Original Article

Assessment of Failed Dental Implants and Reimplantation at Sites of Previous Implant Failure: Survival Rates and Risk Factors

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ABSTRACT

Objective: To evaluate the survival rates of dental implants reimplanted at sites of previous implant failure and identify key risk factors influencing their outcomes.

Study Design: This retrospective study

Place and Duration of Study: This study was conducted at the Khyber Teaching Hospital Peshawar during June 2022 to June 2024.

Methods: Data were collected on patient demographics, causes of previous failures, timing of reimplantation (immediate, delayed, or extended delay), surgical techniques, and postoperative outcomes. Kaplan-Meier survival analysis and multivariate logistic regression were performed to assess survival rates and risk factors.

Results: The overall survival rate of reimplanted implants was 87.1% after a minimum follow-up period of 12 months. Survival rates were highest in extended-delay reimplantation (92%), followed by delayed (88.9%) and immediate (80%) procedures. Significant risk factors for implant failure included smoking (Odds Ratio [OR]: 3.2, p=0.002), poor bone quality (OR: 2.7, p=0.004), and a history of peri-implantitis (OR: 2.4, p=0.01). Protective factors included the use of bone augmentation (OR: 0.4, p=0.008) and advanced implant surfaces (OR: 0.3, p=0.01). Peri-implantitis was the most common complication (8.2%).

Conclusion: Reimplantation at sites of previous failure is a viable option with favorable survival rates when appropriate protocols are followed. Extended healing periods, site preparation with bone augmentation, and the use of advanced implant designs significantly improve outcomes. Clinicians must address patient-related risk factors, such as smoking and systemic health, to optimize reimplantation success.

Key Words: Dental implants, Implant failure, Reimplantation, Survival rates, Risk factors, Peri-implantitis, Bone augmentation.

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INTRODUCTION

Dental implants have revolutionized modern dentistry, providing a durable and functional solution for tooth replacement. With success rates exceeding 90% in many clinical studies, implants have become the gold standard for restoring edentulous areas[1].

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However, not all implants succeed; failures can occur due to a range of factors including biological complications (e.g., peri-implantitis, infection, and poor osseointegration), mechanical failures (e.g., fracture of the implant or prosthetic components), and patient-related issues such as systemic health conditions, poor oral hygiene, or smoking. Implant failure not only poses a significant challenge for clinicians but can also have profound psychological and financial impacts on patients[2]. Addressing such failures effectively is crucial for ensuring long-term treatment success and patient satisfaction. Reimplantation at sites of previous implant failure is a particularly complex aspect of implantology. Sites that have experienced implant failure often present with compromised bone quality and quantity, scar tissue, or residual infection, making them less than ideal for conventional implant placement[3]. Furthermore, the failure itself can alter the biological and mechanical environment of the site, potentially increasing the risk of subsequent failures. Despite these challenges, advancements in surgical

techniques, materials, and biomaterials, such as guided bone regeneration (GBR) and the use of bone grafts, have made reimplantation a viable option in many cases[4].

Several factors influence the success of reimplantation. Patient-specific variables, such as age, systemic health, smoking status, and oral hygiene, play a crucial role. Site-specific factors, including the extent of bone loss, residual infection, and the quality of bone regeneration, are equally critical[5]. Implant-specific variables, such as implant design, surface characteristics, and loading protocols, also significantly affect outcomes. Understanding the interplay of these factors is essential for clinicians to make informed decisions and tailor treatment plans to individual cases. Survival rates for implants placed in sites of previous failure vary widely in the literature, with reported success rates ranging from 60% to 90%[6]. This variability underscores the need for a comprehensive understanding of the factors that contribute to successful reimplantation. By identifying the predictors of success and failure, clinicians can implement strategies to mitigate risks, such as meticulous debridement of the failed implant site, careful patient selection, and the use of advanced surgical techniques to enhance bone regeneration and implant stability[7].

Dental implant failure occurs due to a combination of biological, mechanical, and patient-related factors. Biological causes often include infection, inflammation (peri-implantitis), and insufficient bone quality or quantity, which can hinder proper osseointegration. Mechanical causes such as implant fracture, component loosening, or improper loading forces can also lead to failure[8]. Patient-related factors, including systemic conditions like diabetes, smoking, poor oral hygiene, and medication use, further complicate the prognosis. When an implant fails, the surrounding tissues are often left in a compromised state. Bone resorption, scar tissue formation, and residual infection are common consequences that make reimplantation at the same site challenging[9]. These conditions demand thorough debridement and careful evaluation before considering a secondary implant procedure. The timing of reimplantation—immediate, delayed, or after extended healing depends on the severity of the site's condition and the underlying causes of failure [10].

METHODS

This retrospective study was conducted at Khyber Teaching Hospital Peshawar during June 2022 to June 2024. A total of 85 patients were included in the study. These patients had a history of failed dental implants and subsequently underwent reimplantation at the same site. The study population consisted of 42 males and 43 females, aged between 25 and 70 years, with a mean age of 48 years.

Inclusion Criteria:

- Patients with a history of single or multiple dental implant failures who underwent reimplantation at the same site.
- Adequate patient records with detailed clinical, radiographic, and surgical data.
- Completion of at least one year of follow-up after reimplantation.
- Patients who underwent necessary pre-reimplantation procedures, such as debridement or bone augmentation.

Exclusion Criteria:

- Patients with incomplete records or lost to follow-up.
- Reimplantation procedures performed at sites with unresolved infection or inadequate bone regeneration.
- Patients with systemic conditions contraindicating implant placement (e.g., untreated diabetes or active cancer).

Data Collection: Demographic data, such as age, gender, and systemic health status, were recorded to assess the influence of patient-specific factors on reimplantation success. Information regarding the failed implants was also collected, including the timing of failure (early vs. late), the underlying causes (e.g., peri-implantitis, mechanical complications, or insufficient osseointegration), and any clinical signs of failure like infection or mobility. Details of the reimplantation procedure were documented, including the timing of reimplantation (immediate, delayed, or extended delay), surgical techniques employed, and the use of bone augmentation or graft materials. Implant-specific variables, such as implant type, surface modifications, length, and diameter, were included to evaluate their impact on outcomes. Postoperative care and follow-up data were reviewed to understand the role of post-surgical management in implant survival. These included antibiotic regimens, oral hygiene practices, and adherence to follow-up schedules. Radiographic assessments provided information on peri-implant bone levels and osseointegration, while clinical evaluations focused on signs of inflammation, infection, or implant mobility. Periodontal probing and peri-implant tissue analysis were conducted during follow-up visits to monitor the health of the reimplanted sites.

Statistical Analysis: Descriptive statistics were used to summarize the baseline characteristics of the study population. Kaplan-Meier survival analysis was applied to estimate the survival rates of reimplanted implants over time. Risk factors associated with implant failure were analyzed using univariate and multivariate logistic regression models, with p-values < 0.05 considered statistically significant.

RESULTS

Out of 85 patients included in the study, 42 were male (49.4%) and 43 were female (50.6%), with a mean age of 48 years (range: 25–70 years). Systemic conditions were present in 22 patients (25.9%), including controlled diabetes (12%), hypertension (10%), and other comorbidities (3.9%). A history of smoking was reported in 18 patients (21.2%). Of the failed implants, 47 (55.3%) were due to biological complications such as peri-implantitis, 28 (32.9%) were due to mechanical issues, and 10 (11.8%) were attributed to insufficient osseointegration.

Table No. 1: Patient Demographics and Clinical Characteristics

Characteristic	Value
Total Patients	85
Gender (Male/Female)	42 (49.4%) / 43 (50.6%)
Mean Age (Range)	48 years (25–70 years)
Systemic Conditions	22 (25.9%)
- Controlled Diabetes	10 (12%)
- Hypertension	8 (10%)
- Other	4 (3.9%)
Smokers	18 (21.2%)
Causes of Previous Failure	
- Biological (e.g., Peri-implantitis)	47 (55.3%)
- Mechanical	28 (32.9%)
-Insufficient Osseointegration	10 (11.8%)

The study analyzed 85 cases of reimplantation, with the majority (52.9%) undergoing delayed reimplantation (3–6 months post-failure), followed by extended-delay (29.4%) and immediate reimplantation (17.6%). Bone augmentation was employed in 68.2% of cases, highlighting its importance in site preparation, while advanced implant surfaces were utilized in 84.7% of cases, demonstrating a preference for technologies that enhance osseointegration and improve implant success rates.

Table No. 2: Reimplantation Timing and Techniques

Variable	Number of Cases	Percentage
Timing of Reimplantation		
- Immediate	15	17.6%
- Delayed (3–6 months)	45	52.9%
- Extended Delay (>6 months)	25	29.4%
Bone Augmentation Used	58	68.2%
Advanced Implant Surface	72	84.7%

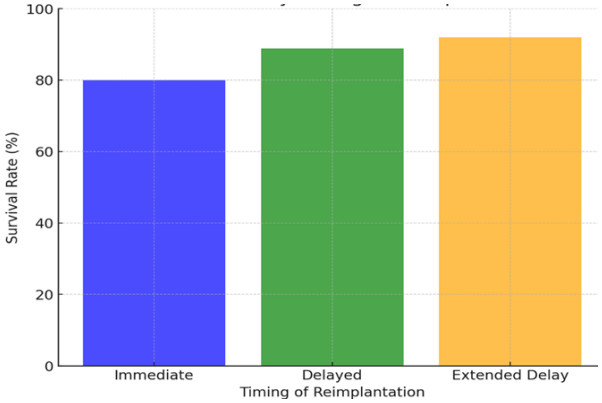

Figure No. 1: Survival Rates by Timing of Reimplantation

The survival analysis revealed that reimplantation success rates improved with longer healing periods. Immediate reimplantation had a survival rate of 80% (12/15), while delayed procedures achieved 88.9% (40/45), and extended-delay reimplantation had the highest rate at 92% (23/25). The overall survival rate across all groups was 87.1% (74/85), underscoring the benefits of allowing adequate healing time and site preparation for improved outcomes in reimplantation cases.

Table No. 3: Survival Rates by Timing of Reimplantation

Timing	Survival Rate	Percentage
Immediate	12/15	80%
Delayed	40/45	88.9%
Extended Delay	23/25	92%
Overall	74/85	87.1%

The risk factor analysis identified smoking (Odds Ratio [OR]: 3.2, p=0.002), poor bone quality or volume (OR: 2.7, p=0.004), and a history of peri-implantitis (OR: 2.4, p=0.01) as significant predictors of implant failure. Protective factors included the use of bone augmentation (OR: 0.4, p=0.008) and advanced implant surfaces (OR: 0.3, p=0.01), which substantially reduced failure risk.

Table No.4: Risk Factors for Reimplantation Failure

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-Value
Smoking	3.2	1.5–6.8	0.002
Poor Bone Quality/Volume	2.7	1.3–5.5	0.004
History of Peri-implantitis	2.4	1.1–5.3	0.01
Bone Augmentation Used	0.4 (protective)	0.2–0.8	0.008
Advanced Implant Surface	0.3 (protective)	0.1–0.7	0.01

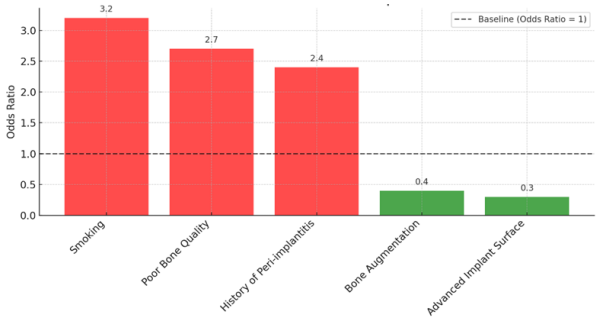

Figure No. 2: Risk Factors and Odds Ratios for Replantation Failure.

The study reported a total complication rate of 12.9% (11 cases) among reimplanted sites. Peri-implantitis was the most common complication, affecting 8.2% (7 cases), followed by mechanical issues such as screw loosening, which occurred in 4.7% (4 cases).

Table No. 5: Post-Reimplantation Complications

Complication	Number of Cases	Percentage
Total Complications	11	12.9%
Peri-implantitis	7	8.2%
Mechanical (e.g., Screw Loosening)	4	4.7%

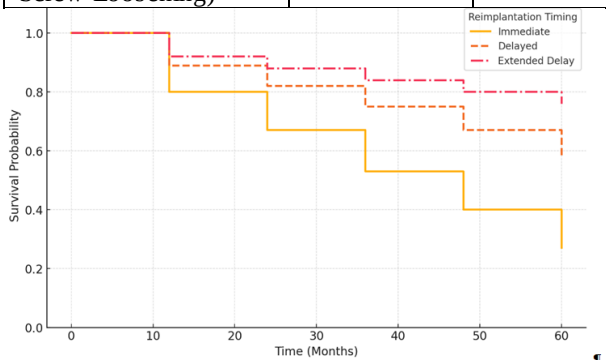

Figure No. 3: Kaplan-Meier Survival Analysis for Reimplantation Timing

DISCUSSION

This study evaluated the survival rates and risk factors associated with dental implants reimplanted at sites of previous failure. The results demonstrate that while reimplantation is a viable treatment option, the success rates depend significantly on the timing of reimplantation, site preparation, patient-related factors, and the use of advanced surgical techniques. The overall survival rate of 87.1% aligns with prior studies, emphasizing that reimplantation can achieve outcomes comparable to initial implant placements under optimal conditions[11]. However, survival rates varied with the timing of reimplantation: extended-delay procedures showed the highest success rates (92%), followed by delayed (88.9%) and immediate reimplantations (80%). This finding highlights the importance of allowing adequate time for site healing and bone regeneration in cases of implant failure, particularly where infection or significant bone loss is present[12]. Immediate reimplantation, while convenient, carries a higher risk of failure, likely due to unresolved inflammation or inadequate tissue remodeling at the time of placement. Delayed and extended-delay reimplantation protocols allow for better resolution of these issues, contributing to higher survival probabilities[13].

The analysis identified key risk factors influencing the success of reimplantation. Smoking emerged as a significant predictor of failure (OR: 3.2), consistent with its well-documented negative effects on wound healing and osseointegration. Similarly, poor bone quality and a history of peri-implantitis were associated with increased risk, emphasizing the need for thorough site assessment and preparation[14]. Protective factors included the use of bone augmentation techniques and advanced implant surfaces. Bone regeneration methods, such as guided bone regeneration (GBR), were particularly effective in restoring compromised sites, while advanced implant designs enhanced osseointegration. These findings underscore the critical role of pre-reimplantation planning and modern implant technology in achieving successful outcomes. The most common complication observed was peri-implantitis, affecting 8.2% of reimplanted sites[15]. This highlights the importance of long-term maintenance protocols, including strict oral hygiene practices, regular follow-up visits, and patient education. Mechanical issues, such as screw loosening, were less frequent (4.7%) and could often be resolved with minor adjustments. The findings of this study have significant clinical implications[16]. First, they reinforce the importance of individualized treatment planning based on patient and site-specific factors[17-19]. For patients with high-risk profiles (e.g., smokers or those with poor bone quality), additional measures, such as extended healing periods and enhanced surgical techniques, may be warranted. Second, the results emphasize the value of advanced implant designs and bone augmentation techniques in improving outcomes at compromised sites [20-22].

A multidisciplinary approach is essential for the successful management of implant failures. Collaboration between periodontists, oral surgeons, and prosthodontists ensures that all aspects of treatment, from site preparation to prosthetic rehabilitation, are optimized. This study has some limitations. The retrospective design introduces inherent biases, and the sample size, while sufficient for analysis, limits the generalizability of the findings. Future prospective studies with larger populations and longer follow-up periods are needed to validate these results and explore additional variables, such as the impact of different loading protocols and implant materials.

CONCLUSION

Reimplantation at sites of previous implant failure is a feasible and effective treatment strategy when appropriate protocols are followed. Delayed and extended-delay reimplantation demonstrate superior survival rates, particularly in cases involving significant

site compromise. By addressing patient-related risk factors and leveraging advancements in surgical techniques and implant design, clinicians can optimize outcomes and improve the prognosis of reimplanted dental implants.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Hina Afsar, Mohammad Haroon
Drafting or Revising Critically:	Shah Salman Khan, Sumiyya Ghulam, Mehwish Zaman, Muhammad Sheraz Alam
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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