ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 05 | May - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PERI-IMPLANTITIS TREATMENT: A COMPREHENSIVE REVIEW OF PAST, PRESENT, AND EMERGING THERAPEUTIC STRATEGIES

Dental Science

Dr. Shreetapa Chand Independent researcher, Mysuru, Karnataka 570015, India

Dr. Muskan Gupta* Independent researcher, Vivekanand Puri, North Delhi 110007, India*Corresponding Author

Sarah Jindal SGT university, Gurugram, Haryana 122505, India

ABSTRACT

Peri-implantitis is a major biological complication associated with dental implants, characterized by inflammation of peri-implant tissues and progressive bone loss. The management of implants has grown to be a major clinical concern due to their increasing use. Treatment strategies have changed over time, from traditional periodontitis-based methods to more sophisticated, implant-specific, and evidence-based procedures. Non-surgical treatment, which largely focuses on biofilm reduction, is mostly regarded as a supportive phase and shows limited efficacy in established disease. Currently, surgical interventions, including resective, regenerative, and combination approaches, represent the cornerstone of treatment; the success of these procedures is mostly reliant on the morphology of the defect and efficient cleaning of the implant surface. In an effort to improve treatment results, recent developments have brought in adjuvant therapies such lasers, photodynamic therapy, biologics, and host modulation techniques. However, long-term predictability remains inconsistent. Future developments focus on physiologically driven, customized strategies that address both host response and microbial dysbiosis. In addition to highlighting contemporary theories and cutting-edge treatment approaches for better clinical results, this study offers a thorough account of the development of peri-implantitis care.

KEYWORDS

Peri-implantitis; Dental Implants; Surgical Management; Regenerative Therapy; Implant Surface Decontamination

INTRODUCTION

- A biofilm-related inflammatory condition called peri-implantitis is represented by a gradual loss of bone surrounding dental implants.
- As implant therapy has become more common, its prevalence has increased, raising serious clinical concerns.
- Due to anatomical and biochemical variations in the tissues around implants, early therapeutic approaches based on periodontitis were insufficient.
- Peri-implantitis is now recognized as a complex disease including local risk factors, host response, and microbial dysbiosis.
- Traditional debridement has given way to more sophisticated surgical, regenerative, and biologically based treatments.
- Achieving consistent, long-term resolution is still a clinical problem despite progress.
- This review emphasizes future therapeutic approaches and focuses on the development of peri-implantitis care from the past to the present.

HISTORICAL ASPECT

- Osteointegration was introduced in the 1960s with an emphasis on implant survival rather than biological problems (Branemark et al.).[1]
- 1980s–1990s: Mechanical debridement and antiseptics were used in management based on periodontitis concepts, with limited effectiveness because of structural variations in peri-implant tissues (Lindhe & Berglundh).[2]
- 1994: The first official classification of peri-implant mucositis and peri-implantitis, along with the identification of periodontal pathogens (Albrektsson & Isidor).[3]
- 2000–2010: The shift toward infection control strategies that included mechanical debridement and adjunctive antimicrobial therapy (Heitz-Mayfield).[4]
- 2010–2020: The emergence of surgical management, including resective and regenerative approaches based on defect morphology (Schwarz et al.).[5]
- 2017: The standardization of diagnostic criteria using clinical and radiographic parameters.[6]
- 2020–Present: Shift to individualized, biologically based treatments that incorporate enhanced decontamination techniques, host modulation, and regenerative approaches (Sanz et al.).[7]

NON-SURGICAL TREATMENT MODALITIES

- Mechanical debridement: This method, which uses curettes or ultrasonic devices to remove biofilm, is not very effective since it cannot reach rough implant surfaces (Mombelli et al.).[8]
- Glycine/erythritol air polishing improves biofilm disruption with little surface damage, although it mostly lowers inflammation without completely eliminating the condition (Heitz-Mayfield).[4]
- When used in conjunction with mechanical therapy, chlorhexidine, a local antiseptic, has a brief antibacterial effect with minimal additional therapeutic benefit.[9]
- By focusing on anaerobic microorganisms, systemic antibiotics may offer short-term relief, but their poor long-term effectiveness and resistance risk limit their regular usage (Renvert et al.).[10]
- Local medication delivery (minocycline/doxycycline): Not enough as a stand-alone treatment, but enables site-specific antibacterial action with slight clinical benefits.[11]
- Although there is conflicting information regarding its clinical superiority but laser therapy (Er:YAG, diode) improves implant surface cleaning with minimum thermal injury (Schwarz et al.).[12]
- Photodynamic treatment (PDT) is a minimally invasive antibacterial strategy with low long-term efficacy and only minor supplementary advantages.[13]

Overall non-surgical therapy is effective for inflammation control but insufficient for established peri-implantitis, mainly serving as a preliminary or supportive phase.

SURGICAL TREATMENT MODALITIES FOR PERI-IMPLANTITIS

- Open flap debridement: Provides direct access for implant surface decontamination, improving clinical parameters but with limited long-term disease resolution.
- Resective surgery: Involves apically positioned flap with or without implantoplasty to eliminate pockets and facilitate hygiene, especially in horizontal bone loss.[5]
- Implantoplasty: Mechanical smoothing of exposed implant surface reduces plaque retention but is irreversible and may compromise implant strength.
- Regenerative surgery: Aims to reconstruct lost bone using grafts and membranes based on GBR principles, with better outcomes in contained defects.[5] Bone grafts (auto/xeno/alloplast) provide scaffold for bone regeneration, with xenografts commonly used due to volume stability. Barrier membranes enhance selective cell repopulation and improve regenerative outcomes, particularly in intrabony defects.
- Combined therapy: Integrates resective (supracrestal) and regenerative (intrabony) approaches for optimal management of complex defects.[10]
- Implant surface decontamination: Critical step using mechanical, chemical, or laser methods, though no gold standard exists.

Overall surgical therapy is the mainstay of treatment, offering superior outcomes compared to non-surgical approaches, though predictability remains variable.

EMERGING TREATMENT MODALITIES

- Although its long-term superiority has not yet been established, laser therapy (Er:YAG, diode) allows for efficient implant surface cleansing with minimal damage.[12]
- Photodynamic therapy (PDT): This modest supplementary treatment uses photosensitizers to produce reactive oxygen species for bacterial elimination.[13]
- By releasing growth factors, platelet concentrates (PRF) improve bone regeneration and soft tissue healing (Miron et al.).[14] Growth factors (PDGF, BMPs): Increase the capacity for regeneration by promoting angiogenesis and osteogenesis, but its clinical prediction varies.
- Enamel matrix derivatives (EMD): Provide limited but potential peri-implant applications to promote periodontal-like regeneration.[15]
- According to new research, host modulation treatment uses substances like pro-resolving mediators and sub-antimicrobial doxycycline to target inflammatory pathways.
- Cold plasma therapy is a cutting-edge method of decontaminating implant surfaces with minimum surface change and potent antibacterial effects.[16]
- Electrochemical decontamination: Improves micro-level biofilm removal without compromising the integrity of the implant surface.
- Probiotics and microbiome modulation: Reflects the shift toward dysbiosis-based medicine by aiming to restore microbial balance rather than eradicate pathogens.
- Nanotechnology-based treatments: Enhances antibacterial and regenerative results by improving medication delivery and surface modification.[17]

Although long-term clinical evidence is still developing, biologically driven, minimally invasive, and tailored medicines are the direction of future management.

CONCLUSION

- A complicated, multifaceted condition that is becoming more common and has a big influence on implant success is peri-implantitis.
- Non-surgical therapy is primarily used as an initial or supportive phase and offers little advantages.
- Effective implant surface cleaning and defect morphology determine the result of surgical care, which continues to be the cornerstone.
- Although they lack substantial long-term proof, emerging medicines exhibit intriguing possibilities.
- A customized, risk-based strategy and stringent maintenance procedures are necessary for effective management in order to stop recurrence.

REFERENCES

1. Kim TI. A tribute to Dr. Per-Ingvar Brånemark. J Periodontal Implant Sci. 2014 Dec;44(6):265. doi: 10.5051/jpis.2014.44.6.265. Epub 2014 Dec 31. PMID: 25568805; PMCID: PMC4284373.
2. Almohandes A, Abrahamsson I, Dionigi C, Berglundh T. Surgical treatment of experimental peri-implantitis using mechanical and chemical decontamination procedures: A pre-clinical in vivo study. Journal of Clinical Periodontology. 2022 May;49(5):518-525. DOI: 10.1111/jcpe.13607. PMID: 35191056.
3. Albrektsson, T & Zarb, George & Worthington, P & Eriksson, A.R.. (1986). The long-term efficacy of currently used dental implants: A review and proposed criteria of success. The International journal of oral & maxillofacial implants. 1. 11-25.
4. Heitz-Mayfield LJA, Salvi GE. Peri-implant mucositis. J Clin Periodontol. 2018;45(Suppl 20):S237–S245. https://doi.org/10.1111/jcpe.12953
5. Schwarz F, Derks J, Monje A, Wang H-L. Peri-implantitis. J Clin Periodontol. 2018;45(Suppl 20):S246–S266. https://doi.org/10.1111/jcpe.12954
6. Berglundh T, Armitage G, Araujo MG, Avila-Ortiz G, Blanco J, Camargo PM, Chen S, Cochran D, Derks J, Figuero E, Hämmerle CHF, Heitz-Mayfield LJA, Huynh-Ba G, Iacono V, Koo KT, Lambert F, McCauley L, Quirynen M, Renvert S, Salvi GE, Schwarz F, Tarnow D, Tomasi C, Wang HL, Zitzmann N. Peri-implant diseases and conditions: Consensus report of workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Periodontol. 2018 Jun;89 Suppl 1:S313-S318. doi: 10.1002/JPER.17-0739. PMID: 29926955.
7. Sanz M, Chapple IL, on behalf of Working Group 4 of the VIII European Workshop on Periodontology. Clinical research on peri-implant diseases: consensus report of Working Group 4. J Clin Periodontol 2012; 39 (Suppl. 12): 202–206. doi: 10.1111/j.1600-051X.2011.01837.x.
8. Mombelli, A. and Décaillet, F. (2011), The characteristics of biofilms in peri-implant disease. Journal of Clinical Periodontology, 38: 203-213. https://doi.org/10.1111/j.1600-051X.2010.01666.x
9. Ye M, Liu W, Cheng S, Yan L. Efficacy of Adjunctive Chlorhexidine in non-surgical treatment of Peri-Implantitis/Peri-Implant Mucositis: An updated systematic review and meta-analysis. Pak J Med Sci. 2023 Mar-Apr;39(2):595-604. doi: 10.12669/pjms.39.2.7253. PMID: 36950440; PMCID: PMC10025710.
10. Renvert, S. and Polyzois, I. (2018), Treatment of pathologic peri-implant pockets. Periodontol 2000, 76: 180-190. https://doi.org/10.1111/prd.12149
11. Sahoo N, Nedumgottil BM, Chakraborty S, Mathew S, Jasthi VC, Duseja S, Nagaral S. Efficacy of Different Local Drug Delivery Systems in the Management of Peri-implantitis: An *In Vivo* Study. J Contemp Dent Pract. 2025 Jul 1;26(7):683-687. doi: 10.5005/jp-journals-10024-3802. PMID: 41045163.
12. Romanos GE, Estrin NE. Laser applications in peri-implantitis therapy: A narrative review. J Dent. 2025 Nov;162:106081. doi: 10.1016/j.jdent.2025.106081. Epub 2025 Sep 1. PMID: 40902817.
13. Rahman B, Acharya AB, Siddiqui R, Verron E, Badran Z. Photodynamic Therapy for Peri-Implant Diseases. Antibiotics (Basel). 2022 Jul 8;11(7):918. doi: 10.3390/antibiotics11070918. PMID: 35884171; PMCID: PMC9311944.
14. Miron RJ, Fujioka-Kobayashi M, Sculean A, Zhang Y. Optimization of platelet-rich fibrin. Periodontol 2000. 2024;94:79-91. doi:10.1111/prd.12521
15. Wilson, T.G., Jr.; Harrel, S.K.; Nunn, M.E. The Use of Enamel Matrix Derivative during Surgical Therapy for Peri-Implantitis: A Case Series. *Dent. J.* **2024**, *12*, 11. https://doi.org/10.3390/dj1201001
16. Irene Mallor-Solís, Trang Nguyen, Nicholas G. Fischer, Lina Niu, Conrado Aparicio, Harnessing plasma for peri-implantitis: Technical and clinical insights into its application on dental implants and abutments, Translational Dental Research,Volume 2, Issue 1,2026,100065,ISSN 2950-3485, https://doi.org/10.1016/j.tdr.2026.100065
17. Hosseini Hooshiar, M., Mozaffari, A., Hamed Ahmed, M. *et al.* Potential role of metal nanoparticles in treatment of peri-implant mucositis and peri-implantitis. *BioMed Eng OnLine* **23**, 101 (2024). https://doi.org/10.1186/s12938-024-01294-0