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Comparison Of Clinical Peri-Implant Indices And Alveolar Bone Levels Around Implants Placed In Non-Diabetic And Diabetic Patients

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ABSTRACT

Background: Diabetes is a serious health concern which is rising globally. This compromises the prognosis of dental implant treatment. The aim of this study was to assess the peri-implant health parameters among the non-diabetic and diabetic patients.

Materials and Methods: The cross-sectional study was conducted in Department of Implantology, Saveetha Dental College and Hospitals Chennai, India among 460 patients who reported between July 2023-August 2024 and had a minimum of single implant in function for at least 1 year after crown cementation. Among 460 patients, 228 were non-diabetic individuals (Group A) and 232 were diabetic patients (Group B). Clinical parameters including peri-implant probing depth (PPD), clinical attachment level (CAL) and radiographic parameter including alveolar bone level (ABL) was recorded and compared between both the groups using independent t-test.

Results: The mean PPD among non-smokers and smokers were 2.58±0.07 and 5.04±0.05 respectively. The mean CAL among non-smokers and smokers were 3.05±0.02 and 5.84±0.04 respectively. The mean ABL among non-smokers and smokers were 1.36±0.03 and 3.17±0.04 respectively. Independent t-test revealed there was statistically significant difference in PPD (p=0.02), CAL (p=0.03) and ABL (p=0.03).

Conclusion: Diabetic patients demonstrated greater peri-implant probing depth, clinical attachment loss and alveolar bone loss as compared to non-diabetic individuals.

Keywords: *Dental implants, Diabetes, Implant survival, Osseointegration*

1. INTRODUCTION

Modern dentistry aims towards restoring normal function, health, speech and aesthetics irrespective of the disease, injury and atrophy. Dental implants have been an ideal choice for replacement due to their biocompatibility. They provide best anchorage support since they are surgically positioned in the jaw beneath the gums and offer support for placing the artificial crown over it, where aesthetic look is achieved.[1-3] Inspite of the success of dental implants, there are a number of risk factors including systemic disorders, smoking, stress, hormones, heredity, age, gender and socioeconomic status that might predispose to peri-implant diseases.[4-7]

Diabetes mellitus is a chronic disorder of glucose metabolism with serious clinical consequences. Diabetes and associated complications pose a major health-care burden worldwide and present major challenges to patients, health-care systems, and national economies. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030.[8] Asian populations are multiracial and have multifactorial causes of diabetes. The mechanisms underlying development of the

disease are complex and varied, even within these populations. The major etiological components of diabetes are impaired insulin secretion and impaired insulin action, which are aggravated by the presence and degree of glucotoxicity. Both components might also be genetically predetermined. This is the pathophysiology of diabetes.[9]

Literature studies indicated that the survival of dental implants in patients with diabetes mellitus was less when compared with healthy patients. Al-Shibani N et al., suggested that clinical stability and radiographic bone levels around implants are determined greatly by the glycemic status and oral hygiene maintenance.[10] Similarly, Dreyer H et al., considering publications from January 1980 until March 2016, found positive association between diabetes mellitus and peri-implantitis, with diabetic patients being two times more prone to develop peri-implantitis.[11] In this context, the aim of the study was to assess the clinical and radiographic parameters in relation to implants placed among non-diabetic and diabetic patients.

2. MATERIALS AND METHODS

Study Design

This cross-sectional study was conducted in Department of Implantology, Saveetha Dental College and Hospitals Chennai, India. A total of 460 patients who reported between July 2023-August 2024 and had a minimum of single implant in function for at least 1 year after crown cementation was enrolled for the present study. Convenience sampling method was employed. Participants were categorized as follows: Group A - Non-diabetic individuals and Group B - Diabetic patients. The ethical clearance was obtained from the Ethical Review Committee of the institution and a written informed consent was obtained from the study participants after explaining in detail about the study.

Inclusion and Exclusion Criteria

Inclusion criteria were patients who had a minimum of single implant in function for at least 1 year after crown cementation, periodontally healthy. In group A, non-diabetic participants were enrolled. In group B, participants diagnosed with diabetes were enrolled. Exclusion criteria were patients under long-term medications, history of periodontal disease, participants who had undergone periodontal therapy, presence of other systemic illness.

Clinical and Radiographic Parameters

Clinical parameters including peri-implant probing depth (PPD), clinical attachment level (CAL) and radiographic parameter including alveolar bone level (ABL) was recorded around the implant. PPD was measured as the average of the distance between peri-implant sulcus base and mucosal margin at six sites (mesio-buccal, mesio-lingual, mid-lingual, disto-buccal, disto-lingual, mid-buccal). CAL was measured as the average of the distance between implant shoulder and peri-implant sulcus base at six sites (mesio-buccal, mesio-lingual, mid-lingual, disto-buccal, disto-lingual, mid-buccal). ABL was measured from intra-oral periapical radiograph as the average of the distance between the most apical point of bone-to-implant contact and the implant/abutment junction at four sites (mesial, lingual, distal, buccal).

Statistical Analysis

The collected data was tabulated and analyzed using Statistical Package for Social Sciences (SPSS Software, Version 23.0). Descriptive and inferential statistics were done for data summarization and presentation. Independent t-test was done to compare the clinical and radiographic parameters between two groups. p value of less than 0.05 was considered as statistically significant.

3. RESULTS

A total of 460 patients who had a minimum of single implant in function for at least 1 year after crown cementation was enrolled for the present study. Among 460 patients, 228 were non-diabetic individuals (Group A) and 232 were diabetic patients (Group B). The mean PPD among non-smokers and smokers were 2.58±0.07 and 5.04±0.05 respectively. The mean CAL among non-smokers and smokers were 3.05±0.02 and 5.84±0.04 respectively. The mean ABL among non-smokers and smokers were 1.36±0.03 and 3.17±0.04 respectively. Independent t-test revealed there was statistically significant difference in PPD (p=0.02), CAL (p=0.03) and ABL (p=0.03). (Table 1)

Table 1: Intergroup comparison of clinical and radiographic parameters

Variable	Mean ± SD		p value
	Group A	Group B	
PPD (mm)	2.58±0.07	5.04±0.05	0.02*
CAL (mm)	3.05±0.02	5.84±0.04	0.03*
ABL (mm)	1.36±0.03	3.17±0.04	0.03*

*Statistically significant at p<0.05 (Independent t-test)

4. DISCUSSION

Studies have shown that the interaction between advanced glycation end products (AGEs) (produced as a result of persistent hyperglycaemia) and their receptors are significantly higher in hyperglycaemic conditions.[12,13] The persistent hyperglycemia in diabetic individuals leads to inhibition of osteoblastic activity and modifies the response of parathyroid hormone which helps in regulation of metabolism of calcium and phosphorous. Uncontrolled blood sugar levels also decrease collagen formation during callus formation, thereby inducing apoptosis in lining cells of bone and increases osteoclastic activity due to persistent inflammatory response.[14] It also induces deleterious effect on bone matrix and diminishes growth and accumulation of extracellular matrix. The end result is diminished bone formation during healing, which is observed in number of experimental animal studies.[15,16] It is therefore hypothesized that the severity of peri-implant clinical and radiographic parameters might vary among patients with and without diabetes.

In the present study, peri-implant probing depth, clinical attachment loss and alveolar bone loss were more among diabetic patients as compared to systemically healthy controls. Gomez-Moreno G et al., reported that immediately loaded implants in the maxillary anterior zone in type 2 diabetes mellitus patients showed 9.6% of failure rate when compared with 0% failure rate in non-diabetic individuals. Also, marginal bone loss was found to increase in relation to increases in HbA1c levels.[17] Furthermore, the meta-analysis by Lagunov VL et al., indicated a statistically significant difference between parameters of implants placed in the glycemic-controlled group and healthy group in marginal bone loss ($p < .001$), bleeding on probing ($p < .04$), and probing depth ($p < .001$). The authors indicated that, despite being glycemic controlled, patients with diabetic mellitus were associated with a higher risk of peri-implant disease.[18]

Abduljabbar T et al., stated that periodontal and peri-implant inflammatory parameters were worse among patients with prediabetes and diabetes compared with controls.[19] Another study highlighted that among individuals without diabetes, peri-implant plaque index, bleeding on probing, probing depth, marginal bone loss, and whole salivary IL-1 β and IL-6 levels were higher among patients with peri-implantitis compared to patients without peri-implantitis. Among patients with diabetes, the severity of the measured parameters appears to be influenced by the glycemic status rather than by peri-implantitis.[20] Our findings are in accordance with the previous studies as the peri-implant clinical and radiographic parameters were worse among patients with diabetes compared with controls. However, in the present study, the type and duration of diabetes was not considered. It is recommended that diabetic patients should be educated about the detrimental effects of chronic hyperglycaemia on oral health and should emphasize the need for routine dental visits.

5. CONCLUSION

The present study suggests that the diabetic patients demonstrated greater peri-implant probing depth, clinical attachment loss and alveolar bone loss as compared to non-diabetic individuals.

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