Original Research

Impact of Diabetes on Dental Implant Outcomes: A Prognostic Study

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ABSTRACT:
Aim: This study aims to assess how diabetes influences the prognosis, success, and complications of dental implants, with the goal of developing effective management strategies for diabetic patients. **Materials and methods:** The study enrolled a total of 50 patients, aged between 30 and 60 years, including 25 men and 25 women. A total of 80 dental implants were placed, with each patient undergoing a thorough medical history assessment and laboratory investigations, including HbA1c level evaluations. The findings revealed a correlation between HbA1c levels and the incidence of complications relative to the number of implants placed. To ensure accurate statistical evaluation, data analysis was conducted using SPSS software. **Results:** The percentage of implant failure was 16.67% in the 8.0-8.9 HbA1c group, 5.00% in the 9.0-9.9 group, 16.67% in the 10.0-10.9 group, 9.09% in the 11.0-11.9 group, 6.67% in the 12.0-12.9 group, and 0% in the 13.0-14.0 group. The overall implant failure rate was 10.00%. Peri-implantitis was observed in 36% of patients and affected 33.33% of implants. Peri-implant mucositis occurred in 28% of patients and was present in 25.71% of implants. Mucosal recession was recorded in 20% of patients, affecting 22.85% of implants. Crestal bone loss was the least common complication, occurring in 16% of patients and impacting 17.14% of implants. **Conclusion:** In conclusion, implant failure rates in diabetic patients are impacted by HbA1c levels, with higher failure rates seen in those with poor glycemic control. While prior studies demonstrate high success rates in well-managed diabetics, our findings emphasize the importance of thorough patient evaluation and individualized treatment strategies to improve implant success.
Keywords: Implants, diabetes, hyperglycemia

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INTRODUCTION

Dental implants have become a widely used and effective method for restoring missing teeth. Advances in implant design, surface characteristics, and surgical techniques have significantly improved their success rates, with a mean survival rate of 94.6% and a success rate of 89.7% over more than 10 years.[1,2] The initial success of an implant relies on proper osseointegration, and any disruption in this biological process can negatively impact the outcome. Once restored and in function, bone remodeling plays a key role in maintaining implant stability. Since bone metabolism is critical for implant survival, assessing risk factors such as systemic conditions becomes essential. Among these, diabetes mellitus remains a condition of particular concern due to its impact on wound healing, bone health, and immune response.[3,4]

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, leading to complications such as micro- and macroangiopathy, delayed healing, and an increased susceptibility to infections. Individuals with diabetes also experience a higher incidence of periodontitis and tooth loss, further complicating their oral health. In the past, diabetes was viewed as a relative contraindication for implant therapy due to these associated risks. However, recent studies suggest that dental implants can provide significant benefits for diabetic patients, particularly in improving their nutrition and metabolic control. Proper oral rehabilitation can help patients consume a wider range of foods, positively influencing their overall health. Despite this shift in perspective, the influence of glycemic control and disease duration on implant success remains an area of ongoing investigation.[5,6,7]

Given the complexities associated with diabetes and implant therapy, a thorough evaluation of potential risks is crucial. Recognizing the factors that may compromise implant success enables clinicians to make informed decisions and refine treatment strategies. [8,9]

Therefore the study aims to assess how diabetes influences the prognosis, success, and complications

of dental implants, with the goal of developing effective management strategies for diabetic patients.

MATERIALS AND METHODS

The study enrolled a total of 50 patients, aged between 30 and 60 years, including 25 men and 25 women. A total of 80 dental implants were placed, with each patient undergoing a thorough medical history assessment and laboratory investigations, including HbA1c level evaluations. The findings revealed a correlation between HbA1c levels and the incidence of complications relative to the number of implants placed.

To ensure accurate statistical evaluation, data analysis was conducted using SPSS software. The study aimed to provide insights into the relationship between systemic conditions, medication use, and the prognosis of dental implants, helping to refine treatment protocols for improved patient outcomes.

RESULTS

Table 1: HbA1c stratification levels and implants survival

HbA1c stratification (%)	Number of patients	Number of implants	Implant failure	% Implant failure
8.0-8.9	10	18	3	16.67%
9.0-9.9	18	20	1	5.00%
10.0-10.9	8	12	2	16.67%
11.0-11.9	5	11	1	9.09%
12.0-12.9	7	15	1	6.67%
13.0-14.0	2	4	0	0%
Total	50	80	8	10.00%

The percentage of implant failure was 16.67% in the 8.0-8.9 HbA1c group, 5.00% in the 9.0-9.9 group, 16.67% in the 10.0-10.9 group, 9.09% in the 11.0-11.9 group, 6.67% in the 12.0-12.9 group, and 0% in the 13.0-14.0 group. The overall implant failure rate was 10.00%.

Table 2: Biologic complications

Biologic complications	Patients (n=25)	Number of implants (n=35)
Peri- implantitis	9 (36%)	12 (33.33%)
Peri- implant mucositis	7 (28%)	9 (25.71%)
Mucosal recession	5 (20%)	8 (22.85%)
Crestal bone loss	4 (16%)	6 (17.14%)

Peri-implantitis was observed in 36% of patients and affected 33.33% of implants. Peri-implant mucositis occurred in 28% of patients and was present in 25.71% of implants. Mucosal recession was recorded in 20% of patients, affecting 22.85% of implants. Crestal bone loss was the least common complication, occurring in 16% of patients and impacting 17.14% of implants.

DISCUSSION

Dental implants have become a widely accepted and effective solution for replacing missing teeth, offering functional and aesthetic benefits. However, the success of implant therapy is influenced by various systemic conditions, with diabetes mellitus being a significant factor. Diabetes, a chronic metabolic disorder characterized by hyperglycemia, is known to impair wound healing, increase susceptibility to infections, and affect bone metabolism, all of which can impact the prognosis of dental implants.[10,11]

Historically, diabetes was considered a relative contraindication for implant therapy due to concerns about delayed osseointegration and a higher risk of implant failure. However, recent advancements in implant materials, surgical techniques, and glycemic control strategies have led to a shift in perspective. Studies suggest that well-controlled diabetes may not significantly compromise implant success, while poorly controlled diabetes remains a concern due to its association with higher complication rates.[12]

In our study the percentage of implant failure was 16.67% in the 8.0-8.9 HbA1c group, 5.00% in the 9.0-9.9 group, 16.67% in the 10.0-10.9 group, 9.09% in the 11.0-11.9 group, 6.67% in the 12.0-12.9 group, and 0% in the 13.0-14.0 group. The overall implant failure rate was 10.00%. Peri-implantitis was observed in 36% of patients and affected 33.33% of implants. Peri-implant mucositis occurred in 28% of patients and was present in 25.71% of implants. Mucosal recession was recorded in 20% of patients, affecting 22.85% of implants. Crestal bone loss was the least common complication, occurring in 16% of patients and impacting 17.14% of implants.

A study conducted by Balshi et al.[13] highlighted that controlled diabetic patients are increasingly being considered suitable candidates for dental implants. The study evaluated 34 diabetic patients who received 227 Brånemark implants. By the time of the second-stage surgery, 214 implants had successfully osseointegrated, resulting in a survival rate of 94.3%. Among the 177 implants that were followed through to final restoration, only one failure was reported, yielding a clinical survival rate of 99.9%. The study emphasizes the importance of screening for diabetes and ensuring metabolic control to enhance

osseointegration success. Additionally, antibiotic prophylaxis and smoking cessation are recommended to further improve implant outcomes.

In the study by Peled et al.[14] evaluated 41 patients with well-controlled type 2 diabetes mellitus who received 141 implants for overdenture retention. The success rates were 97.3% at one year and 94.4% at five years post-implantation. Most patients experienced improved function, with a strong correlation between mucosal health and functional enhancement, though no link was found between implant failure and glucose levels. The study concluded that dental implants in well-controlled diabetic patients yield promising outcomes, but further long-term research is needed to assess implant survival in a broader diabetic population.

Fiorellini JP et al.[15] aimed to evaluate the success and survival rates of dental implants in diabetic patients through a retrospective analysis of 215 implants placed in 40 patients across two clinical centers. Medical and implant data were gathered through chart reviews and interviews. The overall success rate was found to be 85.6%, with 31 implant failures, 24 of which occurred within the first year of functional loading. The average functional loading time was 4.05 ± 2.6 years. Success rates by location were 85.5% for the maxilla and 85.7% for the mandible, while the anterior and posterior regions showed success rates of 83.5% and 85.6%, respectively. Lifetable analysis indicated a cumulative success rate of 85.7% after 6.5 years of function. The findings suggest that while implant survival in controlled diabetic patients is lower than in the general population, the success rate remains acceptable. However, the highest risk of failure occurs within the first year after prosthetic loading.

Our study reported a 10% overall implant failure rate, with variations across HbA1c groups, and highlighted biologic complications such as peri-implantitis (36%), peri-implant mucositis (28%), mucosal recession (20%), and crestal bone loss (16%). These findings align with previous studies that emphasize the viability of dental implants in diabetic patients, though with a slightly higher failure risk than the general population. While some studies report higher survival rates (94.3%-99.9%) in well-controlled diabetic patients, our study observed a moderate failure rate, reinforcing the importance of strict glycemic control and post-implant monitoring. Unlike studies that found no direct link between glucose levels and implant failure, our data suggest variable failure rates across HbA1c stratifications, indicating a potential influence of glycemic status on implant outcomes. Additionally, consistent with prior research, we observed that the highest failure risk is within the first year, emphasizing the need for careful patient selection and preventive strategies to optimize implant longevity in diabetic individuals.

However, a key limitation of our study is the relatively small sample size, which may limit the generalizability of our findings. A larger cohort could provide more robust conclusions and potentially reveal different trends in implant success and complication rates.

CONCLUSION

In conclusion, implant failure rates in diabetic patients are impacted by HbA1c levels, with higher failure rates seen in those with poor glycemic control. While prior studies demonstrate high success rates in well-managed diabetics, our findings emphasize the importance of thorough patient evaluation and individualized treatment strategies to improve implant success.

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