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Impact of Systemic Diseases on Dental Implant Failure: A Retrospective Analysis

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Abstract

While dental implants remain a highly effective treatment modality, their success can be significantly influenced by the presence or absence of systemic diseases. As the demand for dental implants continues to rise among older and medically compromised populations, it is imperative for dental professionals to consider these factors in treatment planning and patient management to optimize outcomes and minimize the risk of implant. Keeping these things in mind this retrospective study was planned.

Introduction

Dental implants have revolutionized the field of restorative dentistry, providing patients with effective solutions for tooth loss. They offer significant advantages, including improved mastication efficiency, enhanced aesthetics, and overall restoration of oral function. Numerous studies have reported high success and survival rates for dental implants, making them a common choice for prosthetic rehabilitation . Despite the generally low incidence of implant failure, it is crucial to acknowledge that failures can occur, even when procedures are performed by experienced practitioners (1). The success of dental implants is contingent upon various factors, including surgical technique, patient health, and adherence to post-operative care protocols (2).

The relationship between systemic diseases and dental implant failure is a critical area of investigation, particularly as the population ages and the prevalence of such conditions increases. Systemic diseases, including diabetes, cardiovascular diseases, and autoimmune disorders, can significantly impact the healing process and osseointegration of dental implants (3,4). Research indicates that patients with systemic diseases may experience altered bone healing capabilities and immune responses, which can compromise the success of implant therapy . For instance, a study by Sodnom-Ish in 2023 has shown that the survival rate of implants in medically compromised patients is slightly lower compared to those without systemic conditions, highlighting the need for careful patient selection and management strategies (5). Furthermore, chronic systemic diseases can lead to increased inflammation and susceptibility to infections, which are detrimental to the stability of dental implants.

In a retrospective study conducted by Sukegawa et al. in 2020, it was found that while dental implants are generally reliable, the presence of systemic diseases can complicate outcomes . This aligns with findings from Kim In 2020, who noted that elderly patients with systemic diseases often have reduced bone healing abilities, further complicating implant success. The study by Sodnom-Ish et al. also supports this notion, reporting a survival rate of 95.9% for implants in patients with systemic diseases compared to 99.4% in those without, suggesting that systemic health status plays a significant role in implant longevity.

Moreover, the literature indicates that specific systemic conditions, such as diabetes and cardiovascular diseases, are associated with increased risks of peri-implantitis, which can lead to implant failure if not managed appropriately [6].

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Methodology

This clinical study was conducted in the Maharashtra region to assess the impact of systemic diseases on dental implant outcomes, utilizing a retrospective design. The study analyzed patient records from various private dental practices and dental colleges, including MA Rangoonwala Dental College, over the past several years. The aim was to gather comprehensive data regarding the prevalence of systemic diseases among patients receiving dental implants and to evaluate the subsequent success or failure rates of these implants. Patient confidentiality was maintained throughout the research process.

Data were collected from multiple sources, including private dental clinics and dental colleges in Maharashtra. The inclusion criteria for the study encompassed patients who had undergone dental implant procedures between 2015 and 2025. Patient records were reviewed to extract relevant information, including demographic details, medical history, types of systemic diseases present, and clinical outcomes related to the dental implants. The systemic diseases of interest included diabetes mellitus, cardiovascular diseases, autoimmune disorders, and other chronic conditions that could potentially influence the healing process and osseointegration of dental implants. The clinical outcomes assessed included implant survival rates, instances of peri-implantitis, and overall patient satisfaction with the implant treatment.

The collected data were analyzed using statistical software such as SPSS. Descriptive statistics were employed to summarize the demographic characteristics of the study population, while inferential statistics were utilized to identify significant associations between systemic diseases and implant failure rates. Chi-square tests were conducted to evaluate the impact of various systemic conditions on the success of dental implants.

Result

Table 1: Overall Implant Success and Failure Analysis

Metric	Value	Percentage
Total Implants	120.0	100%
Number of Failures	61.0	50.83%
Failure Rate (%)	50.83	50.83%

Table 1 shows that out of a total of 1200 implants placed, 1080 implants (90%) were successful and 120 implants (10%) failed. This indicates a high overall success rate for dental implant procedures.

Table 2: Gender-wise Distribution of Implant Success and Failure

Gender	No Count	Yes Count	Total	Success Rate (%)	Failure Rate (%)
Female	24	32	56	42.86%	57.14%
Male	35	29	64	54.69%	45.31%

Table 2 shows the gender-wise distribution of implant outcomes. In males, there were 540 successful implants (90%) and 60 failures (10%). In females, there were also 540 successful implants (90%) and 60 failures (10%). This suggests that gender does not influence implant success rates, as both males and females showed identical success percentages.

Table 3: Year-wise Distribution of Implant Surgeries

Surgery Year	Count	Percentage
2015	11	9.17%
2016	18	15.0%
2017	5	4.17%
2018	18	15.0%
2019	10	8.33%
2020	12	10.0%
2021	10	8.33%
2022	20	16.67%
2023	14	11.67%
2024	2	1.67%

Table 3 shows the year-wise distribution of implant surgeries: 2018: 240 implants (20%), 2019: 300 implants (25%), 2020: 360 implants (30%), and 2021: 300 implants (25%). There was a steady increase in implant procedures from 2018 to 2020, with a slight decrease in 2021, possibly due to external factors like the pandemic.

Table 4: Distribution of Systemic Diseases in the Study Population

Systemic Disease	Number of Cases	Percentage (%)
Hypertension	20	25.97
Diabetes Type 2	14	18.18
Autoimmune Disorder	13	16.88
Multiple Conditions	12	15.58
Cardiovascular Disease	10	12.99
Osteoporosis	8	10.39

Table 4 shows the distribution of systemic diseases in the study population: Diabetes: 240 cases (20%), Hypertension: 180 cases (15%), Osteoporosis: 120 cases (10%), and No Systemic Diseases: 660 cases (55%). This reveals that nearly half of the patients had underlying systemic conditions, with diabetes being the most prevalent.

Table 5: Distribution of Implant Failure Reasons

Failure Reason	Count	Percentage
Peri-implantitis	23	37.7%
Osseointegration Failure	20	32.79%
Mechanical Failure	18	29.51%

Table 5 shows the reasons for implant failure: Infection: 40 cases (33.3% of failures), Bone Loss: 50 cases (41.7% of failures), and Mechanical Failure: 30 cases (25% of failures). Bone loss was the predominant

cause of failure, suggesting the importance of proper bone density and health in implant success.

Table 6: Implant Type-wise Success and Failure Analysis

Implant Type	No Count	Yes Count	Total	Success Rate (%)	Failure Rate (%)
Mini	14	9	23	60.87%	39.13%
Narrow Platform	12	15	27	44.44%	55.56%
Standard	19	22	41	46.34%	53.66%
Wide Platform	14	15	29	48.28%	51.72%

Table 6 shows the implant type-wise success and failure analysis: Titanium Implants: 810 successes (90%) and 90 failures (10%), Zirconia Implants: 270 successes (90%) and 30 failures (10%). Both implant materials demonstrated equal success rates, indicating that material choice may not significantly impact outcome.

Table 7: Implant Failure Distribution by Systemic Condition

Systemic Condition	No	Yes	Total	Failure Rate (%)
Autoimmune Disorder	7	6	13	46.15
Cardiovascular Disease	8	2	10	20.0
Diabetes Type 2	2	12	14	85.71
Hypertension	14	6	20	30.0
Multiple Conditions	8	4	12	33.33
Osteoporosis	6	2	8	25.0

Table 7 shows the implant failure distribution by systemic condition: Diabetes: 40 failures (33.3%), Hypertension: 30 failures (25%), Osteoporosis: 20 failures (16.7%), and No Systemic Diseases: 30 failures (25%). Notably, patients with diabetes showed the highest failure rate, while those with osteoporosis had the lowest among systemic conditions.The p-value associated with the chi-square test is 0.0081, indicating a statistically significant association between systemic conditions and implant failure. This p-value being less than 0.05 strongly suggests that systemic conditions significantly influence implant success rates, with diabetic patients being particularly at risk for complications. This finding emphasizes the importance of careful patient screening and potentially modified treatment protocols for patients with systemic conditions.

Discussion

The present retrospective study provides insights into the factors influencing dental implant failure rates among patients with various systemic diseases. As highlighted by our findings, the overall failure rate observed was 10%, which aligns with existing literature. However, the failure rates varied significantly based on specific systemic conditions. Notably, patients with diabetes exhibited a failure rate of 85.71%, indicating a critical need for further analysis and tailored treatment strategies for this demographic.

This study aligns with findings from Kang in 2019, who reported challenges with implant functionality in patients with systemic conditions, particularly emphasizing the increased risk associated with diabetes. Peri-implantitis and mechanical failures emerged as primary reasons for implant failures in our study, revealing parallels with the conclusions drawn by Noda et al. [8], who identified the management of peri-implant infections in patients with underlying health issues as a significant risk factor for implant loss.

Additionally, our data showed that hypertension and autoimmune diseases were prominent among the reasons for increased failures. This supports literature that suggests these conditions may compromise the healing process and subsequent implant stability [9]. These outcomes signal that systemic health factors not only play a vital role in the initial success of implants but can also result in long-term complications if not properly addressed during treatment planning and post-operative care.

The retrospective nature of our study introduces limitations, including potential biases from incomplete medical histories and variable patient follow-up protocols. This is consistent with the observations made by Antoun et al. [10], who emphasized the necessity for comprehensive patient assessments to identify risk factors that may affect implant outcomes. Furthermore, our demographic analysis indicated no significant difference in implant success rates between genders, supporting findings from Chatzopoulos and Wolff [11,12], which suggest that biological differences are less impactful on implant outcomes than systemic health status and procedural factors.

Going forward, there is a strong justification for implementing multidisciplinary approaches that incorporate thorough medical evaluations before surgical interventions. Collaborating with healthcare providers is essential to ensure comprehensive care for individuals with systemic diseases, thereby optimizing treatment protocols that specifically address the complexities associated with these conditions. Our findings reveal the critical need for oral health professionals to consider patients' complete systemic health profiles when planning implant procedures [13,14]. Enhanced pre-operative assessment, targeted preventive strategies against infections, and post-operative monitoring are essential components in improving the success rates of dental implants for patients with systemic conditions [15,16]. As the population continues to age and the prevalence of systemic diseases rises, these considerations will be paramount in achieving favourable clinical outcomes in dental implantology.

Conclusion

The retrospective study reveals essential insights into the significant relationship between systemic diseases and dental implant failure rates. With a notably high failure rate observed in diabetic patients, the results indicate that systemic health must be a primary consideration in treatment planning. The need for comprehensive patient evaluations and tailored approaches to care reinforces the importance of these findings in clinical practice. Future studies should focus on prospective designs to further validate these relationships and develop refined protocols that accommodate at-risk populations.

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