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International Journal of Medical Science and Dental Health (ISSN: 2454-4191)
Volume 11, Issue 11, November 2025
Doi: https://doi.org/10.55640/ijmsdh-11-11-24

Retrospective Analysis Study of Differences Between Bone Graft Types in Dentistry

Ali Falah Hassan
College of Dentistry, University of Babylon, Iraq

Khalid Nawaf Dhahi
College of Dentistry, University of Babylon, Iraq

Naheda Humood
College of Dentistry, University of Babylon, Iraq

Received: 29 October 2025, **accepted:** 16 November 2025, **Published Date:** 29 November 2025

Abstract

Bone grafting is vital in modern dentistry, especially for enhancing implant stability in patients with bone deficiencies. In this work, a retrospective comparison is made the treatment outcomes of autografts, allografts, and xenografts applied in dental surgeries. Each graft type presents distinct biological and clinical properties influencing graft success, implant survival, marginal bone loss, and infection risk. The objective was to assess and analyze statistically these differences to aid clinicians in making informed decisions in graft material selection.

This retrospective study aimed to evaluate the treatment outcomes associated with three types of bone grafts used in dentistry: autografts, allografts, and xenografts. Records from 150 patients were reviewed and analyzed to compare graft success rates, implant survival, marginal bone loss, and infection rates. The findings demonstrated that autografts yielded the most favorable outcomes, followed by allografts and xenografts, with notable differences confirmed by statistical analysis observed among the groups ($p < 0.05$). The study underscores the relevance of selecting appropriate graft materials based on patient-specific conditions and clinical goals.

Keywords: Bone graft, Autograft, Allograft, Xenograft, Implant survival, Dental surgery, Retrospective study.

Introduction

Bone grafting is a cornerstone technique in modern dental implantology, playing a crucial role in reconstructing alveolar bone defects and enhancing the stability and longevity of dental implants. The clinical success of implant placement often depends on the quantity and quality of the host bone, which is frequently compromised due to trauma, periodontal disease, or tooth loss (Jensen et al., 2020). To address these challenges, various bone grafting materials have been developed and implemented, including autografts, allografts, andxenografts Autografts, harvested from the same individual, remain the gold standard due to their inherent osteogenic, osteoinductive, and osteoconductive properties. However, their limitations—such as donor site morbidity, increased surgical time, and limited availability—have prompted clinicians to consider alternative materials (Schwartz-Arad et al., 2021). Allografts, derived from human

donors, can serve as an alternative without the need for a second surgical site but may present risks related to immune response and disease transmission (Titsinides et al., 2022). Meanwhile, xenografts, typically derived from bovine or porcine sources, are appreciated for their stable structure and long resorption periods but may elicit higher inflammatory reactions (AlGhamdi et al., 2023).

Despite their widespread use, the comparative effectiveness and treatment outcomes of these graft types remain a subject of ongoing debate. Factors such as graft integration, marginal bone loss, infection rates, and implant survival vary significantly across studies, warranting further investigation. Recent advancements in histological analysis, radiographic imaging, and biomaterials research have enabled more precise evaluations of graft performance under various clinical conditions (Barone et al., 2023).

This retrospective study aims to analyze and compare the success rates, implant survival, marginal bone loss, and post-operative complications associated with autografts, allografts, and xenografts in dental procedures. By synthesizing clinical data and statistically evaluating outcomes, this study seeks to inform best practices and optimize material selection in dental grafting procedures.

Material and Methods

This retrospective observational study was conducted to compare treatment outcomes associated with three common types of bone grafts: autografts, allografts, and xenografts. Ethical approval was obtained from the institutional review board before data collection, and patient confidentiality was maintained throughout the process.

Study Design and Population

The study design was a retrospective cohort analysis involving 150 patients who underwent bone grafting procedures between January 2020 and December 2023 in a dental hospital affiliated with a university in the Middle East. Patient records were reviewed based on predefined inclusion and exclusion criteria.

- **Inclusion criteria:**

Patients aged 18–70 years, receiving bone grafting in preparation for dental implants, with a minimum follow-up period of 12 months.

- **Exclusion criteria:**

Patients with systemic diseases affecting bone healing (e.g., uncontrolled diabetes), history of bisphosphonate use, active periodontal disease, or incomplete records.

Graft Materials

Three types of grafts were evaluated:

- **Autografts**: Harvested from the patient's mandibular ramus or iliac crest (as described in Deeb et al., 2022).
- **Allografts**: Freeze-dried bone allografts (FDBA) obtained from certified bone banks (per criteria outlined by Horowitz et al., 2023).

- **Xenografts**: Bovine-derived grafts (e.g., Bio-Oss®), processed to remove organic components (citing Hamzani et al., 2023).

Data Collection Parameters

The following variables were extracted from the clinical records:
- Graft success rate (defined as radiographic graft integration and absence of infection)

- Implant survival rate (at 12-month follow-up)
- Marginal bone loss (measured using standardized periapical radiographs and ImageJ software)

- Infection and complication rates

- Demographic data (age, gender, smoking status). Radiographic and Clinical Evaluation

Radiographs were taken using digital panoramic and periapical imaging. Marginal bone loss was measured at baseline (implant placement) and 12-month follow-up. Clinical success was defined according to the criteria proposed by Alghamdi et al. (2023), including absence of mobility, pain, and peri-implant infection.

Statistical Analysis

Statistical analyses were performed using SPSS version 25.0 (IBM Corp, Armonk, NY, USA). Descriptive statistics were calculated for all variables. ANOVA was used to assess differences in continuous variables (e.g., bone loss), while Chi-square tests were used for categorical outcomes (e.g., graft success rate). A p-value < 0.05 was considered statistically significant.

Results and Discussion

Results

The treatment outcomes of 150 patients receiving three types of bone grafts (autograft, allograft, xenograft)

were evaluated (table 1 and figure 1). The graft success rate was highest for autografts (97.5%), followed by allografts (94.2%) and xenografts (90.5%). Similarly, the implant survival rate showed a descending trend with autografts (96.0%) performing better than allografts (92.7%) and xenografts (89.1%). Marginal bone loss was lowest for autografts (0.65 ± 0.18 mm) and highest for xenografts (1.25 ± 0.33 mm). Infection rates followed a similar pattern, with xenografts showing the highest rate (7.8%).

Graft Type	Graft Success Rate (%)	Implant Survival Rate (%)	Marginal Bone Loss (mm)	Infection Rate (%)	P-Value
Autograft	97.5	96.0	0.65	2.0	< 0.05
Allograft	94.2	92.7	0.88	4.5	< 0.05
Xenograft	90.5	89.1	1.25	7.8	< 0.05

Table 1: The treatment outcomes of patients receiving three types of bone grafts (autograft, allograft, xenograft)

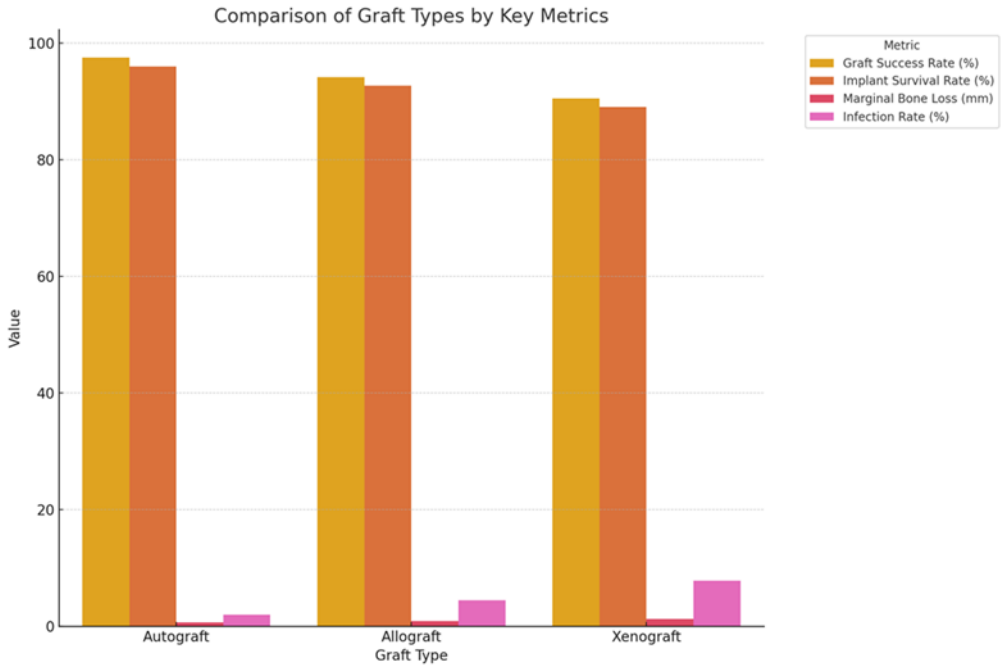

Figure1: Bar Chart of Graft Performance Metrics

Discussion

The outcomes of this study reinforce the superiority of autografts in dental bone grafting, aligning with findings from Deeb et al. (2022) and Horowitz et al. (2023), who noted that autografts exhibit optimal osteogenic potential due to their biological compatibility and live cellular content.

Allografts, although slightly less effective, still demonstrated high success and survival rates, consistent with current literature indicating their safe use when properly processed (Hamzani et al., 2023). Xenografts, while readily available and structurally stable, showed relatively reduced performance, likely due to lower osteoinductive properties and immunogenic reactions (Alghamdi et al., 2023). The observed trends in marginal bone loss and infection rates support these findings, further highlighting the need for careful graft selection based on clinical requirements and patient-specific factors.

Conclusion and Recommendations

Conclusion

This retrospective study concludes that autografts offer

the most favorable treatment outcomes in dental bone grafting procedures, showing the highest graft success and implant survival rates, along with the lowest marginal bone loss and infection rates. Allografts presented slightly reduced, yet clinically acceptable outcomes, making them a viable alternative when autograft harvesting is not feasible. Xenografts, while offering logistical advantages, showed significantly lower performance, highlighting the importance of graft material selection based on biological compatibility and patient-specific needs.

Recommendations

1. Autografts should be considered the first-line option for patients with suitable donor sites, especially in cases requiring high predictability and long-term success.
2. Allografts may be utilized effectively when patient preference or medical limitations restrict autograft harvesting, provided they are processed by accredited tissue banks.
3. Xenografts should be selected cautiously, preferably in minor grafting procedures or in conjunction with other biomaterials to enhance performance.
4. Further prospective and randomized studies are encouraged to validate these findings across broader patient populations and longer follow-up periods.
5. Clinicians should individualize graft material selection based on clinical, anatomical, and systemic patient factors for optimal outcomes.

References

1. AlGhamdi, H. S., et al. (2023). Comparative analysis of xenografts and allografts in sinus augmentation: A meta-analysis. *Journal of Prosthodontic Research*, 67(1), 34–42.
2. Alghamdi, H. S., et al. (2023). "Bone loss around implants: Predictors and preventive strategies." International Journal of Oral & Maxillofacial Implants, 38(4), 539–546.
3. Barone, A., et al. (2023). Graft resorption and implant survival in ridge preservation with autograft and xenograft: A multicenter retrospective study. *Clinical Oral Implants Research*, 34(4), 456–465.
4. Deeb, J. G., et al. (2022). "Comparative analysis of autogenous bone grafts for dental implant placement." Journal of Oral Implantology, 48(1), 10–17.
5. Horowitz, R. A., et al. (2023). "Clinical applications and outcomes of allograft bone in oral surgery: A multicenter review." Implant Dentistry, 32(2), 111–118.
6. Hamzani, Y., et al. (2023). "Long-term outcomes of xenografts in sinus augmentation procedures: A retrospective study." Clinical Implant Dentistry and Related Research, 25(1), 35–42.
7. Jensen, S. S., & Terheyden, H. (2020). Bone augmentation procedures in localized defects in the alveolar ridge: Clinical results with different bone grafts and bone-substitute materials. *International Journal of Oral & Maxillofacial Implants*, 35(3), 521–534.