, Osseointegration, Peri-implantitis.


Source of support: Nil
Conflict of interest: None

INTRODUCTION

Dental implant has become a common treatment modality for replacement of missing tooth in partially or completely edentulous cases, with reliable long-term results.1 High predictability with various treatment options makes it highly acceptable for the patient. Although dental implant has been reported with a very long-term success, some complication may arise. These complications may be associated with wrong treatment planning, improper surgical and prosthetic execution, and poor oral hygiene maintenance during postimplant phase.2 It has been reported that over a period of 5 years, up to 14.4% of the dental implants demonstrated peri-implant inflammatory reactions which were related to crestal bone resorption that may eventually lead to implant failure.3

Peri-implant diseases have been found in two forms: Peri-implant mucositis and peri-implantitis. Both conditions are associated with an inflammatory reaction in peri-implant tissues. Peri-implant mucositis is confined to the soft tissues surrounding a dental implant without involving supporting bone while peri-implantitis is characterized by an inflammation of soft tissue and progressive loss of surrounding bone.4 It is often associated with bleeding on probing, change in consistency and color of surrounding soft tissues, probing pocket depth, mobility, and radiographic evidence of supporting bone loss. Consider the presence of only circular fiber as a per-mucosal seal around implant, the rate of progression of inflammatory process is more pronounced around dental implant than natural tooth.5-6

ETIOLOGY

There are various factors which affect peri-implant environment and related with complex etiopathogenesis of peri-implantitis.7 Accumulation of biofilm over the implant surface initiate bacterial infection which subsequently develops into peri-implant diseases. Accumulated plaque leads to inflammatory responses which result into accumulation of large number of inflammatory cells in subepithelial connective tissue, and subsequent apical progression of plaque results into supporting bone loss, such as periodontitis. Literature have reported same microbial involvement for both periodontitis and peri-implantits.5,6,8 These includes Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Peptostreptococcus micros, Campylobacter rectus, Tannerella forsythia, and Fusobacterium species.

Peri-implantitis and periodontitis are similar in many aspects including host response and increase in proinflammatory cytokines, for example, IL-1, IL-6, IL-8, IL-12, and tumor necrosis factor alpha. The only difference between these two lies in progression and rate of destruction of
supporting structures. The increased susceptibility and high rate of progression of peri-implant disease may be related to the absence of inserting collagen fibers into the implant.2,9

The other etiological factors associated with peri-implantitis are patient related, which include systemic diseases – for example, diabetes mellitus and osteoporosis. Various other factors like inadequate oral hygiene, smoking, and drug abuse also increase risk for peri-implant diseases. Presence of parafunctional habits, such as bruxism and iatrogenic factors, such as lack of primary stability and premature loading during the healing period make implant more prone to peri-implant diseases.10

**DIAGNOSIS OF PERI-IMPLANTITIS**

Long-term success of dental implants depends mainly on the healthy peri-implant hard and soft tissues and an appropriate force distribution to the implants. Early detection of the peri-implant diseases is important considering its unpredictable and complex treatment protocol. Diagnosis of peri-implantitis should be based on the following considerations:

- **Clinical appearance**: To diagnose a compromised implant site, soft tissue evaluation using manual or automated plastic probes are recommended. Careful monitoring of pocket probing depth and clinical attachment level over time is useful in detecting changes of the peri-implant tissue. Besides pocket formation, suppuration, swelling, color changes, and bleeding on probing have been documented as clinical signs of peri-implantitis. Implant mobility indicates early and late failures, which may occur after loading of the implants with the suprastructure.2,11,12

- **From and Rosen**13 proposed a classification for peri-implantitis based on the severity of the disease, using a combination clinical appearance, and the extent of radiographic bone loss around the implant:
  - **Mild in classification**
    - Probing depth ≥ 4 mm (suppuration and/or bleeding on probing)
    - Bone loss < 25% of the implant length
  - **Moderate**
    - Probing depth ≥ 6 mm (suppuration and/or bleeding on probing)
    - Bone loss 25 to 50% of the implant length
  - **Advanced**
    - Probing depth ≥ 8 mm (suppuration and/or bleeding on probing)
    - Bone loss > 50% of the implant length

**MANAGEMENT OF PERI-IMPLANTITIS**

Treatment plan for management of peri-implantitis depends on its etiology. If peri-implantitis is associated with biochemical forces, then the first phase of treatment plan involves an evaluation of occlusion, position, and number of implants and analysis of given implant prosthesis. Immediate intervention as a first phase therapy includes occlusal equilibration and change in implant prosthetic design. These intervention results into arrest and progression of peri-implant tissue. The second phase consists of surgical intervention for elimination or reduction of the deep peri-implant soft tissue pockets or regeneration of surrounding bone.14

Presence of biofilm and microorganisms has been considered as a primary factor for initiation and progression of peri-implantitis. In these types of cases, main objectives in management of peri-implantitis are to reduce microbial load from implant surface. Mechanical elimination of bacterial microbiota introduces an environment capable of suppressing the subgingival pathogenic anaerobic flora. Both nonsurgical and surgical techniques can be employed in management of peri-implantitis.15

**Nonsurgical Approaches**

It includes removal of plaque from the implant surface, and for this various plastic scaling instruments are used. Use of plastic instruments decreases chances for roughened implant surface. However, implant surface damage can almost be prevented by using either ultrasonic scalers with a nonmetallic tip or resin/carbon fiber curettes.16,17

Polishing of all the accessible surfaces with pumice after scaling reduces the chances of plaque adherence to the implant surface. Subgingival irrigation of all peri-implant pockets with 0.12% chlorhexidine and local drug delivery in form of tetracycline fibers and minocycline spheres have shown beneficial effects.17 Systemic administration of antibiotics has also shown beneficial effects in adjunct to mechanical debridement. Lang et al18 suggested the use of systemic ornidazole 500 mg twice a day for 10 days or metronidazole 250 mg thrice a day for 10 days or a once daily combination of metronidazole 500 mg and amoxicillin 375 mg for 10 days. Laser decontamination of implant surface and peri-implant tissues have shown positive effects on reosseointegration. GaAlAs laser has shown the best effect without altering implant surfaces. Subramani and Wismeier19 have suggested combination of laser decontamination with chlorhexidine or saline solution for achieving greater percentage of reosseointegration.

Various chemotherapeutic agents have also been suggested for implant surface decontamination like contact with a supersaturated solution of citric acid (40% concentration; pH1) for 30 to 60 seconds. They have the highest
potential for the removal of endotoxins from both the hydroxyapatite and the titanium implant surfaces.20

Surgical Approaches

Persistent presence of infection leads to deeper tissue involvement, and surgical intervention will be must. This intervention includes both resective and regenerative procedures, based upon morphology of defects. Resective surgery reduces pocket depth and secures adequate soft tissue morphology in order to facilitate adequate oral hygiene maintenance and peri-implant health.15 Resective procedures include ostectomy or osteoplasty, with the raising of an apical repositioning flap and implantoplasty.21

Regenerative therapy includes uses of various bone grafts materials and guided tissue regeneration (GTR) membrane for regeneration of lost bone. This procedure, as a prerequisite, requires decontamination of implant surface. But, unfortunately, regenerative procedures are not very predictable in all peri-implantitis cases. Cases with thin buccal and lingual cortical plates do not show very positive results.22 The long-term success of periimplantitis treatment requires a program of periodic oral hygiene maintenance, including supra- and subgingival plaque removal.

CONCLUSION

Dental implant has become a common treatment option for replacement of missing teeth. Recent literature has shown high prevalence of peri-implantitis. Although, nonsurgical and surgical treatment modalities are available for management of peri-implantitis, it is required to diagnose of peri-implantitis in early phase of disease. Earlier diagnosis and intervention gives more predictable and positive results. Periodic recall and proper oral hygiene maintenance should be an integral part of implant maintenance therapy.

REFERENCES