



Peri-Implantitis: Causes, Clinical Features, Management (A Brief Review)

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Abstract:

Peri-implantitis is a significant complication in implant dentistry, posing a threat to the long-term success of dental implants. This review provides a comprehensive understanding of the causes, clinical features, and management strategies for peri-implantitis. The etiology involves microbial, implant-related, and host-related factors, with microbial biofilm accumulation playing a central role. Clinical features encompass soft tissue inflammation, bleeding on probing, increased probing depths, suppuration, and progressive loss of peri-implant bone, necessitating early detection and intervention. Management strategies include non-surgical and surgical interventions, addressing microbial control, inflammation resolution, and tissue regeneration. Non-surgical therapy involves mechanical debridement, chemical disinfection, and local antimicrobial therapy, while surgical options include open flap debridement, implant surface decontamination, bone grafting, and guided tissue regeneration techniques. Long-term success relies on comprehensive supportive therapy and maintenance protocols. A multidisciplinary approach and advances in research and clinical practices are crucial for achieving successful outcomes in peri-implantitis management and improving the long-term prognosis and success rates of dental implant therapy.

Keywords: Peri-implantitis, Implant, Surgical management, non-surgical management

Introduction

Peri-implantitis, a condition characterized by inflammation and progressive loss of supporting bone around dental implants, has emerged as a significant clinical concern within the field of implant dentistry. This condition poses a substantial threat to the long-term success and stability of dental implants, mirroring the destructive nature of periodontitis and necessitating a comprehensive understanding of its causes, clinical features, and evolving management strategies.^{1,2}

The increasing prevalence of dental implants as a reliable and esthetically pleasing treatment modality for tooth replacement has been paralleled by a rise in the reported incidence of peri-implantitis.

Estimates of peri-implantitis prevalence vary, with rates ranging from 19% to 65% in different populations, underlining the growing significance of addressing this clinical challenge within the dental community. Consequently, a deep exploration of peri-implantitis is essential to comprehend the breadth and complexity of factors driving its occurrence and progression.^{3,4} This review provides a comprehensive understanding of the causes, clinical features, and management strategies for peri-implantitis.

Etiology of peri-implantitis:⁵⁻⁹

1. **Microbial Factors:** Peri-implantitis is initiated and perpetuated by the accumulation of microbial biofilm on implant surfaces, consisting of diverse bacterial species with the capacity to induce inflammation and peri-implant tissue destruction.
2. **Implant-Related Factors:** The design, surface characteristics, and positioning of dental implants influence their susceptibility to peri-implantitis, with rough implant surfaces and suboptimal placement increasing the risk of microbial colonization and inflammatory response.
3. **Host-Related Factors:** Systemic conditions such as diabetes, smoking, and genetic predispositions can heighten the individual's susceptibility to peri-implantitis, impacting the immune response and tissue healing around the implants.
4. **Oral Hygiene:** Inadequate oral hygiene practices contribute to the persistence of microbial biofilm around implants, exacerbating the inflammatory processes and bone loss characteristic of peri-implantitis.
5. **Peri-implant Mucositis:** Pre-existing inflammation of the soft tissues surrounding implants, known as peri-implant mucositis, may progress to peri-implantitis in the presence of continued microbial challenge and unresolved inflammatory response.
6. **Immunological Factors:** The immune response of the host plays a pivotal role in influencing the susceptibility to and progression of peri-implantitis, with variations in immune function impacting the severity and extent of peri-implant tissue destruction.
7. **Systemic Health:** Underlying systemic health conditions, such as osteoporosis and immunocompromised states, can alter the physiological response of peri-implant tissues to microbial challenge, contributing to the etiology of peri-implantitis.

Clinical features of peri-implantitis ¹⁰⁻¹⁴

1. **Soft Tissue Changes:** Clinical examination often reveals inflammation and swelling of the peri-implant mucosa, with changes in color, texture, and contour indicative of the inflammatory response associated with peri-implantitis.
2. **Bleeding on Probing:** Similar to periodontal disease, peri-implantitis is characterized by bleeding on gentle probing of the peri-implant sulcus, reflecting the presence of inflammation and tissue breakdown.
3. **Suppuration:** Pus discharge from the peri-implant sulcus or around the implant abutment may be evident in more advanced cases of peri-implantitis, signifying localized infection and tissue destruction.
4. **Progressive Bone Loss:** Radiographic assessment commonly reveals peri-implant bone loss, with periapical or panoramic radiographs demonstrating the extent of vertical and horizontal bone resorption around the affected implant.
5. **Pocket Formation:** Deepening of the peri-implant sulcus leads to the formation of peri-implant pockets, providing a niche for microbial colonization and impeding effective oral hygiene practices in the affected area.
6. **Implant Mobility:** In advanced stages of peri-implantitis, implant mobility may become apparent due to the loss of supporting bone and compromised osseointegration, indicating significant peri-implant tissue destruction.
7. **Pain or Discomfort:** Patients may report pain, tenderness, or discomfort around the implant site, especially during mastication or manipulation of the peri-implant tissues, reflecting the inflammatory and destructive processes associated with peri-implantitis.
8. **Radiographic Evidence of Infection:** Imaging modalities such as periapical radiographs, panoramic radiographs, or cone beam computed tomography (CBCT) may reveal peri-implant radiolucencies, bone defects, and irregularities suggestive of peri-implantitis-associated bone loss and tissue destruction.
9. **Gingival Recession:** Progressive peri-implant bone loss and soft tissue inflammation can lead to gingival recession around the implant, further compromising the stability and esthetics of the peri-implant tissues.
10. **Halitosis:** Malodor or persistent bad breath may be reported by patients with peri-implantitis due to the presence of microbial biofilm, suppuration, and inflammatory processes within the peri-implant environment.

Investigation for peri-implantitis:

The investigation for peri-implantitis involves a comprehensive assessment encompassing clinical, radiographic, and microbiological evaluations to characterize the extent of peri-implant tissue inflammation, bone loss, microbial colonization, and host response. The following investigative modalities are commonly employed in the diagnostic workup for peri-implantitis:¹⁵⁻¹⁸

1. **Clinical Examination: Soft Tissue Assessment:** Inspection of the peri-implant soft tissues for signs of inflammation, including erythema, swelling, and changes in mucosal texture. Evaluation of peri-implant sulcus depth and presence of suppuration

Probing Depth Measurement: Measurement of pocket depths around the implant to assess the extent of soft tissue attachment loss and peri-implant sulcus inflammation.

2. **Radiographic Imaging: Periapical Radiography-** Utilization of periapical radiographs to evaluate peri-implant bone levels, identify peri-implant radiolucency, and assess bone loss around the implant fixture.

Panoramic Radiography: Examination of panoramic radiographs to visualize the overall status of the peri-implant bone and identify any gross bone loss or implant-related complications.

Cone Beam Computed Tomography (CBCT): In cases requiring detailed three-dimensional assessment, CBCT may be employed to visualize the peri-implant bone morphology, assess defect dimensions, and aid in treatment planning for surgical intervention.

3. **Microbiological Analysis: Microbial Sampling-** Collection of peri-implant plaque or tissue samples for microbiological analysis to identify the presence of peri-implant pathogens and assess microbial colonization within the peri-implant environment. Techniques such as PCR, DNA-DNA hybridization, and next-generation sequencing can provide detailed microbial profiles associated with peri-implantitis.

4. **Bleeding on Probing (BoP): Assessment of Bleeding on Probing:** Evaluation of bleeding on probing as a clinical parameter to assess the inflammatory status of the peri-implant mucosa. Bleeding on probing is indicative of mucositis or peri-implantitis, depending on the extent and probing depth associated with the bleeding sites.

5. **Mobility Testing: Assessment of Implant Mobility:** Evaluation of implant mobility using clinical manipulation to determine the presence of potential implant instability, which may be indicative of advanced peri-implant tissue breakdown.

6. **Histological Analysis: Biopsy and Histopathological Evaluation:** In select cases, a biopsy of peri-implant soft tissue may be performed to assess histopathological changes, inflammatory infiltrates,

fibrotic alterations, and tissue response to peri-implant inflammation.

These investigative approaches aid in the comprehensive characterization of peri-implantitis, enabling clinicians to determine the extent of peri-implant tissue inflammation, assess bone loss and defect morphology, identify microbial pathogens associated with the disease, and guide the formulation of a personalized management plan tailored to the specific needs of the affected implant site. Integration of these investigative modalities allows for a thorough understanding of the peri-implantitis condition and facilitates the implementation of targeted therapeutic interventions to mitigate disease progression and restore peri-implant tissue health.

Management of peri-implantitis

Non-Surgical Management of Peri-Implantitis:

1. Mechanical Debridement:

Mechanical debridement involves the removal of microbial biofilms, calculus, and soft tissue overgrowth from the implant surface and peri-implant tissues. This procedure is typically performed using ultrasonic and hand instruments to achieve thorough decontamination of the implant surface and surrounding tissues.

2. Chemical Disinfection:

Local application of antiseptic agents, such as chlorhexidine, hydrogen peroxide, or other disinfectants, may aid in reducing microbial load and promoting peri-implant tissue healing. These agents are often used as adjuncts to mechanical debridement to enhance microbial control.

3. Laser Therapy: Utilization of laser therapy, such as diode lasers or erbium lasers, for decontamination of peri-implant tissues and modulation of the inflammatory response. Laser therapy can aid in reducing microbial colonization and promoting tissue resolution in cases of peri-implantitis.

4. Antibiotic Therapy: Short-term systemic or local antibiotic therapy may be considered in cases of peri-implantitis, especially when microbial assessment indicates the presence of specific pathogens resistant to mechanical debridement alone. The use of antibiotics should be guided by microbial susceptibility testing and tailored to the individual patient's needs.

5. Host Modulation: Adjunctive therapies targeting the host response, such as local delivery of anti-inflammatory agents or host modulation agents, may be considered to mitigate the inflammatory process and support resolution of peri-implantitis-related tissue changes.

Surgical Management of Peri-Implantitis:

1. **Open Flap Debridement:** Surgical access to the peri-implant tissues with elevation of a flap to facilitate thorough debridement of the implant surface, defect morphology assessment, and removal of granulation tissue. Open flap debridement allows for direct visualization and decontamination of the peri-implant environment.
2. **Resective Osseous Surgery:** Surgical resection of the peri-implant defect accompanied by osseous recontouring to eliminate infrabony defects and promote favorable bone architecture. This procedure aims to remove diseased bone and promote osseous healing for regeneration of peri-implant support.
3. **Guided Bone Regeneration (GBR):** Utilization of barrier membranes and bone grafting materials to facilitate guided tissue regeneration around peri-implant defects. GBR techniques aim to promote new bone formation and soft tissue attachment, thereby enhancing the peri-implant tissue architecture and promoting resolution of bony defects.
4. **Use of Growth Factors:** Application of growth factors, such as platelet-derived growth factor (PDGF) or enamel matrix derivative (EMD), to enhance tissue healing and promote regenerative outcomes in peri-implantitis management. These biologic agents may be used to support periodontal tissue regeneration around affected implants.
5. **Implant Surface Decontamination:** Removal of contaminated implant surfaces using mechanical or chemical methods to eliminate microbial biofilms and promote reosseointegration of the implant surface. This may involve surface detoxification through various modalities aimed at promoting implant stability and tissue healing.

It is essential to emphasize that the selection of non-surgical or surgical interventions for peri-implantitis management should be guided by the severity of the disease, extent of tissue destruction, implant stability, and individual patient-related factors. A thorough assessment of the peri-implant condition, including clinical, radiographic, and microbiological data, will aid in formulating a personalized treatment plan aimed at addressing the specific needs of each patient with peri-implantitis. Furthermore, close post-treatment follow-up and maintenance care are critical components to monitor treatment outcomes and ensure long-term peri-implant health.

Conclusion

A prevalent condition that causes tissue death and implant loss is peri-implantitis. Its onset and progression are mostly influenced by plaque accumulation and biofilm production. Clinical data is

required to determine whether prosthetic variables such as overloading and leftover cement can cause peri-implantitis. Preventive supportive therapy lowers the chance that peri-implantitis will develop. The course of treatment for peri-implantitis should be determined by the severity of the illness. The first line of treatment should be nonsurgical mechanical therapy because it is advantageous. Antibiotic usage had a minimal effect on the outcome of peri-implantitis treatment. Early supragingival biofilm is removed by lasers, and soft tissue regeneration is induced with low-intensity laser therapy. Utilizing rotating tools, implantoplasty smooths the implant surface. While partial regeneration has been demonstrated by a number of regenerative procedures, complete reosseointegration is challenging to achieve.

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