A REVIEW: PERI-IMPLANTITIS – MANAGEMENT.

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ABSTRACT: Dental implants have 89% above survival rate at 10 to 15 yrs, but periimplantitis or dental implant infections may be as high as 14%. Periimplantitis can limit clinical success and impose health and financial burdens to patients and health providers. Pathogenic bacterial species of periodontitis (e.g.: fusobacterium spp, A.A.comitans, P.gingivalis,) are also associated with periimplantitis. Incidence of periimplantitis is higher in patient who smokes or poor oral health as well as with calcium phosphate coated or surface roughened implants. Antibiotics have been used in the treatment of periimplantitis as fibers, gels, and beads to deliver the drug. Guided tissue regeneration membranes loaded with anti bacterial preparations are used in osseointegration at periimplantitis zone. Experimental approaches include the development of anti-bio-adhesion coatings, (e.g.,vancomycin, ag, zn,) coating surfaces with antimicrobial agents(e.g., calcium phosphate, polyactic acid) or antimicrobial releasing coatings(e.g., calcium phosphate.poly lactic acid, chitosan). Future strategies include the development of surfaces that become antimicrobial in response to infection, and improvements in the per mucosal seal. Research still needed to identify strategies to prevent bacterial attachment and enhance normal cell / tissue attachment to implant surface.

KEYWORDS: Dental Implants; Periimplantitis; Antibiotics delivery/release; Surface modification.

INTRODUCTION
The use of implants has been developed significantly during the past two decades. Dental implant complications have been classified as follows: compromised successful implant (presence of inflammation and fistula near a successfully osseo-integrated implant), failing implant (increasing bone loss in a functional implant) and failed implant (infection around a compromised implant). According to Mellonig et al, implant failures can be placed in two categories; namely, failure due to infection (periimplantitis or retrograde periimplantitis) and failure due to trauma (excessive overloading or implant fracture). Meffert et al categorized problematic implants into ailing, failing or failed. Ailing implants demonstrate bone loss with pocket formation which is static at maintenance phases. Failing implants demonstrate bone loss with pocket formation, bleeding upon probing and exudates. Failed implants are clinically mobile. All these failures categorised into two. Biological 2.Biomechanical. Biomechanical failures are associated with functional loads exceeding the implant-bone interface due to overloading condition such as bruxism/clenching and fracture or mechanical damage to implant or super structure. Biological failures are associated with microbial plaque accumulation and fibrointegration due to surgical trauma. Biological failures again divided into early and late failures. Early failures are associated with dental implant infection as result of contaminated surgical placement or impaired host healing. Late dental implant infections generally occur after more than one year of placement is termed plaque induced periimplantitis. Infections of dental implant impose significant health emotional and financial burden to both patient and health providers. In this review providing implants diseases associated with bacterial infections and how to reduce periimplant diseases.

Dental implants-surgical techniques
Dental implant systems have different designs, size, and material according to manufactures considerations. Many modern implants are cylindrical with screw and various size 3-5 mm diameter, 7-20 mm length, to meet different anatomical, clinical considerations. The dental implants are made up of commercially pure titanium, or titanium-6, aluminium-4, vanadium alloy due to their biocompatibility, mechanical properties and ease of manufactures. Implants are also coated with calcium phosphate ceramic material to enhance the implant-bone compatibility, but not used in bulk because poor toughness. The implant superstructures (crown, bridge, and denture) are attached to implants via screws or adhesive cements.

Osseointegration is defined as the “process whereby clinically asymptomatic rigid fixation of alloplastic material is achieved and maintained in bone during functional
loading. From histological point, this is the intimate apposition of bone tissue to the implant without intervening fibrous tissue. The establishment of osseointegration of the implant. The permucosal seal protects the body of the implant from the microbial communities of the oral cavity, which can prevent or reverse the osseointegration.

Perimplant diseases

Bacterial dental plaque formation around dental implants can lead to inflammatory reactions which results loss of osseointegration. Perimplant disease is general term used host tissue inflammatory reaction. Perimplants infections are two types: perimplant mucositis and perimplantitis. Perimplant-mucositis defined as reversible inflammatory reaction in soft tissue surrounding an implant. And perimplantitis is defined as "inflammatory process affecting the soft and hard tissues surrounding an osseointegrated implant resulting in rapid loss of supporting bone and associated with bleeding and suppuration. However perimplant diseases are not considered as implant failure because there are treatments that may be used in an attempt to stop the infection progression.

Dental plaque, peri-pathogens, and pathogenesis:

Dental plaque is a biofilm found on natural tooth and restorative surfaces. Plaque is composed of a different microbial community with up to 1000 various bacteria embedded in plaque matrix. The microflora composition of dental plaque changed to acid producing bacteria or gram negative anaerobes with time can lead to perimplantitis. The peri-pathogenic species of natural dentition (periodontitis) and dental implants (peri-implantitis) are essentially the same. However, it is important to understand that many periopathogenic species are endogenous to the oral cavity and can be found patients without teeth or implant disease in very low number. The successful implants are reported to be populated with gram positive coccoid cells, very few rods, a low ratio of anaerobes/aerobes and a low number of gram negative anaerobes. The infected and failing implants show greater proportion of periodontal pathogens, including gram negative anaerobe rods, motile rods, fusiform bacteria and spirochetes than nonfailing implants.

After implantation of implant, pathogenic bacteria move from periodontal pockets, tongue, tonsils, and inflamed gingival to colonize on dental implant surface. Bacterial colonization first appears on transmucosal abutment of implant surface, adherence and colonization of microorganisms on implant surface starts at irregular surfaces supragingivally and spreads down apically. This is why implants with rough surfaces are associated with increased bacterial accumulation and higher incidence of peri-implant disease, especially in periodontally compromised patient.

With plaque maturation and a shift in microbiota to a higher proportion of periopathogens, an inflammatory infiltrate develops in mucosal tissues, also known as permucositis. The infiltrate is dominated by plasma cells and PMN cells. This inflammatory reaction can lead to proliferation and over growth of sulcular epithelium, degeneration of connective tissue around the abutment, loss of permucosal seal, and epithelial migration. This lead to developing of bone lesion encircles the implant and results in the saucer shaped appearance of bone loss in radiographic images which are used in clinical diagnosis of perimplantitis.

The failure of implants is more when placed immediately after heavily infected extracted teeth socket. Even after systemic anti-biotic therapy with implant placement is contraindicated in infected sockets because impaired blood flow reduces the ability of antimicrobial agents to achieve effective antibacterial property in the extracted tooth socket.

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Diagnosis of peri-implant disease

Diagnosis of perimplant disease assessed by pain at surrounding tissue of implant surface, probing depth, bleeding index, radiographic evaluation of bone loss, rigid fixation of implant, and sounding (sound up on percussion). Signs of perimplant disease include bleeding or suppuration on gentle probing, tissue swelling and redness, perimplant pockets greater than 4mm, crestal bone loss or saucer shaped radiolucency around the implant, mobility and pain. The diagnosis of perimplant mucositis is generally associated with exudate swelling and/or bleeding on probing, without crestal bone loss. Perimplantitis exhibits similar symptoms as peri-mucositis but also exhibits crestal bone loss. Moderate to advanced perimplantitis is determined by radiographs showing saucerisation of bone around implant (Fig.1). Loss of gingival attachment, probing depth greater than 4mm, mobility of implant and separation of implant tissues. The terms success and failure of dental implants scale was developed by James and Mish et al ranges from group 1 (optimum conditions) to group 5 (absolute failure).

Group 1- less than 1mm bone loss, stable probing depth, no exudates and no radiolucency.

Group 2- mucositis without bone loss presence of exudate, bleeding on probing without
Group 3: Moderate implantitis, exhibits some degree of bone loss, less than 1 mm mobility, implant remains stable in the bone.

Group 4: Pain on palpation/function, greater than 1 mm horizontal mobility, uncontrolled exudate, and radiolucency upon radiographic examination (unable to restore the implant).

Group 5: Absolute failure, implant is surgically removed or exfoliated by the body.

Fig. 1. Radiographs showing saucerisation of bone around implant.

Treatment and management of periimplantitis

When periimplant infection has been diagnosed, there are many therapeutic approaches to save the implant. Treatment procedure generally follows in four stages.

1st stage: Scaling / root planning or mechanical debridement to remove the biofilm from the implant in the periimplant pocket.

2nd stage: Antiseptic treatment to decontaminate the implant surface.

3rd stage: Antibiotic treatment to eliminate infectious bacteria in the surrounding periimplant tissue.

4th stage: Regenerative or resective surgeries to establish the bone-implant interface (osseointegration).

These treatment modalities were suggested by Lang et al. to be used in sequential and cumulative fashion referred to as the “cumulative interceptive supportive therapy” (CIST) protocol.

Scaling and root planning

The first line treatment in the CIST is mechanical debridement or scaling and root planning, referred to as non-surgical debridement. Here the metal or plastic instruments are used in the debridement of subgingival surface of the implant around affected areas, and with strict oral hygiene regimen by the doctor to the patient. Scaling is usually combined with antiseptic material or irrigation using chlorhexidine solution. There are concerns about scratching and roughening of the implant surface with scaling or probing instruments which may contribute to increasing of plaque accumulation on the abutment surface. The decontamination of implant surface is evaluated by burnishing with cotton pellet soaked in water, citric acid, or chlorhexidine or air powered abrasives. Machined implants are more easily decontaminated than titanium plasma sprayed implants, or hydroxyapatite coated implants. Air abrasion was the least damaging and most effective decontamination method for all surfaces and was found most biocompatible in vitro, with fibroblast cells. But all the modalities including laser (Er:YAG), ultrasonic scalers, in decontamination were failed to restore the original in vitro biocompatibility of the previously uncontaminated surface.

Anti microbial delivery in periodontitis and periimplantitis

Local antibiotics delivery is indicated when the pockets progressed to 5 mm or more either in periodontal pocket or implant pocket. To maintain sustained level of antibiotic at the site of infection, controlled release devices such as gels, chips, polymeric fibers or microcapsules have been developed. Various antibiotics and antiseptics have been incorporated into these devices, including tetracycline, doxycycline, minocycline, chlorhexidine, and metronidazole. Tetracycline should remove from pocket after 7-14 days whereas minocycline, doxycycline, chlorhexidine are biodegradable and do not require removal. Mombelli et al. conducted study showed that local delivery of tetracycline from polymeric fibers may be used to improve the clinical and microbiological parameters around infected implant but no significant improvement in probing depth. In the same study with doxycycline the probing depth was significantly reduced. This implies that simply using periodontal therapies to treat periimplantitis may not be an adequate solution.

Regenerative surgery/Resective surgery

When implant scaling and local anti-microbial therapies fail in the progression of periimplantitis, surgical (regenerative and resective) treatment can be utilized. This involves resection of affected tissue, debridement and surface decontamination followed by bone grafting with barrier membranes. A clinical study showed improvement in defect fill and probing depth when patients were treated with bone graft and resorbable membranes. The tetracycline incorporated in GTR membranes showed...
an increase in osteoblast cells and elicited new bone formation instead of connective tissue formation. To develop osseo-reintegration between bone and implant surface, requires further more effective surgical techniques with the combination of other therapies. Evidence of the ability to osseo-reintegrate in contaminated implant surface is lacking.  

**Experimental materials and approaches**

The materials can promote the osseo-reintegration and interfere bacterial adhesion by modifying their surface energy, surface immobilized molecules that are bactericidal, releases metal ions or antibiotics.

1. Anti-Bio adhesion coatings.  
2. Covalent Modification of Surfaces  
3. Photo catalytic Surfaces  
4. Silver and Zinc Modified Surfaces  
5. Antibiotic Releasing Coatings

These implant surfaces enhances osseo-integration between bone and surface of implant. Osseo-integration, per mucosal seal, antimicrobial surface, biocompatibility, osseo-reintegration capacity are the qualities of the implants which prevent periimplantitis.

**CONCLUSION**

Perimplant mucositis and periimplantitis are challenge for practitioners who use dental implants in the treatment of edentulism. It is conceivable that protocols for surface decontamination may have different effects depending on the macro- and microstructure of the surface, and hence not all methods may work equally well in all instances. It is furthermore presently unknown to what extent bacterial and nonbacterial residues have to be removed from an implant surface to obtain a predictable, stable clinical result after treatment. There should be continued investigation into materials which have the ability to discourage biofilm formation/bacterial attachment and promote osseointegration and the development of the per mucosal seal.

**References**


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