Original Article

CLINICAL AND RADIOGRAPHIC PERI-IMPLANT COMPARISON BETWEEN TREATED PERIODONTITIS ON SUPPORTIVE CARE AND HEALTHY CONTROLS

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ABSTRACT

Peri-implant tissue stability plays a crucial role in the long-term success of dental implants. A history of periodontitis is considered a major risk factor for peri-implant complications, even in patients undergoing supportive periodontal therapy (SPT). To compare peri-implant clinical and radiographic parameters between individuals with treated periodontitis on regular SPT and periodontally healthy subjects. This cross-sectional observational study included 120 systemically healthy individuals aged 30–55 years, divided into two groups: Group 1 (n=60) with a history of generalized chronic periodontitis who had received full-mouth periodontal therapy and were on SPT for at least one year, and Group 2 (n=60) comprising periodontally healthy individuals. All participants had at least one functional implant placed more than 12 months prior to evaluation. Probing depth (PD), clinical attachment level (CAL), and crestal bone loss (CBL) were recorded around each implant. Statistical analysis was performed using independent t-tests and Chi-square tests, with significance set at $p < 0.05$. There was no significant difference in age ($p=0.38$) or sex distribution ($p=0.67$) between the groups. Group 1 showed significantly higher values for PD (5.21 ± 0.36 mm), CAL (5.48 ± 0.41 mm), and CBL (2.95 ± 0.23 mm) compared to Group 2 (3.56 ± 0.41 mm, 3.68 ± 0.35 mm, and 1.52 ± 0.29 mm, respectively), with all differences being statistically significant ($p < 0.05$). Patients with a history of periodontitis exhibit greater peri-implant breakdown than periodontally healthy individuals despite being on regular SPT.

Key words: Dental implants, Implant maintenance, Peri-implant diseases, Peri-implant health, Periodontitis, Supportive periodontal therapy.

Introduction

Dental implants have revolutionized the management of partial and complete edentulism, offering a highly predictable and long-term solution for tooth replacement [1-3]. Their success is closely tied to the preservation of peri-implant tissue health. However, with the increasing prevalence of dental implants, a concurrent rise in biological complications, particularly peri-implant mucositis and peri-implantitis, has become a growing concern in clinical practice. These conditions, characterized by inflammation of the peri-implant soft tissues and progressive bone loss, can significantly compromise implant survival if left unaddressed [4, 5].

Multiple risk factors have been implicated in the onset and progression of peri-implant diseases. These include poor oral hygiene, inadequate plaque control, smoking, systemic conditions such as diabetes mellitus, genetic predisposition, residual cement, prosthetic design flaws, lack of keratinized mucosa, history of periodontitis, and irregular maintenance care [6-10]. Among these, a prior history of periodontitis stands out as one of the most significant and well-documented risk indicators for peri-implant tissue breakdown [11-13]

Despite undergoing successful active periodontal therapy, individuals with a background of chronic periodontitis may retain a heightened susceptibility to peri-implant inflammation. This risk persists even under supportive periodontal therapy (SPT), which is designed to maintain periodontal health through regular debridement, monitoring, and reinforcement of oral hygiene practices. The persistent microbial burden, inflammatory response, and altered host immune mechanisms in these individuals may contribute to compromised peri-implant outcomes when compared to those with no previous periodontal disease. On the other hand, periodontally healthy individuals, those with no clinical or radiographic evidence of periodontal destruction, typically exhibit more stable peri-implant tissues and a reduced risk of disease progression, assuming adequate maintenance protocols are followed [14-18]

Given this background, the present cross-sectional study was conducted to evaluate and compare peri-implant clinical and radiographic parameters between patients with a history of chronic periodontitis undergoing regular SPT and periodontally healthy individuals. This comparison aimed to elucidate whether a prior history of periodontitis continues to influence peri-implant outcomes despite adherence to maintenance therapy.

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Materials and Methods

Study design and population

This cross-sectional observational study was conducted in the Department of Periodontology at Saveetha Dental College and Hospitals, Chennai, India, following approval from the Institutional Ethics Committee. Informed written consent was acquired from all participants, and the study was conducted in compliance with the Declaration of Helsinki. A total of 120 systemically healthy individuals aged between 30 and 55 years were enrolled and equally divided into two groups: Group 1 (n = 60), consisting of patients with a history of generalized chronic periodontitis, and Group 2 (n = 60), comprising periodontally healthy individuals. The sample size was calculated using G*Power software (Version 3.1.9.4), based on previously published mean and standard deviation values [19].

Participants in Group 1 had previously undergone comprehensive periodontal treatment, including full-mouth periodontal flap surgery, followed by regular supportive periodontal therapy (SPT) for a minimum of one year. Each subject had received at least one endosseous dental implant, restored with a functional prosthesis, and maintained in function for at least 12 months prior to evaluation. Group 2 consisted of age- and sex-matched individuals with no clinical or radiographic evidence of periodontitis. All control subjects had at least one functional dental implant in place for a minimum of 12 months and were under routine dental maintenance care.

Inclusion criteria for both groups required systemically healthy participants to be within the age range of 30 to 55 years, have at least one functional implant placed more than 12 months prior, and possess complete clinical and radiographic records at baseline and one-year follow-up. Patients were excluded if they had a history of aggressive periodontitis, systemic conditions affecting periodontal or peri-implant health, current or past tobacco use, recent use of antibiotics or anti-inflammatory medications (within three months), or incomplete clinical or radiographic documentation.

Outcome parameters

Probing depth (PD) and clinical attachment level (CAL) were assessed at six sites around each implant using a UNC-15 periodontal probe. The mean value per implant was calculated for both parameters. Crestal bone loss (CBL) was evaluated using standardized digital periapical radiographs obtained with the paralleling technique. Measurements were made from the implant platform to the most coronal level of bone contact at the mesial and distal aspects, and the average of these two values was recorded to represent the CBL for each implant.

Statistical analysis

The implant served as the primary unit of analysis. Descriptive statistics are presented as mean ± standard deviation. Normal distribution of the data was confirmed using the Shapiro–Wilk test. Intergroup comparisons of age, PD, CAL, and CBL were performed using independent t-tests. Gender distribution between the groups was analyzed using the Chi-square test. A p-value < 0.05 was considered statistically significant. All statistical analyses were conducted using SPSS software, version 23.0 (IBM Corp., Armonk, NY, USA).

Results and Discussion

No statistically significant differences were observed between the two groups with respect to demographic variables. The mean age of participants in the treated periodontitis group was 43.62 ± 6.58 years, while that in the periodontally healthy group was 42.71 ± 7.03 years ($p = 0.38$). Both groups were similarly distributed in terms of sex, with 32 males and 28 females in the treated group and 30 males and 30 females in the healthy group ($p = 0.67$). These findings indicate that the groups were comparable in terms of age and gender distribution, eliminating demographic bias in outcome interpretation.

The intergroup comparison revealed statistically significant differences across all evaluated peri-implant parameters. The treated periodontitis group exhibited significantly greater probing depth (5.21 ± 0.36 mm), clinical attachment level (5.48 ± 0.41 mm), and crestal bone loss (2.95 ± 0.23 mm) compared to the periodontally healthy group, which showed lower values for probing depth (3.56 ± 0.41 mm), clinical attachment level (3.68 ± 0.35 mm), and crestal bone loss (1.52 ± 0.29 mm), with all p values being <0.05 **(Table 1)**.

Table 1. Intergroup Comparison of Clinical and Radiographic Parameters

Parameter	Treated Periodontitis Group (Mean ± SD)	Periodontally Healthy Group (Mean ± SD)	p value
Probing Depth (PD)	5.21 ± 0.36 mm	3.56 ± 0.41 mm	0.00*
Clinical Attachment Level (CAL)	5.48 ± 0.41 mm	3.68 ± 0.35 mm	0.00*
Crestal Bone Loss (CBL)	2.95 ± 0.23 mm	1.52 ± 0.29 mm	0.00*

*Statistically significant

In recent years, research in implant dentistry has increasingly explored strategies to enhance implant longevity and clinical success. These efforts include advancements in surface engineering, bioactive material coatings, host-modulatory approaches, and individualized risk assessment protocols, each aimed at improving tissue integration and minimizing biological complications [20-25]. While osseointegration remains a foundational aspect of implant success, the preservation of peri-implant soft and

hard tissues is equally critical. Among the recognized risk factors for peri-implant disease, a previous history of periodontitis stands out as a significant contributor, even in patients who adhere to regular SPT. The present study was designed to evaluate the impact of such a history by comparing peri-implant clinical and radiographic parameters between treated periodontitis patients under SPT and periodontally healthy individuals, thereby shedding light on how prior periodontal disease may influence peri-implant tissue health.

The findings of the present study demonstrated significantly greater probing depth, clinical attachment loss, and crestal bone loss in the treated periodontitis group compared to the periodontally healthy group, despite both cohorts being under routine maintenance care. These results reflect the lasting impact of prior periodontal breakdown on the peri-implant environment, highlighting the potential for residual susceptibility in previously diseased individuals.

Our findings align with those of Aguirre-Zorzano *et al*. [26-29] who reported a notable prevalence of peri-implant mucositis and peri-implantitis in periodontally compromised patients even under regular SPT. They identified plaque accumulation, type of periodontitis, and implant location as significant contributing factors. Similarly, Roccuzzo *et al*. [30-32] in a 20-year longitudinal evaluation, emphasized that patients with a history of periodontitis were more likely to develop peri-implantitis over time, particularly those who were non-compliant with maintenance therapy. Their study further demonstrated that long-term peri-implant health was strongly linked to both periodontal history and adherence to tailored SPT programs.

Arunyanak *et al*. [32-34] reinforced these observations, showing that patients with prior chronic periodontitis had a 2.5-fold increased risk of developing peri-implantitis compared to those without such a history. This association was particularly evident in those with a history of severe disease. The role of inadequate maintenance and presence of residual inflammation has also been confirmed by Pjetursson *et al*. [35-37] who reported higher rates of peri-implantitis in patients with residual pockets at the end of active periodontal therapy. Additionally, the importance of structured maintenance care is highlighted in studies by Rokn *et al*. [38, 39] and Mir-Mari *et al*. [40, 41] where the absence of regular follow-up correlated with increased peri-implant tissue complications. In contrast, studies such as Gianserra *et al*. [42] and Gatti *et al*. [43] showed variable impact of periodontal history on implant survival, possibly due to differences in study design, maintenance protocols, and disease severity. Other studies, such as those by Saaby *et al*. [44, 45] and Daubert *et al*. [46, 47] further identified smoking, diabetes, and poor plaque control as compounding factors for peri-implant tissue deterioration, especially in individuals with a history of periodontal disease. These risk modifiers, when coupled with pre-existing susceptibility, can significantly influence implant prognosis even under optimal clinical care.

Taken together, the present findings and existing evidence underscore the need for heightened vigilance and individualized maintenance strategies in patients with a history of periodontitis, even after successful periodontal therapy and implant placement. A key strength of this study lies in its strict inclusion criteria, ensuring both groups were systemically healthy, age-matched, and under consistent maintenance care, thereby isolating the effect of periodontal history. However, the cross-sectional design limits the ability to establish causal relationships, and the sample size, though adequate, may not fully capture long-term disease progression. Additionally, variations in implant systems, prosthetic designs, and individual compliance levels could not be fully standardized. Future longitudinal studies with larger, multicentric cohorts are warranted to evaluate the trajectory of peri-implant tissue changes over time in patients with different severities of past periodontal disease. Further research should also explore the role of host immune response, microbial profiles, and adjunctive preventive strategies to mitigate peri-implant risks in periodontitis-susceptible individuals.

Conclusion

Within the limitations of this cross-sectional study, it can be concluded that individuals with a history of treated periodontitis, even when maintained on regular supportive periodontal therapy, exhibit significantly greater peri-implant probing depths, clinical attachment loss, and crestal bone loss compared to individuals with periodontally healthy teeth. These findings highlight the lasting influence of prior periodontal disease on peri-implant tissue health and emphasize the need for individualized risk-based maintenance protocols, more frequent monitoring, and proactive preventive strategies to ensure long-term implant success in periodontitis-susceptible patients.

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Conflict of interest: None

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Ethics statement: The study protocol was approved by Institutional Ethics Committee, Saveetha Dental College and Hospitals, Chennai, India (SDC/MSIMPLANT-2406/24/274).

References

1. Alghamdi HS, Jansen JA. The development and future of dental implants. Dent Mater J. 2020;39(2):167-72.
2. Agarwal S, Ashok V, Maiti S, Agarwal V. Dentists' preference toward fixed versus removable implant prosthesis on edentulous jaws to improve quality of life. J Long Term Eff Med Implants. 2023;33(1):83-9.

3. Royapuram Parthasarathy P, Anaiambalam Tharmar MA, Thangavelu L. Ceramic biomaterials in dental implantology—time for change of status quo: an updated review. World J Dent. 2024;15(8):733-42.
4. Klinge B, Klinge A, Bertl K, Stavropoulos A. Peri-implant diseases. Eur J Oral Sci. 2018;126:88-94.
5. Makhoahle P, Gaseitsiwe T. Efficacy of disinfectants on common laboratory surface microorganisms at R.S Mangaliso Hospital, NHLS Laboratory, South Africa. Bull Pioneer Res Med Clin Sci. 2022;1(1):1-12. doi:0.51847/d5bXpXAtcI
6. Kwatra D, Venugopal A, Anant S. Studying the efficacy of tolmetin radiosensitizing effect in radiotherapy treatment on human clonal cancer cells. Bull Pioneer Res Med Clin Sci. 2024;3(2):22-8. doi:0.51847/Uuhjk0fMC8
7. Sri HK, Ahmed N, Sasanka LK. Association of age, gender, and site of implant placement: an institution-based retrospective study. J Long Term Eff Med Implants. 2024;34(3):75-82.
8. Duraisamy R, Ganapathy D, Shanmugam R, Thangavelu L. Systematic review on hydroxyapatite and chitosan combination-coated titanium implants on osseointegration. World J Dent. 2024;15(1):79-86.
9. Devarakonda S, Subramanian AK, Sivashanmugam P. Surface characterization of strontium phosphate coating on magnesium for bioimplant applications: a preliminary in vitro study. World J Dent. 2024;15(3):208-13.
10. Nahata B, Maiti S, Ganesh MK, Heboyan A, Sai L, Paulraj J. Sulfonated polyether ketone (SPEKK) implant as an alternative to titanium implant: in vivo study on Wistar albino rat mandible. BMC Oral Health. 2025;25(1):557.
11. Casado PL, Pereira MC, Duarte ME, Granjeiro JM. A history of chronic periodontitis is a high-risk indicator for peri-implant disease. Braz Dent J. 2013;24:136-41.
12. Shen F, Bao L. Studying the effects of music on the time to gain independent oral feeding in premature infants. J Integr Nurs Palliat Care. 2025;6:1-6. doi:0.51847/xBTC4CiH10
13. İlhan N, Telli S, Temel B, Aştı T. Investigating the sexual satisfaction mediating role in the relationship between health literacy and self-care of men with diabetes and women's marital satisfaction. J Integr Nurs Palliat Care. 2022;3:19-25. doi:0.51847/sFjL3OLpqg
14. Ağaçkıran M, Avşaroğullar OL, Şenol V. Examining the frequency of violence versus nurses and the factors affecting it in hospitals. J Integr Nurs Palliat Care. 2023;4:11-6. doi:0.51847/0rzZBHvQ2d
15. Bandi V, Dey SK, Rao O. Factors influencing the physician prescribing behaviour of medicines in developed and developing countries: a systematic review. J Integr Nurs Palliat Care. 2024;5:21-34. doi:0.51847/ZS3boQgksO
16. Dhanasekar P, Rajayyan JS, Veerabadiran Y, Kumar KS, Kumar KS, Chinnadurai N. Evaluation of alum and purification process of water by coagulation method. Bull Pioneer Res Med Clin Sci. 2022;1(2):1-6. doi:0.51847/R8GyfOmMDh
17. Darby I. Risk factors for periodontitis & peri-implantitis. Periodontol 2000. 2022;90(1):9-12.
18. Cui Z, Wang P, Gao W. Microbial dysbiosis in periodontitis and peri-implantitis: pathogenesis, immune responses, and therapeutic. Front Cell Infect Microbiol. 2025;15:1517154.
19. Graetz C, El-Sayed KF, Geiken A, Plaumann A, Sälzer S, Behrens E, et al. Effect of periodontitis history on implant success: a long-term evaluation during supportive periodontal therapy in a university setting. Clin Oral Investig. 2018;22:235-44.
20. Maiti S, Dhakshinya M, Nallaswamy D, Jessy P. Comparative analysis of surface characteristics and hardness of three-dimensional printed PEEK vs PEKK as implant biomaterial. J Osseointegration. 2024;16(1):16-22.
21. Gnanajothi J, Rajasekar A. Inflammatory status of patients with dental implants of different microgeometry using ELISA: a prospective clinical study. J Int Oral Health. 2024;16(6):472-8.
22. Senthil R. Bone implant substitutes from synthetic polymer and reduced graphene oxide: current perspective. Int J Artif Organs. 2023;47(1):57-66.
23. Enwa FO, Jewo AO, Oyubu LO, Adjekuko CO, Effiong V. Incidence of vaginal infections among females of different age categories in Delta State, Nigeria. Bull Pioneer Res Med Clin Sci. 2022;1(1):18-23. doi:0.51847/C1oahQ115n
24. Mubayrik AFB, Al-Turck K, Aldaijy RE, Alshehri RM, Bedaiwi AA, Alofisan AO, et al. Understanding the dangers of sun exposure and the importance of photoprotection practices in public awareness. Turk J Public Health Dent. 2022;2(1):1-8. doi:0.51847/32g0nPWudc
25. Skeie MS, Klock KS. A public health strategy for preventing early childhood caries. Turk J Public Health Dent. 2023;3(2):1-6. doi:0.51847/hH5vylmK34
26. García E, Jaramillo S. Telescopic retention in prosthodontics: a digital approach for enhanced patient outcomes. Asian J Periodontics Orthod. 2023;3:25-9. doi:0.51847/zpD7lrfE1t
27. Sugimori T, Yamaguchi M, Kikuta J, Shimizu M, Negishi S. The biomechanical and cellular response to micro-perforations in orthodontic therapy. Asian J Periodontics Orthod. 2022;2:1-15. doi:0.51847/Z9adSJ59rj
28. Kızılcı E, Duman B, Demiroğlu C, Ayhan B. Studying the relationship between severe dental caries in childhood and body mass index in children. Ann J Dent Med Assist. 2024;4(1):24-9. doi:0.51847/l1XzMq8peF
29. Aguirre-Zorzano LA, Estefanía-Fresco R, Telletxea O, Bravo M. Prevalence of peri-implant inflammatory disease in patients with a history of periodontal disease who receive supportive periodontal therapy. Clin Oral Implants Res. 2015;26(11):1338-44.

30. Roccuzzo A, Weigel L, Marruganti C, Imber JC, Ramieri G, Sculean A, et al. Longitudinal assessment of peri-implant diseases in patients with and without history of periodontitis: a 20-year follow-up study. Int J Oral Implantol. 2023;16(3):211-22.
31. Heimes D, Mark NA, Kuchen R, Pabst A, Becker P, Kyyak S, et al. Awareness and preparedness of Saudi dental trainees on medication-related osteonecrosis of the jaw. Ann J Dent Med Assist. 2022;2(2):1-9. doi:0.51847/SkHmFpUrKD
32. Reshetnikov AD, Barashkova AI. The role of veterinary innovations in reindeer husbandry for climate change adaptation. Int J Vet Res Allied Sci. 2022;2(1):1-8. doi:0.51847/UlrjooXH9s
33. Fiodorova OA, Sivkova EI, Nikonov AA. Safeguarding beef cattle from gnats and gadflies in the Southern Tyumen region. Int J Vet Res Allied Sci. 2022;2(2):8-13. doi:0.51847/iVXOeXmSNZ
34. Arunyanak SP, Sophon N, Tangsathian T, Supanimitkul K, Suwanwichit T, Kungsadalpipob K. The effect of factors related to periodontal status toward peri-implantitis. Clin Oral Implants Res. 2019;30(8):791-9.
35. Pjetursson BE, Helbling C, Weber HP, Matuliene G, Salvi GE, Brägger U, et al. Peri-implantitis susceptibility as it relates to periodontal therapy and supportive care. Clin Oral Implants Res. 2012;23(7):888-94.
36. Furukawa K, Inai N, Tagami J. Influence of luting cements on the fracture resistance of hybrid ceramic restorations. Ann Orthod Periodontics Spec. 2024;4:1-13. doi:0.51847/dgJjH8rfJd
37. Wilhelmy L, Willmann JH, Tarraf NE, Wilmes B, Drescher D. Managing first molar agenesis: a long-term assessment of space closure and implant options. Ann Orthod Periodontics Spec. 2022;2:1-7. doi:0.51847/ryKxA1287r
38. Perrine KTA, Moïse AAA, Claver KA, Tenon C, Brice BJ, Herve KK, et al. Assessment of the impact of Ocimum gratissimum L. (Lamiaceae) extracts on Nasutitermes termites, cocoa pests in Côte d'Ivoire. Entomol Lett. 2023;3(1):7-17. doi:0.51847/gYbXNUKPX6
39. Rokn A, Aslroosta H, Akbari S, Najafi H, Zayeri F, Hashemi K. Prevalence of peri-implantitis in patients not participating in well-designed supportive periodontal treatments: a cross-sectional study. Clin Oral Implants Res. 2017;28(3):314-9.
40. Mir-Mari J, Mir-Orfila P, Figueiredo R, Valmaseda-Castellón E, Gay-Escoda C. Prevalence of peri-implant diseases: a cross-sectional study based on a private practice environment. J Clin Periodontol. 2012;39(5):490-4.
41. Canassa VF, Baldin ELL. Impact of sorghum genotypes on nymphal development and reproduction of Melanaphis sacchari. Entomol Lett. 2022;2(2):10-8. doi:0.51847/QgKDLAX7eV
42. Gianserra R, Cavalcanti R, Oreglia F, Manfredonia MF, Esposito M. Outcome of dental implants in patients with and without a history of periodontitis: a 5-year pragmatic multicentre retrospective cohort study of 1727 patients. Eur J Oral Implantol. 2010;3(4):307-14.
43. Gatti C, Gatti F, Chiapasco M, Esposito M. Outcome of dental implants in partially edentulous patients with and without a history of periodontitis: a 5-year interim analysis of a cohort study. Eur J Oral Implantol. 2008;1(1):45-51.
44. Saaby M, Karring E, Schou S, Isidor F. Factors influencing severity of peri-implantitis. Clin Oral Implants Res. 2016;27(1):7-12.
45. Pavithra A, Paulraj J, Rajeshkumar S, Maiti S. Comparative analysis of antimicrobial properties and compressive strength of traditional and thyme-enhanced glass ionomer cement. Int J Dent Res Allied Sci. 2023;3(2):16-23. doi:0.51847/y77YKMTRI8
46. Chidambaranathan AS, Culathur T. Acupuncture for temporomandibular joint muscular disorder: a prospective clinical assessment of its therapeutic effectiveness. Int J Dent Res Allied Sci. 2022;2(2):10-5. doi:0.51847/7MWBiwx7jQ
47. Daubert DM, Weinstein BF, Bordin S, Leroux BG, Flemmig TF. Prevalence and predictive factors for peri-implant disease and implant failure: a cross-sectional analysis. J Periodontol. 2015;86(3):337-47.