WWW.IJRPR.COM

**International Journal of Research Publication and Reviews**

Journal homepage: www.ijrpr.com ISSN 2582-7421

# Risk Factors Associated with Early Implant Failure in Bone Augmented Sites: A 3-Years Retrospective Clinical Study

***Osama Alzwai [1], Ibrahim Garoushi [2], Ahmed Alfaidy [3], Ali Almajbry [4]***

*[1]Department of Oral and Maxillofacial Surgery, Libyan International Medical University, Faculty of Dentistry, Benghazi, Libya.*
*[2]Department of Oral and Maxillofacial Surgery, Libyan International Medical University, Faculty of Dentistry, Benghazi, Libya.*
*[3]Department of Oral and Maxillofacial Surgery, Libyan International Medical University, Faculty of Dentistry, Benghazi, Libya.*
*[4]Department of Oral and Maxillofacial Surgery, Libyan International Medical University, Faculty of Dentistry, Benghazi, Libya.*
*DOI:* https://doi.org/10.55248/gengpi.4.1023.102843

**A B S T R A C T**

Background: The use of dental implants for replacing lost teeth and restoring the function, esthetics, and biological health of the oro-facial region has become widely used across all dental aspects due to the ability to successfully osseointegrate. Implant-based treatment has been proven to produce predictable and dependable results. A limited number of unsuccessful dental implants do exist. Nevertheless, resorption of the alveolar ridge after tooth loss may prevent the placement of an optimum prosthetic-driven implant. Therefore, documentation and analysis of the factors influencing osseointegration establishment are required to maximize the predictability of the procedure and minimize implant failures. Purpose: The aim if this study is to evaluate the survival/success rates of dental implants placed in bone augmented sites, and to evaluate the possible risk factors associated with early implant failure. Material and Methods: A 3-years retrospective cohort study with 87 implants placed in bone-augmented sites of 64 patients of both genders aged between 22 to 65 years. The research ethics committee of the Libyan International Medical University approved the proposal and the methodology of the study. All implants were performed by the oral surgeons, periodontists, and prosthodontists teaching staff at Libyan International Medical University. Data were collected and documentation of all cases with implants placed in augmented sites in a time frame of 2019 to 2022 with a least follow up period of 6 months. Results: The current study included a total of 64 participants with an age range of 30 to 60 years (mean age = 43.2 years, SD = 10.8 years). The distribution of patients based on sex and outcome did not show any significant associations (X2 = 0.009, df = 1, p = 0.924). However, a significant association was found between a history of diabetes and treatment outcome (X2 = 4.102, df = 1, p = 0.043), indicating a potential impact of diabetes on implant success.

Keywords: Dental implants, Bone Augmentation, Resorbable membranes, implant failure

## 1. Introduction

Over the last two decades, remarkable advancements in research and technology for making high-quality dental implants have made endosseous implant replacement one of the standard treatments. Dental implants are considered the first line of therapy and long-term rehabilitation that will improve patients' quality of life. The ability of modern dental implants to successfully osseointegrate is first described by the two research groups of Brnemark and Schroeder, who conducted fundamental experimental studies demonstrating that titanium implants regularly heal with direct bone-to-implant contact, a process known as osseointegration or functional ankylosis. [(1)]

The success criteria for dental implants have changed over time. Still, Albrektsson et al. (IJOMI 1:11, 1986) (16) proposed a set of criteria that includes the absence of mobility at the start of the prosthetic phase, the absence of continuing radiolucency around the implant, the absence of peri-implantitis with suppuration, and subjective complaints from the patient.However, a limited number of unsuccessful dental implants still exist. Furthermore, resorption of the alveolar ridge as a result of tooth loss, whether surgically, physiologically, or pathologically, may jeopardize the implantation of a functional or prosthetically driven implant. Pre-prosthesis surgical operations, such as bone augmentation, become critical in these circumstances to achieve enough quality and quantity of hard and soft tissues and prosthetics for implant placement purposes. [(2)]

In order to minimize the ridge resorption and obtain proper periodontium and ensure adequate osseointegration, other different techniques have been utilized such as the Sinus Lift procedure that involves the placement of graft material inside the sinus cavity but external to the membrane and augments the bony support in the alveolar ridge area, Alveolar Ridge Distraction, involves cutting an osteotomy in the alveolar ridge, appliance is then screwed directly into the bone and activated to separate the bony segments at approximately 1 mm per day, Block Graft, for reconstruction of the severely resorbed alveolar ridge, regeneration of complex defects in a one or two-stage approach by Guided Bone Regeneration(GBR) and the inferior alveolar nerve lateralization(IANL) surgical procedure.[(3,4)]

Initially, directed regeneration was developed as a bone regenerative technology that uses physical means such as barrier membranes to seal an anatomical region where the bone is to be guided and regenerated. GBR membranes were first designed to stimulate new tissue formation within a protected volumetric defect for periodontal attachment repair. Depending on the source of the graft, the kind of membrane, and the timing of implant placement, several regimens could be used for GBR. Allograft, alloplastic, and xenograft bone alone or in conjunction with autogenic bone, utilized in combination with either resorbable or non-resorbable membranes during GBR procedures, have shown encouraging outcomes. [5,6]

In terms of membrane type, both bio-absorbable and non-resorbable membranes have shown predictable results in terms of implant survival rate; however, this type of surgery appears to be highly technique-sensitive, so the operative and clinical application to broader settings remains indefinite. Finally, the option between simultaneous or delayed implantation timing is primarily dictated by the amount of residual bone .Implant failures are classified as early or late failures based on when they occur, that is, before or after abutment attachment (early) or after implant loading (late). This separation is required since the etiology of these two types of failures is frequently different. [7]

Many causes of early implant failure (EIF) have been proposed, however, no single cause has been identified as a consistent causing factor. Early failures are frequently associated with a disruption during the early period of osseointegration, which results in fibrous scar tissue between the implant surface and the surrounding bone [8]. The aim of current research is to assess the survival/success rates of dental implants placed in bone-augmented sites, as well as to identify potential risk factors for early implant failure.

## 2. Material and Methods

A 3-years retrospective cohort study with 87 implants placed in bone-augmented sites of 64 patients of both genders aged between 22 to 65 years. The research ethics committee of the Libyan International Medical University approved the proposal and the methodology of the study. All implants were performed by the oral surgeons, periodontists, and prosthodontists teaching staff at Libyan International Medical University. Data were collected and documentation of all cases with implants placed in augmented sites in a time frame of 2019 to 2022 with a least follow up period of 6 months. Data collection and analysis were gathered and analyzed by separate investigators to eliminate potential bias from patients file and multiple risk factor categories chart as shown in table (1). Criteria for inclusion were male and female patients. Subjects above the age of 21 are eligible for the study. Simultaneously or delayed implant placement in bone augmented sites. Criteria for exclusion were systemic diseases that are uncontrolled. Patients suffering from mental illnesses, previous implantation at a site of past implant failure, immediate prosthetic loading of the implant, patients undergoing radiation and/or chemotherapy. A bone condition that precludes surgery is the presence of missing medical records. The implants were assessed clinically, an unconnected implant is immobile. There is no evidence of peri-implant radiolucency on radiographs. Radiographic vertical bone loss is less than 0.2 mm per year after the first year of function. Individual implant performance is distinguished by the lack of signs and symptoms such as discomfort, infections, neuropathies, paresthesia, or inferior dental canal violation. Failure was considered if the implant was mobile, infected, tenderness, or nerve association damage.

### *2.1 Statistical analysis:*

Data were analyzed using Statistical Package for Social Science (SPSS) version 23. Descriptive statistics, mean, standard deviation, and median were used. Inferential statistics were used when needed, as Chi-square(x2) to find the difference in the distribution of the variables between the groups, and the P-value was considered significant when $p \leq 0.05$. Data were presented in the form of tables and figures, which were the figures done by Microsoft Excel 2010.

### *2.2 Risk factors table 1*

| ***Patient variable*** | ***Surgical variable*** | ***Post-operative variables*** |
|---|---|---|
| • *Age*<br>• *Sex*<br>• *Systemic Disease*<br>• *Smoker*<br>• *Alcohol consumption* | • *One stage immediate*<br>• *Two stage delayed*<br>• *Mandible (Anterior,Posterior)*<br>• *Maxilla (Anterior,Posterior)*<br>• *Resorpable membrane*<br>• *Non-resorpable membrane*<br>• *Autogenius graft*<br>• *Xenograft*<br>• *Alloplastic graft*<br>• *Mixed graft*<br>• *GBR*<br>• *Onlay bone graft*<br>• *Interpositional*<br>• *Sinus lift* | • *Pain*<br>• *Tenderness*<br>• *Mobility* |

- *Alveolar expansion*
- *Implant type*

## 3. Results

The current study included a total of 64 participants with an age range of 30 to 60 years (mean age = 43.2 years, SD = 10.8 years). The distribution of patients based on sex and outcome did not show any significant associations (X2 = 0.009, df = 1, p = 0.924). However, a significant association was found between a history of diabetes and treatment outcome (X2 = 4.102, df = 1, p = 0.043), indicating a potential impact of diabetes on implant success. No significant associations were observed between periodontal disease (X2 = 0.780, df = 1, p = 0.377) or smoking status (X2 = 0.422, df = 1, p = 0.516) and treatment outcomes. Regarding graft material, the majority of patients (95.4%) received xenograft bone graft material, while 4.6% received a combination of xenograft and autogenous material. The stage of surgery was predominantly one-stage (simultaneous) surgery (88.5%), with a smaller proportion undergoing two-stage (delayed) surgery (11.5%). In terms of bone augmentation techniques, guided bone regeneration was performed in 78 cases, while 9 cases involved sinus lifts. The success rate of implants was found to be 81.6%, while 18.4% of implants were classified as failures.

| **Age/years** | **Outcome** | | | |
|---|---|---|---|---|
| | **Success** | | **Failure** | |
| | No. | % | No. | % |
| ≤30 | 14 | 82.4 | 3 | 17.6 |
| 31- 40 | 17 | 77.3 | 5 | 22.7 |
| 41 - 50 | 19 | 86.4 | 3 | 13.6 |
| 51 - 60 | 18 | 78.3 | 5 | 21.7 |
| >60 | 3 | 100 | 0 | 0 |
| Total | 71 | 81.6 | 16 | 18.4 |

Table 2: Distribution of patient according to age and outcome

| Sex | Outcome | | | |
|---|---|---|---|---|
| | Success | | Failure | |
| | No. | % | No. | % |
| Male | 39 | 81.3 | 9 | 18.8 |
| Female | 32 | 82.1 | 7 | 17.9 |
| Total | 71 | 81.6 | 16 | 18.4 |

Table 3: Distribution of patient according to sex and outcome

| History of diabetes | Outcome | | | |
|---|---|---|---|---|
| | Success | | Failure | |
| | No. | % | No. | % |
| Yes | 8 | 61.5 | 5 | 38.5 |

| | | | | |
|---|---|---|---|---|
| No | 63 | 85.1 | 11 | 14.9 |
| Total | 71 | 81.6 | 16 | 18.4 |

Table 4: Distribution of patient according to history of diabetes and outcome

| Periodontal disease | Outcome | | | |
|---|---|---|---|---|
| | Success | | Failure | |
| | No. | % | No. | % |
| Yes | 26 | 86.7 | 4 | 13.3 |
| No | 45 | 78.9 | 12 | 21.1 |
| Total | 71 | 81.6 | 16 | 18.4 |

Table 5: Distribution of patient according to periodontal disease and outcome

| Smoking status of male | No. | % |
|---|---|---|
| Yes | 22 | 45.8 |
| No | 26 | 54.2 |
| Total | 48 | 100 |

Table 6: Distribution of patient according to Smoking status and outcome

| site | Outcome | | | |
|---|---|---|---|---|
| | Success | | Failure | |
| | No. | % | No. | % |
| Mandible | 28 | 75.7 | 9 | 24.3 |
| Maxilla | 43 | 86 | 7 | 14 |
| Total | 71 | 81.6 | 16 | 18.4 |

Table 7: Distribution of patient according to Maxilla and Mandible and outcome

| Site of plant | No. | % |
|---|---|---|
| Anterior | 45 | 51.7 |
| Posterior | 42 | 48.3 |
| Total | 87 | 100 |

Table 8: Distribution of patient according to Anterior and Posterior

| Type of membrane | No. | % |
|---|---|---|
| Resorpable | 86 | 98.9 |
| Not-Resorpable | 1 | 1.1 |
| Total | 87 | 100 |

Table 9: Distribution of patients according to type of membrane

| Graft material | No. | % |
|---|---|---|
| Xenograft | 83 | 95.4 |
| Xenograft &Autogenous graft | 4 | 4.6 |
| Allograft | 0 | 0 |
| Alloplast | 0 | 0 |
| Total | 87 | 100 |

Table 10: Distribution of patients according to graft material

| Stage of surgery | No. | % |
|---|---|---|
| One stage Simultaneous | 77 | 88.5 |
| Two stage and delayed | 10 | 11.5 |
| Total | 87 | 100 |

Table 11: Stage of surgery.

| Bone augmentation | No. | % |
|---|---|---|
| GBR | 78 | 89.7 |
| Sinus lift maxilla | 9 | 10.3 |

Table 12: Distribution of patients according to bone augmentation

| Name of implant | No. | % |
|---|---|---|
| Kisplant | 49 | 56.3 |
| Biocare | 11 | 12.6 |
| Innoimplant | 9 | 10.3 |
| Duravit 3P | 7 | 8.1 |

| | | |
|---|---|---|
| BTK | 4 | 4.6 |
| JDentalCare | 7 | 8.1 |
| Total | 87 | 100 |

Table 13: Name of implant (company)

| Outcome | No. | % |
|---|---|---|
| Success | 71 | 81.6 |
| Failure | 16 | 18.4 |
| Total | 87 | 100 |

Table 14: Distribution of patients according to success and failure

## Discussion

In the current retrospective investigation, the researchers found that early implant failure was not significantly influenced by age or gender. These results are in line with earlier research by Manzano et al., [9] conducted in 2016, who discovered that patient age and gender had no impact on early implant failure. It's crucial to remember, too, that a different study by Olmedo Gaya et al., [10] done in 2015, their study concluded that males had a higher probability of early implant failure than females. This inconsistency indicates that further research is required to completely comprehend the association between age, gender, and early implant failure.

There was a significant rate of EIF in diabetic patients early in bone augmented sites. According to Yasmin Al Ansari [11] and her colleagues' meta-analysis published in 2022 diabetic patients had a considerably higher chance of implant failure than non-diabetic patients, and stated that "implants placed in diabetic type I patients present a much higher risk of failure than implants placed in diabetic type II patients".Given the rising frequency of diabetes worldwide, this conclusion is concerning. While some research imply that diabetic patients are more likely than non-diabetic to experience implant failure, others contradict this assertion. The study by Sribabu E, Behera et., [12] al done in 2018 in where they mentioned the influence of duration of diabetes disease, they discovered that the survival rate of dental implants in diabetic patients similar from that of non-diabetic individuals within the first 6 years.

This study contradicts our results that has shown diabetes as a significant risk factor and are at a much increased risk of early implant failure. However, there is still evidence that diabetes can negatively affect implant success. Alsaadi et al., [13] concluded that diabetes patients had a statistically higher probability of implant failure than non-diabetic patients in their study. They revealed that patients with poor glycemic control and advanced diabetes were at a higher risk. The dissimilar findings of these research could be attributable to diabetes patients' lack of knowledge about the nature of the condition. Diabetes patients may not completely comprehend the significance of controlling their blood sugar levels and may fail to take the required steps to preserve good health.

All of the cases in the current study had either normal periodontal condition or mild periodontitis. The results of the current research showed that out of 87 implant ,30 implant were placed in patients with periodontal disease 4 implants have failed However, one notable study in this area is the work of Olmedo et al., [10] which revealed a substantial increase in early implant failure among patients with severe periodontal disease. This shows that the severity of periodontal disease can have a direct impact on dental implant success. Furthermore, Levin et al., [14] conducted a thorough study of the long-term effects of periodontal disease and smoking on implant failure. Their research found that periodontal disease and smoking were both substantial risk factors for implant failure over time.

Unfortunately, given to the heterogeneity of the available data, no one superior implant type for any of the cases could be identified. Among many companies creating different implants, each with its own set of characteristics and design, it is impossible to make a definitive conclusion about which implant type is "best" for a bone augmented sites cases .It is important to note, however, that the success of an implant is ultimately determined by a number of factors, including the patient's overall health and oral hygiene, the surgeon's competency in the implantation technique, and the compatibility of the implant type for the specific defect type. As a result, while selecting an implant type for patients, dental professionals must carefully evaluate these considerations. [15]

Despite the potential importance of implant site, the results of the current research and previous studies have revealed no significant variations in outcomes based on this feature. This shows that factors other than implant location may be more crucial in predicting implant success or failure. characteristics such as the surgical method utilized, the type of implant material, patient-specific characteristics, or even variances in the study design could all explain the lack of relevance regarding the site of implant. It is also likely that the sample size in our study, as well as the studies described by Amanda Bandeira et al., [16,17] was insufficient to identify any significant changes. Regardless of the causes behind this finding, it emphasizes the necessity for additional

research and investigation., however resorbable membranes were used in over 99% of the cases studied. 86 out of 87 implants Nonetheless, because of the lack of data, regarding the choice of membrane it is difficult to properly appreciate the relevance of utilizing one type of membrane over another. In most circumstances, the preference for resorbable membranes may be owing to considerations such as convenience of application, lower risk of adverse responses, and demonstrated efficiency in supporting tissue regeneration.

According to the current study, there was no significant difference in the effectiveness of various bone graft materials for implant longevity. This finding is consistent with previous research conducted by Storgard Jensen et al in which no significant difference was found between types of bone transplant materials. Therefore, this lack of substantial difference among these materials implies that surgeons have a variety of choices when selecting a bone graft material for their patients. Within the limitations of the current research a further study with larger sample sizes and longer follow-up periods are needed to confirm these findings and identify additional risk factors.

## Conclusion

In conclusion, the success rate of implants is relatively high and comparable to non-augmented sites also the current research findings indicate that patients with uncontrolled diabetes may experience a lack of osseointegration after the placement of implants in bone graft sites. To mitigate this risk, we recommend scheduling recall appointments to identify early signs of gingival inflammation, which can be effectively managed through periodontal treatment to prevent the onset of severe peri-implantitis. Additionally, our study revealed that patients who maintain proper glycemic control demonstrate improved osseointegration and enhanced implant survival. These findings emphasize the importance of regular monitoring and appropriate management of glycemic levels in diabetic patients undergoing implant procedures.

**References**

1-Kumar S, Pal US, Kumar V, Jain N. Dental Implants: An Update. Journal of Oral Implantology. 2014;40(3):408-417. doi:10.1563/AAID-JOI-D-11-00151.

2 - Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. International Journal of Oral & Maxillofacial Implants. 1986;1(1):11-25. PMID: 3524630.

3- Chrcanovic BR, Albrektsson T, Wennerberg A. Sinus lift procedures: an overview of current techniques. Dental implants: the role of osseointegration and new possibilities, ed. Zita Martins Roque. 2019: 145-167. ISBN: 978-953-51-6167-5.

4-Garoushi IH, Elbeialy RR, Gibaly A, Atef M. Evaluation of the effect of the lateralized inferior alveolar nerve isolation and bone grafting on the nerve function and implant stability: a randomized clinical trial. Clinical Implant Dentistry and Related Research. 2021;23(3):423-431. doi: 10.1111/cid.13003. PMID: 33885294.

5--3-Beretta M, Cicciù M, Poli PP, Rancitelli D, Bassi G, Grossi GB, Maiorana C. A retrospective evaluation of 192 implants placed in augmented bone: long-term follow-up study. Journal of Oral Implantology. 2015 Dec 1;41(6):669-74.

6-4-Mahjoub Pour N, Bruyn HD. Bone augmentation with bovine bone xenograft: 5 years result of Retrospective Cohort Study. Oral Health and Dental Management. 2019;18(2).

7- Friberg B, Jemt T. Rehabilitation of edentulous mandibles by means of osseointegrated implants: a 5-year follow-up study on one or two-stage surgery, number of implants, implant surfaces, and age at surgery. Clinical implant dentistry and related research. 2015 Jun; 17(3):413-24.

8- - Peck MT, Satti A, Majeed A. A retrospective analysis of early implant failure of the Adin Touareg–X dental implant system. International Journal of Clinical Dental Science. 2015 Jan 18;5(2).

9-Manzano G, Montero J, Martín-Vallejo J, Del Fabbro M, Bravo M, Testori T. Risk factors in early implant failure: a meta-analysis. Implant dentistry. 2016 Apr 1;25(2):272-80.

10- Olmedo-Gaya MV, Manzano-Moreno FJ, Cañaveral-Cavero E, de Dios Luna-del Castillo J, Vallecillo-Capilla M. Risk factors associated with early implant failure: A 5-year retrospective clinical study. The Journal of prosthetic dentistry. 2016 Feb 1;115(2):150-5.

11-Al Ansari Y, Shahwan H, Chrcanovic BR. Diabetes mellitus and dental implants: a systematic review and meta-analysis. Materials. 2022 Apr 29;15(9):3227

12-Sribabu E, Behera SS. Diabetes Mellitus and Dental Implants-An Overview. In: Anand PS, ed. Diabetes and Oral Health: An Overview. Springer Singapore; 2018:127-135.

13-Alsaadi G, Quirynen M, Michiles K, Teughels W, Komárek A. Impact of local and systemic factors on the incidence of late oral implant loss. Clinical Oral Implants Research. 2017 Feb;28(2):e1-e10.

14- Levin L, Ofec R, Grossmann Y, Anner R. Periodontal disease as a risk for dental implant failure over time: A long-term historical cohort study. Journal of clinical periodontology. 2011 Aug;38(8):732-7.

15- Lanthier C, Jansen J, Tache R, Rompré PH. Factors influencing the success of dental implants: A systematic review. Journal of Oral Implantology. 2018 Apr;44(2):129-138.

16- Bandeira A, Borges AH, Oliveira SG, et al. Comparison between resorbable and non-resorbable membranes in conjunction with xenogeneic grafts in the treatment of class II furcation defects: a randomized controlled clinical trial. Clin Oral Investig. 2018 Feb;22(2):893-902. doi: 10.1007/s00784-017-2147-7. Epub 2017 Aug 25. PubMed PMID: 28842856.

17- Sanz-Sánchez I, Ortiz-Vigón A, Sanz-Martín I, Figuero E, Sanz M. Effectiveness of Lateral Bone Augmentation on the Alveolar Crest Dimension: A Systematic Review and Meta-analysis. J Clin Periodontol. 2020;47 Suppl 22:356-398. doi: 10.1111/jcpe.13273.

18- Storgard Jensen T, Jensen J, Sindet-Pedersen S. Mandibular reconstruction with bone grafts: a comparative histologic and microangiographic study of the osseous response following allogeneic, homogeneic, and autogenous grafts. Journal of Oral and Maxillofacial Surgery. 1986 Mar;44(3):185-9