

# Peri-Implantitis: A Critical Overview of Literature

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## ABSTRACT

Peri-implantitis is a serious condition that affects the soft and hard tissues around dental implants and develops after the dental implants are placed. Effective preventative interventions include specific, continuous exams together with the identification and eradication of risk factors (such as smoking, systemic disorders, and periodontitis). Along with the features of osseointegration, the composition and architecture of the implant surface are significant. Treatment options for peri-implant disease include a number of conservative and surgical approaches. With conservative methods, mucositis and mild cases of peri-implantitis can be effectively treated. These consist of several kinds of manual ablation, devices that use lasers, and photodynamic treatment, which can be enhanced by antibiotics, either systemic or local. Reestablishing osseointegration is possible. When peri-implantitis is progressed, surgical therapies are more successful than nonsurgical ones. The goal of this critical appraisal of literature is to give dental practitioners an overview of current data and recommendations for diagnosing, preventing, and treating peri-implantitis.

**Keywords:** Dental Implants, Dentistry, Implantology, Peri-implantitis, Periodontics

## INTRODUCTION

Implants have revolutionized the fields of maxillary reconstruction, prosthetic dentistry, and dental rehabilitation. Similar to normal dentition, dental implants pass between the sterile jawbone and the contaminated oral cavity, with the mucosa around them serving as a barrier. As good periodontal tissue is for the dentition, so too is healthy peri-implant tissue critical to the dental implant's long-term viability.<sup>1</sup> Despite the great success of implant therapy, infections around implants, such as

peri-implant mucositis or peri-implantitis, are becoming more common.<sup>2</sup> Therefore, contemporary dental rehabilitation techniques should include peri-implant disease preventive and therapy strategies.<sup>3</sup> An overview of the etiology, clinical features, prevention, treatment options, and therapeutic alternatives for peri-implantitis is currently been discussed.

## ETIOLOGY

Following initial remodelling, bone loss is mostly caused by que at the mucosal margin or peri-implant, which causes local inflammation. This inflammation is the body's intricate reaction to infectious microorganisms. The loss of connective tissue, which is followed by bone disintegration, indicates the change from peri-implant mucositis to peri-implantitis. Peri-implantitis in two-stage implant systems may arise as a result of bacterial contamination of the micro-gap. Intense inflammation is caused by neutrophil granulocytes, lymphocytes, plasma cells, and macrophages, which also kill tissue. Restricted clinical trials found that the most often found microorganisms in peri-implantitis lesions were Porphyromonasgingivalis, Fusobacteriumnucleatum, Tannerella forsythia, Treponemadenticola, and Prevotella intermedia. Numerous studies have revealed that peri-implantitis may be associated with S. aureus.<sup>3</sup>

## RISK FACTORS

- **Poor oral hygiene:** Both peri-implantitis and peri-implant mucositis are associated with each other. All patients have to be made aware of these issues and motivated to maintain proper oral hygiene.
- **Dental cement:** The existence of dental cement, or cement-retained restorations, in the implant's sulcus worries a lot of implant dentists. The incapacity to eliminate surplus cement leads to iatrogenic cement peri-implantitis. Initially, the cement may cause mucositis, but with time, the inflammation (peri-implantitis) may migrate to the supporting bone and cause bone loss.
- **History of periodontitis:** Patients with a history of chronic periodontitis were found to have a five times higher risk of peri-implantitis.
- **Cigarette smoking:** There is a greater occurrence of peri-implant disease, such as suppuration, peri-implantitis, and bone loss, among individuals who smoke.
- **Alcohol consumption:** Alcoholics might experience a lack of vitamin K, leading to impaired prothrombin production and impacting blood clotting processes, while substances in alcoholic drinks like fuel oil, nitrosamines, and ethanol can stimulate bone breakdown and hinder new bone formation. A single research project, conducted by Galindo-Moreno et al., discovered a correlation between peri-implant marginal bone loss and alcohol consumption exceeding 10 grams per day, as well as a more severe case of peri-implantitis in comparison to smoking.<sup>3,4</sup>
- **Diabetes:** Diabetic individuals had a higher chance of developing peri-implantitis compared to non-diabetic individuals.
- **Genetic traits:** Among smokers, there was a connection found between gene variations specific to interleukin (IL)-1 and bone loss around dental implants.
- **Lacking keratinized mucosa:** The presence of keratinized gingiva surrounding implants is connected to the well-being of soft and hard tissues, as well as the lifespan of the implant.
- **Systemic Medications:** Implant failure rates have been associated with selective serotonin reuptake inhibitors and proton pump inhibitors. The two medications have been associated with reduced bone mineral density as a result of their negative impact on the growth and functioning of osteoblasts.
- **Implant surface characteristics:** Newer titanium implants with a textured surface have enhanced osseointegration but have also increased bacterial adhesion, leading to challenges in cleaning the implant.

- **Other non-confirmed risks:** Xerostomia, Postmenopausal osteoporosis, Implants placed in the maxillary anterior region.<sup>3,4</sup>

### PREVENTION

Measure to prevent peri-implantitis can be broadly classified under the following headings<sup>5</sup> which the clinician has to look into during the clinical procedure:

- Implant design:
- Implant site
- Patient related factors like periodontitis, oral hygiene, smoking and diabetes.
- Prosthesis related factors

### TREATMENT

Various treatment modalities have been documented in the scientific literature, the choice of selecting one for a particular case depends on the knowledge and the clinical expertise of the clinician.

- **Non-surgical Treatment of Peri-implantitis:**
  - ✓ Microbiological Test
  - ✓ Mechanical Therapy alone
  - ✓ Mechanical therapy with an adjunct of an Antiseptic Agent
  - ✓ Mechanical therapy with an adjunct of antibiotic therapy<sup>6</sup>
- **Surgical Treatment of Peri-implantitis:**
  - ✓ Resective Surgery
  - ✓ Bone Regeneration<sup>7,8</sup>
- **Laser-assisted treatment of peri-implantitis**
  - ✓ Non-surgical therapy
  - ✓ Surgical therapy<sup>9</sup>

### CRITICAL REVIEW OF LITERATURE

The condition known as peri-implantitis affects the tissues surrounding dental implants, causing inflammation in the connective tissue and gradual loss of supporting bone. The specific factors that lead

to the progression from peri-implant mucositis to peri-implantitis are not fully understood. Peri-implantitis can develop early after the initial procedure and follows a pattern of non-linear and accelerating advancement. Sites affected by peri-implantitis show signs of inflammation and increased probing depths compared to initial measurements. Histologically, peri-implantitis sites typically exhibit larger inflammatory lesions compared to sites affected by periodontitis. When surgical intervention is needed at peri-implantitis sites, bone loss patterns often present in a circumferential configuration. There is substantial evidence that patients with a history of chronic periodontitis, poor plaque control, and lack of regular maintenance following implant therapy are at higher risk of developing peri-implantitis. The role of smoking and diabetes as potential risk factors for peri-implantitis is not definitively established. Limited evidence also suggests that peri-implantitis may be related to other factors such as the presence of submucosal cement post-restoration, insufficient peri-implant keratinized mucosa, and implant positioning, all of which can complicate oral hygiene and maintenance. It is uncommon for implants to experience progressive crestal bone loss without visible signs of soft tissue inflammation.<sup>10</sup>

The use of implant dentistry has become a primary approach to replace missing teeth in patients who are completely or partially without teeth. Implant dentistry can lead to the development of peri-implantitis, which is characterized by inflammation and damage to the tissues supporting the implant due to the formation of biofilm on the implant surface. Factors such as a history of periodontal disease, inadequate oral hygiene, and smoking are considered to increase the risk of peri-implantitis. In some cases, peri-implantitis can be linked to iatrogenic factors, which have only recently been recognized as direct causes, such as the placement of non-parallel

adjacent implants or the presence of a gap between the implant fixture and prosthetic components. Both traditional non-surgical periodontal therapy protocols and laser treatment appear to be effective alternative approaches for treating peri-implantitis. The use of laser-assisted non-surgical therapy has shown a reduction in periodontal pocket depth.<sup>11</sup>

Peri-implant diseases are modern oral infections in people, causing inflammation and tissue destruction around implants due to biofilm build-up on the implant surface. The functioning of its causal agents' roles is still not understood. Periodontitis history, inadequate oral care, and smoking increase the risk of peri-implant diseases. Sometimes unsuccessful implants are linked to factors caused by healthcare providers, which have only recently been recognized as a main reason for issues around dental implants, such as implants not being aligned properly or having a space between the implant and the prosthetic parts. Using both traditional nonsurgical periodontal therapy protocols and diode laser appears to be a successful option for treating peri-implantitis, a condition that affects dental implants. The use of laser-aided non-invasive peri-implant therapy decreased the depth of the periodontal pocket. Intraoral periapical radiographs, captured 6 months and 1 year after nonsurgical treatment, appeared to show signs of improvement in bone level.<sup>12</sup> Retrograde peri-implantitis refers to a radiolucent lesion located at the most apical aspect of a bone-integrated implant. It occurs during the initial months after placement. The research findings suggested that retrograde peri-implantitis is triggered by a leftover scar or granulomatous tissue at the site where the implant is placed: endodontic issues from the extracted tooth (scar tissue-impacted tooth) or potential endodontic problems from an adjacent tooth.<sup>13</sup>

The study findings of Van der Weijden GA et al showed that by using clinical criteria:

patients can be selected to increase the likelihood of diagnosing an *A. actinomycetemcomitans* infection in the subgingival flora. Four key clinical criteria stand out: age (under 30 years old), localized breakdown (especially in the first molar and incisor regions), an angular pattern of bone loss (visible on full-mouth radiographs). If three of these criteria are present, it indicates the need to confirm a possible *A. actinomycetemcomitans* infection before starting initial therapy. If subgingival scaling and root planning produce an inadequate response, there's also a need to investigate the potential presence of this micro-organism in the subgingival plaque.<sup>14</sup>

Peri-implantitis can lead to systemic alterations in blood cell count, serum biochemical parameters, and cytokine levels, potentially impacting overall health and disease states. Nevertheless, the question remains unanswered as to whether and how these factors could impact the development or advancement of systemic illnesses. Additional research that is prospective in nature is required to investigate this causal relationship.<sup>15</sup> Marginal bone levels and soft tissue outcomes indicate that it is possible to regenerate severe peri-implant hard and soft tissue deficiencies using a laser-assisted approach for peri-implant defect regeneration. By implementing this idea, it appears that it could be possible to cleanse implant surfaces while simultaneously enhancing both hard and soft tissues, thus avoiding any negative postoperative exposure of titanium surfaces. Including a connective tissue graft during peri-implantitis treatment led to a short-term increase in vestibular soft tissue thickness.<sup>16</sup>

A recent systematic review reported that coronally advanced flap and connective tissue graft is considered the most effective method for treating single and multiple Miller class I/II gingival recessions. However, there is limited evidence on the long-term effectiveness of other techniques and adjuncts

after at least 5 years of follow-up.<sup>17</sup> Even though natural teeth and dental implants are placed in similar surroundings, their inherent variances can lead to inflammatory diseases with minimal overlapping traits, requiring distinct tools and tactics for treatment and diagnosis. When the understanding of periodontal disease changes, certain beliefs tied to it, such as the idea that periodontal pockets are a source of infection for periodontal inflammation, need to be reevaluated. Periodontitis is a definite risk factor for peri-implantitis, however, the key factor influencing this risk lies not in the bacteria found in periodontal pockets, but in the circumstances that led to the development of the periodontal disease.<sup>18</sup> The systematic review and meta-analysis by Hashim D et al showed that 24.1% of implants with bleeding on gentle probing result in a diagnosis of peri-implantitis, compared to 33.8% for patients who are bleeding on gentle probing-positive. Clinicians need to be mindful of the high likelihood of falsely identifying bleeding during gentle probing as a sign of peri-implantitis.<sup>19</sup>

The peri-implant disease is dependent on biofilm and requires the host-inflammatory response for its development. Therefore, its etiology and pathogenesis are comparable to periodontal disease. Nevertheless, the inflammation seen in peri-implant disease is sudden, resulting in extensive tissue damage over a brief timeframe. Currently, the treatment guidelines for peri-implant disease align with periodontal therapy. Additional research is necessary in the near future to establish precise guidelines for effectively managing peri-implant diseases. Regularly scheduled check-ups are crucial for preventing peri-implant disease and ensuring the lasting effectiveness of implant-supported restorations.<sup>20</sup>

## CONCLUSION

Prevention is the most important tool, relying on appropriate treatment plans, gentle implant placement, and routine professional cleanings for both teeth and implants. The best treatment for peri-implantitis involves using various methods to create a personalized plan based on multiple causes, treatment options, and study results. Continued research is needed to better understand why and how implant disease occurs, to design appropriate and appropriate diagnostic tools for early diagnosis and better treatment.

### *Declaration by Authors*

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