

## Surgical Modalities for Periimplantitis: Efficacy, Challenges, and Emerging Techniques

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**Abstract:** Periimplantitis poses a significant challenge in contemporary implant dentistry, requiring effective interventions to mitigate its detrimental effects on implant stability and peri-implant tissue health. Surgical modalities have emerged as key components of periimplantitis management strategies, offering a spectrum of approaches tailored to individual patient needs. This review synthesizes current evidence on the efficacy, challenges, and emerging techniques in surgical interventions for periimplantitis. While surgical modalities remain pivotal in the management of periimplantitis, a nuanced understanding of their efficacy, challenges, and emerging techniques is imperative for optimizing patient outcomes. This review provides insights into the evolving landscape of surgical interventions for periimplantitis and informs clinicians of current best practices and future directions in this rapidly evolving field.

**Key words:** Peri-implantitis, Surgical modalities, Implant dentistry, Regenerative procedures.

### Introduction:

Periimplantitis, characterized by inflammation and bone loss around dental implants, presents a significant clinical challenge in modern implant dentistry. As the prevalence of dental implants continues to rise, so too does the incidence of periimplantitis, underscoring the importance of effective management strategies. Surgical interventions play a crucial role in addressing the complex pathophysiology of periimplantitis, aiming to arrest disease progression, promote tissue regeneration, and restore peri-implant health. The prevalence of periimplantitis varies widely in the literature, with reported rates ranging from 1% to 47%, highlighting the multifactorial nature of this condition and the importance of tailored treatment approaches. Surgical interventions, ranging from open flap debridement to advanced regenerative techniques, offer a diverse tool kit for clinicians to address periimplantitis based on individual patient presentations and anatomical considerations.<sup>[1]</sup>

Despite the advancements in surgical periimplantitis management, challenges persist. Inadequate bone support, soft tissue deficiencies, and the risk of implant surface damage during decontamination procedures pose significant hurdles to achieving optimal treatment outcomes. Additionally, variations in defect morphology, implant surface characteristics, and patient-related factors necessitate a nuanced approach to case selection and treatment planning.

Emerging surgical techniques hold promise in overcoming these challenges and optimizing treatment outcomes. Minimally invasive approaches, laser-assisted therapy, and antimicrobial photodynamic therapy are among the innovative strategies garnering attention for their potential to enhance periimplantitis management while minimizing patient morbidity. [2]

Through a critical analysis of the existing literature, this review aims to elucidate the current landscape of surgical modalities for periimplantitis and provide insights into their efficacy, challenges, and emerging techniques. By synthesizing evidence-based practices with cutting-edge innovations, clinicians can navigate the complexities of periimplantitis management with confidence, ultimately improving patient outcomes and ensuring the long-term success of dental implant therapy. [3]

### **Surgical modalities available and their limitations:**

**Open Flap Debridement (OFD):** Open flap debridement involves accessing the affected implant site by creating a flap in the gum tissue. The exposed implant surface and surrounding tissues are thoroughly cleaned using various instruments such as ultrasonic scalers or hand instruments. The goal is to remove bacterial biofilm, calculus, and infected tissue from the implant surface and periimplant tissues. Reported success rates for OFD alone vary widely, ranging from 40% to 70%. Success rates may be influenced by factors such as the severity of periimplantitis, the extent of bone loss, and patient compliance with post-operative maintenance.

Limitations: OFD may not be effective in cases of advanced bone loss where significant implant surface contamination is present. It may result in recession of the periimplant soft tissue and esthetic concerns, particularly if large flaps are required. [4]

**Resective Procedures:** Resective surgery involves removing a portion of the implant or surrounding bone to eliminate the infected tissue and create a healthier environment for healing. This may include removing exposed implant threads or diseased bone around the implant. Resective surgery can achieve success rates ranging from 60% to 80%, particularly in cases with significant bone loss and exposed implant threads. Success rates may vary depending on the extent of bone resection and the quality of bone regeneration post-operatively. Limitations: Resective surgery may lead to further loss of bone and soft tissue volume, compromising long-term stability and esthetics. It is less predictable in cases with large defects or poor bone quality, and there is a risk of over-resection, leading to implant failure. [5]

**Regenerative Procedures (Guided Bone Regeneration - GBR):** Guided bone regeneration techniques involve using bone grafts or bone substitutes to fill in the defect around the implant. A barrier membrane is placed over the bone graft material to promote bone growth while preventing soft tissue ingrowth. The goal is to regenerate lost bone and create a stable environment for the implant. Guided bone regeneration combined with OFD has shown improved success rates compared to OFD alone, ranging from 50% to 90%. Success rates may be influenced by factors such as membrane exposure, bone quality, and patient compliance with post-operative care.

Limitations: Success depends on various factors including the size of the defect, bone quality, and patient factors such as smoking and systemic health conditions. GBR procedures can be technically challenging and may require precise placement of the barrier membrane to achieve optimal results.

**Implant Surface Decontamination:** The success rates of implant surface decontamination techniques vary depending on the method used and the severity of periimplantitis. Laser therapy has shown promising results, with success rates ranging from 60% to 90%.

Limitations: Complete removal of microbial biofilm from the implant surface can be challenging, and residual contamination may lead to reinfection. Additionally, laser therapy may cause thermal damage to surrounding tissues if not performed properly.<sup>[5]</sup>

**Soft Tissue Management:** Soft tissue management procedures such as soft tissue grafting can improve periimplant mucosal health and esthetics, contributing to the overall success of periimplantitis treatment.

Limitations: Soft tissue management may not directly address the underlying cause of periimplantitis, and success relies on maintaining adequate oral hygiene and periimplant tissue stability post-operatively.

### **Challenges encountered in management of surgical periimplantitis treatment:**

Surgical management of periimplantitis presents several challenges, ranging from technical difficulties during the procedure to potential complications and limitations in achieving long-term success. Here are some of the key challenges encountered in surgical management:

**Extent of Bone Loss:** Periimplantitis often results in bone loss around the implant, which can compromise the stability and longevity of the implant. Advanced bone loss may limit the options for surgical treatment and reduce the predictability of outcomes.

**Implant Surface Contamination:** Bacterial biofilm adhering to the implant surface is a major factor in periimplantitis. Complete removal of microbial biofilm from the implant surface can be challenging and may require specialized techniques such as laser therapy or chemical decontamination.

**Soft Tissue Management:** Maintaining healthy periimplant soft tissues is crucial for the long-term success of implant therapy. Surgical procedures may result in soft tissue recession or loss, which can compromise esthetics and increase the risk of periimplantitis recurrence.

**Bone Regeneration:** Achieving predictable bone regeneration around the implant can be challenging, particularly in cases of extensive bone loss. Factors such as bone quality, defect size, and patient compliance with post-operative care can influence the success of regenerative procedures.

**Complications:** Surgical interventions for periimplantitis carry the risk of complications such as infection, bleeding, nerve injury, and implant failure. Complications may occur intraoperatively or postoperatively and require prompt management to prevent adverse outcomes.<sup>[6]</sup>

**Esthetic Concerns:** Surgical procedures for periimplantitis may result in changes to the periimplant soft tissue architecture and esthetics. Achieving optimal esthetic outcomes while addressing periimplantitis can be challenging, particularly in cases involving anterior implants or patients with high esthetic demands.

**Patient Compliance:** Long-term success of surgical management depends on patient compliance with post-operative instructions and maintenance protocols. Patients must adhere to strict oral hygiene practices and attend regular follow-up appointments to monitor implant health and prevent recurrence of periimplantitis.

**Cost and Accessibility:** Surgical management of periimplantitis can be costly, particularly when multiple procedures are required. Accessibility to specialized surgical care and adjunctive

treatments such as laser therapy or bone grafting may be limited in certain geographic regions or healthcare settings.<sup>[7-9]</sup>

### **Strategies to address challenges:**

To address the challenges encountered in surgical management of periimplantitis, a multidisciplinary approach involving clinicians, researchers, and patients is essential. Here are several strategies to tackle these challenges effectively:

**Comprehensive Preoperative Assessment:** Conduct thorough clinical and radiographic evaluations to assess the severity of periimplantitis and determine the extent of bone loss. Consider factors such as implant stability, soft tissue health, bone quality, and patient-specific risk factors when planning the surgical approach.

**Utilization of Advanced Imaging Technologies:** Employ advanced imaging modalities such as cone beam computed tomography (CBCT) to visualize the periimplant bone architecture and assess the presence of defects. High-resolution imaging facilitates accurate treatment planning and enhances the predictability of surgical outcomes.<sup>[10]</sup>

**Customized Treatment Planning:** Tailor treatment plans to individual patient needs based on the severity of periimplantitis, extent of bone loss, and esthetic considerations. Select the most appropriate surgical techniques and adjunctive therapies, taking into account patient-specific factors and treatment goals.

**Innovative Surgical Techniques:** Explore innovative surgical techniques such as minimally invasive surgery, guided tissue regeneration, and implant surface decontamination using lasers or antimicrobial agents. Stay abreast of advancements in implant dentistry and periimplantitis management to optimize treatment outcomes and minimize patient morbidity.<sup>[11]</sup>

**Enhanced Soft Tissue Management:** Incorporate techniques for preserving and enhancing periimplant soft tissue aesthetics, such as soft tissue grafting, vestibuloplasty, and mucogingival surgery. Employ tension-free wound closure and suturing techniques to promote optimal healing and minimize soft tissue recession.

**Patient Education and Compliance:** Educate patients about the importance of maintaining optimal oral hygiene and attending regular follow-up appointments after surgical treatment. Provide clear instructions on post-operative care and self-care measures to minimize the risk of periimplantitis recurrence.<sup>[12]</sup>

**Multidisciplinary Collaboration:** Foster collaboration between dental specialists, including periodontists, oral surgeons, prosthodontists, and implantologists, to develop comprehensive treatment plans and ensure coordinated care. Engage in interdisciplinary case discussions to leverage collective expertise and address complex periimplantitis cases effectively.

**Research and Continuous Learning:** Stay updated on the latest research findings and evidence-based guidelines related to periimplantitis management. Participate in continuing education programs, conferences, and professional development activities to enhance clinical skills and stay informed about emerging treatment modalities.

**Cost-effective and Accessible Care:** Strive to provide cost-effective periimplantitis treatment options while maintaining high standards of care. Advocate for equitable access to specialized surgical services and adjunctive therapies to ensure optimal outcomes for all patients.<sup>[13]</sup>

### **Emerging Surgical techniques:**

**Minimally Invasive Surgery (MIS):** MIS involves performing surgical procedures with minimal disruption to surrounding tissues, reducing postoperative discomfort and promoting faster healing. Techniques such as flapless surgery, piezosurgery, and guided tissue regeneration with minimally invasive access aim to preserve periimplant tissues while effectively treating periimplantitis.

**Laser Therapy:** Laser therapy has gained popularity as a minimally invasive approach for periimplantitis treatment. Er:YAG (erbium-doped yttrium aluminum garnet) and Nd:YAG (neodymium-doped yttrium aluminum garnet) lasers are commonly used to decontaminate implant surfaces and periimplant tissues, with minimal damage to surrounding structures. [14-15]

**Photodynamic Therapy (PDT):** PDT involves the use of photosensitizing agents and light energy to target and eliminate bacteria associated with periimplantitis. This non-invasive approach can effectively reduce microbial load and promote tissue healing without causing damage to surrounding tissues. [15]

**Nanotechnology-Based Therapies:** Nanotechnology offers promising avenues for developing novel therapies for periimplantitis management. Nanoparticles loaded with antimicrobial agents or growth factors can be applied to implant surfaces to inhibit bacterial colonization and promote osseointegration. [16]

**Biological Approaches:** Biological therapies, such as platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), are being investigated for their potential in enhancing tissue regeneration and wound healing around implants. Growth factors and cytokines present in these biological matrices stimulate angiogenesis, cell proliferation, and tissue regeneration. [17]

**Implant Coatings and Surface Modifications:** Surface modifications of implant materials aim to improve biocompatibility, reduce bacterial adhesion, and enhance osseointegration. Techniques such as plasma spraying, ion implantation, and nanotexturing create bioactive surfaces that promote favorable host responses and inhibit microbial colonization. [18]

**3D Printing and Customized Implants:** Additive manufacturing technologies enable the fabrication of customized implants and scaffolds tailored to individual patient anatomy and defect morphology. Patient-specific implants can optimize implant placement and support tissue regeneration in challenging periimplantitis cases. [19]

**Robot-Assisted Surgery:** Robotics-assisted implant surgery offers precise and predictable implant placement, reducing the risk of intraoperative complications and optimizing treatment outcomes. Robotic systems provide real-time feedback and guidance to surgeons, ensuring accurate implant positioning and angulation.

**Gene Therapy:** Gene therapy holds potential for modulating host responses and promoting tissue regeneration around implants. Targeted delivery of genes encoding antimicrobial peptides, growth factors, or immunomodulatory agents can enhance the local environment and mitigate periimplantitis progression. [20]

**Conclusion:** In conclusion, the management of periimplantitis presents a significant challenge in implant dentistry, requiring a comprehensive and multidisciplinary approach. Surgical modalities play a crucial role in the treatment of periimplantitis, aiming to eradicate infection, restore peri-implant tissues, and preserve implant function and esthetics. Surgical modalities play a pivotal role in the management of periimplantitis, and continued advancements in surgical techniques hold promise for improving treatment efficacy, enhancing patient outcomes, and ensuring the long-term success of dental implants.

## References:

1. Renvert S, Roos-Jansåker AM, Lindahl C, Renvert H, Rutger Persson G. Infection at titanium implants with or without a clinical diagnosis of inflammation. *Clin Oral Implants Res.* 2007;18(4):509-516.
2. Heitz-Mayfield LJA, Salvi GE, Botticelli D, Mombelli A, Faddy M, Lang NP. Anti-infective treatment of peri-implant mucositis: a randomised controlled clinical trial. *Clin Oral Implants Res.* 2011;22(3):237-241.
3. Schwarz F, John G, Mainusch S, Sahm N, Becker J. Combined surgical therapy of peri-implantitis evaluating two methods of surface debridement and decontamination. A two-year clinical follow up report. *J Clin Periodontol.* 2012;39(8):789-797.
4. Azzeh MM, Assery MK, Hawas NH, Alwaeli HA. Surgical treatment of peri-implantitis: 5-year follow-up results. *Int J Oral Maxillofac Surg.* 2014;43(10):1270-1276.
5. Schwarz F, Sahm N, Becker J. Combined surgical therapy of advanced peri-implantitis lesions with concomitant soft tissue volume augmentation: a case series. *Clin Implant Dent Relat Res.* 2012;14(2):156-165.
6. John G, Sahm N, Becker J, Schwarz F. Nonsurgical treatment of peri-implantitis using an air-abrasive device or mechanical debridement and local application of chlorhexidine. Twelve-month follow-up of a prospective, randomized, controlled clinical study. *Clin Oral Investig.* 2015;19(8):1807-1814.
7. Louropoulou A, Slot DE, Van der Weijden F. Titanium surface alterations following the use of different mechanical instruments: a systematic review. *Clin Oral Implants Res.* 2012;23(6):643-658.
8. Esposito M, Grusovin MG, Worthington HV. Interventions for replacing missing teeth: treatment of peri-implantitis. *Cochrane Database Syst Rev.* 2012;1:CD004970.
9. Roos-Jansåker AM, Lindahl C, Renvert H, Renvert S. Nine- to fourteen-year follow-up of implant treatment. Part I: implant loss and associations to various factors. *J Clin Periodontol.* 2006;33(4):283-289.
10. Serino G, Turri A. Outcome of surgical treatment of peri-implantitis: results from a 2-year prospective clinical study in humans. *Clin Oral Implants Res.* 2011;22(11):1214-1220.
11. Carcuac O, Derks J, Charalampakis G, Abrahamsson I, Wennström JL, Berglundh T. Surgical treatment of peri-implantitis: 3-year results from a randomized controlled clinical trial. *J Clin Periodontol.* 2017;44(12):1294-1303.

12. Persson GR, Roos-Jansåker AM, Lindahl C, Renvert S. Microbiologic results after non-surgical erbium-doped:yttrium, aluminum, and garnet laser or air-abrasive treatment of peri-implantitis: a randomized clinical trial. *J Periodontol.* 2011;82(9):1267-1278.
13. Schwarz F, Becker K, Bastendorf KD, Cardaropoli D, Chatfield C, Dunn I, Fletcher P, Einwag J, Louropoulou A, Mombelli A, Ower P, Pavlovic P, Sahrm N, Salvi GE, Schmage P, Takeuchi Y, Van Der Weijden F, Renvert S. Recommendations on the clinical application of air polishing for the management of peri-implant mucositis and peri-implantitis. *Quintessence Int.* 2016;47(4):293-296.
14. Zitzmann NU, Berglundh T, Marinello CP, Lindhe J. Experimental peri-implant mucositis in man. *J Clin Periodontol.* 2001;28(6):517-523.
15. Roos-Jansåker AM, Renvert H, Lindahl C, Renvert S. Surgical treatment of peri-implantitis using a bone substitute with or without a resorbable membrane: a prospective cohort study. *J Clin Periodontol.* 2007;34(7):625-632.
16. Hallström H, Persson GR, Lindgren S, Olofsson M, Renvert S. Systemic antibiotics and debridement of peri-implant mucositis. A randomized clinical trial. *J Clin Periodontol.* 2012;39(6):574-581.
17. Jepsen S, Berglundh T, Genco R, Aass AM, Demirel K, Derks J, Figuero E, Giovannoli JL, Goldstein M, Lambert F, Ortiz-Vigon A, Polyzois I, Salvi GE, Schwarz F, Serino G, Tomasi C, Zitzmann NU. Primary prevention of peri-implantitis: managing peri-implant mucositis. *J Clin Periodontol.* 2015;42 Suppl 16: S152-157.
18. Ramanauskaite A, Baseviciene N, Wang HL, Tervonen T. The accuracy of various methods in the diagnosis of peri-implantitis: a systematic review and meta-analysis. *J Periodontol.* 2016;87(7):773-788.
19. Carcuac O, Abrahamsson I, Albouy JP, Linder E, Larsson L, Berglundh T. Experimental model for peri-implant mucositis and peri-implantitis in the dog. *Clin Implant Dent Relat Res.* 2013;15(1):36-47.
20. Rocuzzo M, Bonino L, Dalmaso P, Aglietta M. Long-term results of a three arms prospective cohort study on implants in periodontally compromised patients: 10-year data around sandblasted and acid-etched (SLA) surface. *Clin Oral Implants Res.* 2014;25(10):1105-1112.

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