Jordan Journal of Dentistry, Volume **3**, No. **4**, **2026**
DOI: https://doi.org/10.14525/JJD.v3i4.09

Jordan Journal of Dentistry

https://jjd.just.edu.jo

The Role of Alveolar Bone Housing in Implant Success: A Case Report on Managing Compromised Bone Level

Muhammad Adib Mohamad Mazri [1], **Khamiza Zainol Abidin** [1]

1 Ministry of Health, Malaysia.

ARTICLE INFO

Article History:
Received: 7/1/2026
Accepted: 17/4/2026

Correspondence:
Muhammad Adib Mohamad Mazri,
Ministry of Health, Malaysia.
adibmazri@gmail.com

ABSTRACT

This case report highlights the successful implant placement in a 40-year-old male patient presenting with severe post-extraction bone loss, but preserved alveolar bone housing (ABH). Despite an initial atraumatic extraction and alveolar ridge preservation (ARP) using Geistlich Bio-Oss, significant buccal bone resorption occurred, extending to approximately two-thirds of the bone height. The patient was informed of a guarded prognosis, but elected to proceed. A Straumann implant was placed within the preserved ABH morphology to achieve apical stability, followed by simultaneous guided bone regeneration (GBR) using Bio-Oss and a collagen membrane to restore the buccal defect. Following successful osseointegration, the final implant-supported crown demonstrated excellent functional and aesthetic outcomes. This case underscores that preserved alveolar bone housing, combined with strategic regenerative techniques and meticulous oral hygiene, can lead to successful implant integration even in severely compromised bone situations.

Keywords: Alveolar bone housing, Guided bone regeneration, Implant stability, Bone resorption, Osseointegration.

1. Introduction

The rehabilitation of the anterior maxilla with dental implants is a complex undertaking due to high aesthetic demands and the naturally thin anatomical architecture of the region. Success in this "aesthetic zone" is primarily governed by the alveolar bone housing (ABH); the three-dimensional bony architecture surrounding the tooth or implant (1).

In the anterior maxilla, the facial alveolar bone (FAB) is often less than 1 mm thick. Following extraction, the loss of blood supply from the periodontal ligament triggers significant buccal plate resorption (3). The sagittal root position (SRP) within the ABH dictates the severity of this volume loss (4). This report presents a case where, despite the failure of initial ridge preservation, the preservation of the deeper palatal and apical ABH allowed for successful implant placement.

The clinical prevalence of deficient buccal bone architecture at potential implant sites underscores the magnitude of this challenge. A micro-computed tomography investigation of the anterior maxilla confirmed that the buccal alveolar wall is consistently thin and frequently exhibits fenestrations at multiple positions, demanding a thorough, individualized treatment plan to prevent complications and ensure stable long-term aesthetic and functional outcomes (10). Epidemiological data further suggests that a thick buccal plate exceeding 1 mm is present in fewer than 5% of patients at the maxillary central incisor region, meaning that the overwhelming majority of implant candidates in the esthetic zone will require some form of regenerative or augmentative intervention (11). A multi-center randomized controlled trial comparing immediate and delayed implant placement protocols confirmed that even when ARP is performed, a substantial proportion of patients still require additional soft tissue augmentation at the time of definitive restoration, highlighting the inherent limitations of conventional socket grafting in fully preventing three-dimensional tissue loss (11).

When ARP fails to prevent significant buccal plate collapse, guided bone regeneration (GBR) performed simultaneously with implant placement has emerged as the most rigorously validated strategy for managing peri-implant dehiscence defects (12). A systematic review confirmed that GBR at implant placement is the preferred treatment to correct bony dehiscence, with residual dehiscence representing a risk factor for long-term peri-implant biological complications (12). Evidence from a multicenter randomized controlled trial further demonstrated that GBR using deproteinized bovine bone mineral (DBBM) combined with a resorbable collagen membrane achieves predictable bone fill and favorable peri-implant health at medium-term follow-up, regardless of the grafting material selected (13). However, the feasibility of combining implant placement and simultaneous GBR is critically contingent upon attaining adequate primary mechanical stability, which depends directly on the residual volume and morphology of the alveolar bone housing (2).

Despite these advances, a clinical scenario that remains insufficiently documented in the literature is one in which initial ARP proves inadequate to prevent catastrophic buccal plate resorption, yet the palatal and apical components of the ABH remain sufficiently intact to provide implant anchorage. Published case reports documenting simultaneous GBR in the context of a completely resorbed buccal wall following a failed ARP attempt are scarce, and evidence-based decision-making frameworks for this situation are lacking. The present case report addresses this gap by describing the strategic utilization of residual palatal and apical ABH morphology to achieve primary implant stability, followed by simultaneous GBR in a severely compromised anterior maxillary site where ARP had failed. This report demonstrates that even under these challenging conditions, satisfactory functional and aesthetic outcomes are achievable through meticulous surgical planning, appropriate biomaterial selection, and optimized patient-specific systemic support.

2. Case Presentation

2.1 Patient Assessment

A 40-year-old systemically healthy male presented with a fractured maxillary left central incisor (tooth 21). Clinical and radiographic examinations revealed a horizontal fracture at the cervical third and a calcified apical third.

Treatment options discussed included tooth maintenance via crown lengthening (ruled out due to poor prognosis), a fixed partial denture (refused by the patient), and a dental implant. The implant plan was selected. At the time of treatment, the facility was not yet equipped with Cone Beam Computed Tomography (CBCT). Consequently, pre-surgical planning relied on high-resolution intraoral periapical radiographs (IOPA) and meticulous clinical ridge mapping to evaluate the available bone volume.

2.2 Periodontal and Pre-Surgical Phase

The patient’s periodontal status was assessed using the Basic Periodontal Examination (BPE), yielding a score of 3, indicative of moderate periodontitis. Initial therapy involved a comprehensive phase of non-surgical periodontal treatment, including full-mouth scaling, root surface debridement, and intensive oral hygiene instructions to reduce the bacterial load and inflammatory markers before surgical intervention.

2.3 Surgical Phase I: Extraction and Ridge Preservation

Following the stabilization of periodontal health, tooth 21 was extracted. An atraumatic technique was employed using periotomes to preserve the remaining alveolar walls. Despite the careful extraction, the buccal plate was noted to be extremely thin. To mitigate the expected post-extraction shrinkage, Alveolar Ridge Preservation (ARP) was performed. The socket was grafted with bovine-derived xenograft (Geistlich Bio-Oss®) and covered with a collagen plug to facilitate haemostasis and protect the graft. An immediate partial denture was delivered, ensuring that it was "relieved" over the surgical site to prevent any pressure-induced resorption during the five-month healing period.

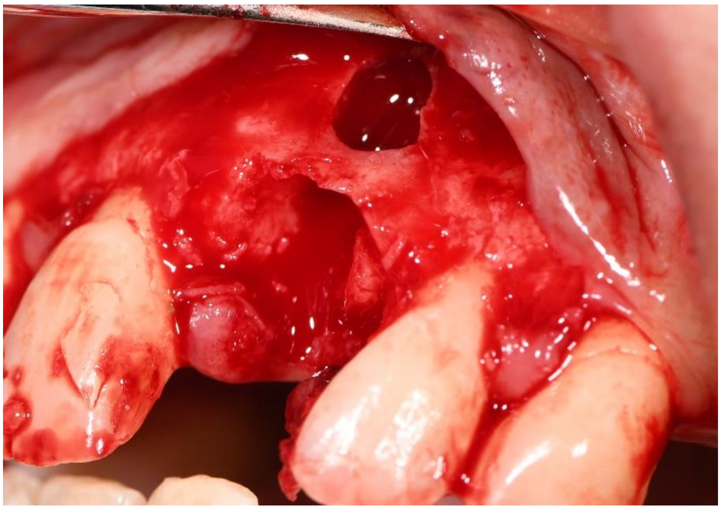

Figure 1: Immediate post-extraction view of maxillary left incisor tooth

2.4 Surgical Phase II: Implant Placement and GBR

Five months' post-extraction, a radiographic assessment was performed using an IOPA to evaluate the healed site. The IOPA (Figure 2) revealed the vertical bone height and proximity to the incisive canal. Clinical assessment and ridge mapping indicated a narrow ridge, suggesting a guarded prognosis.

Figure 2: Pre-surgical IOPA assessment five months post-ARP

Upon flap reflection, a significant buccal dehiscence was confirmed. A periosteal releasing incision was performed at the base of the full-thickness flap to allow for tension-free primary closure (6). A 3.3 mm diameter Straumann® Bone Level Tapered (BLT) implant was placed, purposely angled toward the palatal wall of the ABH to achieve apical stability.

Simultaneous GBR was performed by packing Bio-Oss® into the buccal defect and covering it with a Geistlich Bio-Gide® collagen membrane. The membrane was stabilized by the advanced flap and secured with 4-0 Vicryl sutures. No tacks or pins were used as stability was achieved through the coronal advancement and tension-free closure.

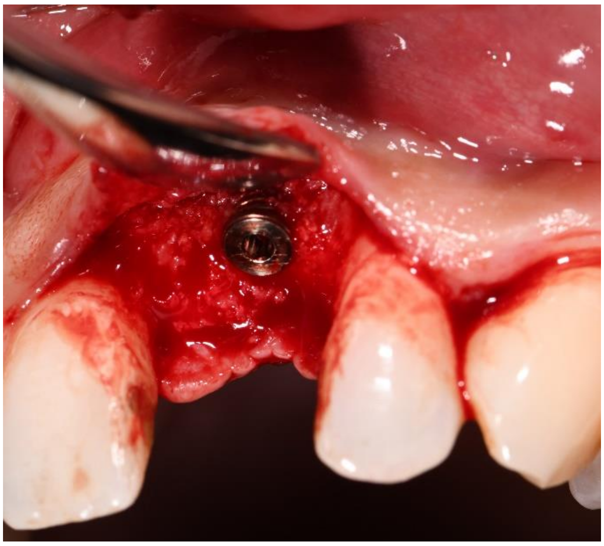

Figure 3: Post-implant placement demonstrating the use of GBR material

2.5 Prosthetic Phase

After six months of undisturbed healing, second-stage surgery was performed to expose the implant. The implant demonstrated clinical stability with no signs of peri-implantitis or graft failure. A healing abutment was placed to begin the "emergence profile" development.

One month later, the prosthetic phase commenced using a digital workflow. An intraoral scanner (3Shape TRIOS®) was used to capture a digital impression with a scan body in situ. This ensured high precision for the final screw-retained ceramic crown. The final restoration was delivered with adjusted occlusion to ensure no "heavy" contacts during protrusive or lateral movements.

The post-operative healing was uneventful. At second-stage surgery, the implant showed excellent clinical stability. The final restoration achieved satisfactory aesthetic integration. At the 6-month follow-up, peri-implant tissues were healthy and bone levels were stable on IOPA.

Figure 4: Healing abutment in place after successful osseointegration

3. Discussion

The success of this case hinges on the biological understanding of the alveolar bone housing. While the initial ARP did not prevent buccal bone loss, it likely preserved the overall ridge volume sufficiently to allow for the secondary GBR procedure. The complete loss of the buccal plate in the anterior maxilla is a common phenomenon when the initial bone thickness is <1 mm, as the bundle bone is almost entirely resorbed following the loss of the periodontal ligament (3).

The absence of pre-surgical CBCT imaging is acknowledged as a limitation. While CBCT is the standard for 3D visualization of the SRP and buccal plate thickness (2,7), its use was precluded in this instance due to institutional equipment limitations at the time of treatment. However, this case demonstrates that clinical success can be achieved through the application of sound surgical principles, such as engaging the available ABH and performing tension-free flap advancement, even when advanced 3D imaging is unavailable.

Figure 5: Implant scan body in position for digital impression

Primary stability is a mechanical phenomenon determined by the contact between the implant threads and the surrounding bone. In cases of severe buccal resorption, the clinician must rely on the palatal and apical "housing" of the bone. In this case, by placing the implant slightly more palatally and utilizing the apical 3 mm of the ABH, we achieved sufficient torque to allow for a one-stage augmentation (2).

The decision to use Bio-Oss® was based on its slow resorption rate, which provides long-term volume stability for the buccal contour. However, the biological success of GBR is also dependent on the host's regenerative capacity. We emphasized the role of nutrition, advising the patient to supplement with vitamin C (for collagen synthesis), vitamin D, and calcium (for bone mineralization) (5). This holistic approach, combined with the patient's transition from a BPE score of 3 to excellent oral hygiene, was likely a deciding factor in the successful integration of the graft.

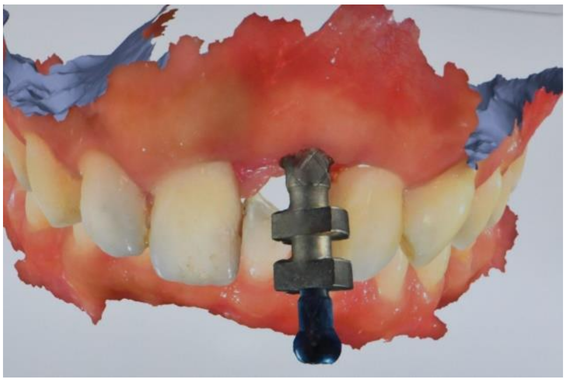

Figure 6: View of the intraoral digital scanning process

The deep anterior bite of the patient posed a risk for "overloading" the implant. By carefully managing the occlusion and using a narrower 3.3 mm implant, we maximized the thickness of the regenerated bone on the buccal aspect, which is essential for preventing future gingival recession (4).

Figure 7: Final implant abutment at maxillary left incisor tooth prior to crown placement

Figure 8: Final prosthesis

4. Conclusions

This case demonstrates that even with a guarded prognosis due to severe buccal bone loss, successful outcomes are possible if the apical and palatal alveolar bone housing remains intact. Clinicians are advised to utilize the preserved portions of the ABH for mechanical stability, combine high-quality bone substitutes (GBR) with patient-specific systemic health support and use digital workflows to ensure that the final prosthesis is aligned with the biological constraints of the regenerated site.

Acknowledgments

The authors would like to thank the Director General of Health Malaysia for providing the permission and support to publish this paper.

Conflict of Interests

The authors declare no conflict of interests.

Funding Information

No funding or financial support was received for this manuscript.

References

1. Tiong NT, Din LS. Replacing missing teeth: Dental implants. In Atlas of Operative Maxillofacial Trauma Surgery: Post-Traumatic Deformity. 2020 Mar 19, pp. 779-799. Springer Nature, London.
2. Li Y, Huang J, Fan Z, Han M, Gu Y, et al. Changes in alveolar bone remodeling after maxillary anterior retraction using fixed appliances with different periodontal conditions: A retrospective study based on cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2025;168:99-109.
3. Yıldırım B, Akçaboy C. Efficacy of alveolar ridge preservation with xenografts and resorbable socket sealing materials in the aesthetic region: A systematic review with meta-analysis. Clin Implant Dent Relat Res. 2024;26:618-632.
4. Rodrigues DM, Petersen RL, Montez C, de Moraes JR,

Ferreira V, et al. The relationship between tomographic sagittal root position of maxillary anterior teeth and the bone housing. J Prosthet Dent. 2023;130:705-714.

5. Hinduja S, Waghmare M. Evaluation of alveolar bone housing of maxillary anterior teeth and its influence on anterior alveolar arch form: A cross-sectional analytical CBCT study. IP Int J Maxillofac Imaging. 2024;10:38-42.
6. Aytekin M, Arisan V. Alveolar ridge augmentation techniques in implant dentistry. In Oral and Maxillofacial Surgery 2020 Dec 3 (p. 141). London, UK: IntechOpen.
7. Babiker J, Affendi NHK, Yusof MYPM, Chu SJ. Qualitative and quantitative assessments of alveolar bone dimension and its correlation with tooth angulation in the anterior maxilla for immediate implant placement. J Contemp Dent Pract. 2021;22:1237-1242.
8. Sghaireen MG, Shrivastava D, Alnusayri MO, Alahmari AD, Aldajani AM, et al. Bone grafts in dental implant management: A narrative review. Curr Pediatr Rev. 2022;19:15-20.
9. Xu R, Guo D, Zhou X, Sun J, Zhou Y, et al. Disturbed bone remodelling activity varies in different stages of experimental gradually progressive apical periodontitis in rats. Int J Oral Sci. 2019;11:27.
10. Todorovic VS, Postma TC, Hoffman J, van Zyl AW. Buccal and palatal alveolar bone dimensions in the anterior maxilla: A micro-CT study. Clin Implant Dent Relat Res. 2023;25:261-270.
11. Cosyn J, Seyssens L, de Bruyckere T, Djurkin A, Eghbali A, et al. A multi-centre randomized controlled trial on alveolar ridge preservation with immediate or delayed implant placement: Need for soft-tissue augmentation. J Clin Periodontol. 2024;51:1644-1655.
12. Severi M, Trombelli L, Heitz-Mayfield L, Farina R, Simonelli A. Minimal invasiveness in lateral bone augmentation with simultaneous implant placement: A systematic review. Periodontol 2000. 2023;91:113-125.
13. Cha M, Yoon YJ, Oh JS, Park CJ, Kim JH. Guided bone regeneration at dehiscence comparing synthetic bone substitute versus bovine bone mineral: A multicenter, noninferiority, randomized trial. Clin Implant Dent Relat Res. 2024;26:1233-1244.