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Surgical Case Report of Buccal Bone Block of Impacted Maxillary Permanent Canine Teeth for Lateral Alveolar Ridge Augmentation in the Maxilla

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Abstract

Background: Edentulous patients with an embedded tooth often require tooth extraction prior to implant placement. Bone tissues will be partially removed during the extraction procedure. This report aims to describe one case of using the buccal bone block of impacted maxillary permanent canine teeth as lateral on-lay grafts for alveolar ridge augmentation.

Case Presentation: In this case, a 50-year-old female patient with severe dentition defects presented with missing teeth at sites #11, #12, #13, and #14. The #10 and #15 teeth were residual root and residual crown in dentition, respectively. One embedded tooth #11 was present in the maxillary bone and hindered the insertion of implants at the #10-12 sites. Moreover, the alveolar bone at the #11-12 site was significantly absorbed and only a thin alveolar ridge remained. In this case, we preserved the buccal bone plate of the embedded tooth #11 during the extraction and used it as a lateral on-lay graft for alveolar bone augmentation at the implant site. Then, the alveolar cavity of embedded tooth was filled with artificial bone powder and covered with resorbable collagen membranes for alveolar reconstruction. After 6 months, the alveolar width increased by 3-4 mm, which enabled us to place implants at the #10, #12, #13, and #14 sites. Eighteen months later, a 2-mm-wide bone plate covered with regenerated cortical bone tissue at the buccal site of implant could be identified in X-ray images.

Conclusion: This case indicates that the buccal bone tissues at the site of embedded tooth can serve as donor site for alveolar bone grafting without untoward complications or functional deficits.

Keywords: apical cortical bone; autologous bone graft; alveolar ridge augmentation; implant

Abbreviations: GBR: Guided Tissue Regeneration; CBCT: Cone Beam Computed Tomography

Introduction

After tooth loss, the alveolar ridge tends to be resorbed, and the labial wall of alveolar bone will be resorbed more rapidly [1]. This leads to reduced bone mass insufficient for implant replacement. Many clinical techniques can be used to increase the volume of alveolar bone, including ridge splitting, autogenous bone grafting, and guided tissue regeneration (GBR) [2]. Autogenous bone blocks remain the "gold standard" for alveolar bone augmentation, as they have osteoconductive, osteoinductive, and osteogenic properties [3]. Ideally, the autograft will be selected from intraoral sites, including the ramus and symphysis [4]. However, the use of autogenous bone is often limited by the need for additional surgical intervention, hyposensitivity

at the harvesting site, limited bone supply of the donor region, potential infection, and increased morbidity [5,6]. Consequently, many fresh donor bone sites, such as the zygomatic buttress, maxillary tuberosity, and mandibular symphysis have been investigated in recent studies [7,8]. In this case, the embedded tooth and the insufficient size of the alveolar ridge led to difficulties in implant placement. We used the buccal bone plate of embedded tooth which located at the apical zone of anterior maxillary as a bone graft for alveolar ridge augmentation.

Case Presentation

The treatments complied with all committee regulations approved by the Ethics Committee of the First

Affiliated Hospital of Dalian Medical University and were approved by the patient herself. The patient was a 50-year-old female. She presented to the first Affiliated Hospital of Dalian Medical University, Liaoning, China, with the chief complaint of maxillary tooth loss. Clinical examination revealed that teeth #11, #12, #13, and #14 were lost. In addition, teeth #10 and #15 were residual root and residual crown, respectively, in the second quadrant of dentition (Figure 1A). Cone beam computed tomography (CBCT) and simulation software were used to assess the bone volume. We found a thin alveolar ridge, especially in the lateral region at the #11 and #12 sites (Figure 1B). The width of the alveolar ridge was between 3.0 and 4.0 mm, as indicated by the metrical data. Moreover, one embedded tooth occupied the site of implant placement in the left maxilla (Figure 1B).

Figure 1: Clinical situation before treatment. Intraoral view of the edentulous patient (A). Preoperative CBCT scan images revealed an atrophic alveolar ridge at the #11 and #12 site, a defect in dentition, and the embedded tooth (B).

The surgical procedure was performed under local anesthesia. The buccal bone was removed as a bone block to reveal the impacted teeth and to enable its extraction (Figure 2A-C). After extraction of embedded tooth, the buccal bone block (Figure 2D) was harvested and preserved in normal saline. The block was approximately 2 cm in length, 1 cm wide, and 2 mm thick. After being refined, the bone blocks were used as on-lay grafts for alveolar ridge augmentation at the #11 and #12 sites (Figures 2E & 2F). The grafts were made immobile using titanium osteosynthesis screws. An

Figure 2: The process of operation. During extraction of the impacted tooth (A-C), an autogenous bone block (D) was harvested from the buccal cortical bone of the tooth and used as on-lay bone graft at the #11 and #12 sites. An on-lay bone graft technique combining with GBR (E-I) was used for alveolar ridge augmentation.

alloplastic particulate bone (Dentium, Korea) (Figure 2E-G) was used to fill the extraction socket and cover the surface of the bone grafts to promote the reconstruction of alveolar bone and reduce the absorption of the graft. The alloplastic particulate bone was secured using artificial membranes (Heal-all, Yantai, China) (Figure 2H). The gingival incision was then closed using sutures (Figure 2I).

One month prior to implant insertion, the residual root of tooth #10 was extracted using a minimally invasive instrument (Figure 3A). The intraoral wound had healed well, with no graft exposure observed during the healing period (Fig. 3A). Six months later, the flap was opened. Newborn and solid bone tissues were observed at the graft sites (#11 and #12), where the width of the alveolar bone had increased by 3-4 mm (Figure 3B). Four implants (Dentium, Korea) were placed at the #10, #12, #13, and #14 sites using routine procedures (Figure 3B). An X-ray image obtained 6 months later revealed ideal osseointegration (Fig. 3C). The prosthetic work was finished at this time (Figure 3D).

During the treatment, CBCT was used to observe the changes of alveolar bone at the #10 (Figure 4A, B & C), #11 (Fig. 4D, E and F), and #12 (Figure 4G, H & I) sites. After alveolar augmentation for 5 months, the #10 residual root was extracted. The width of the alveolar bone had increased

Figure 3: The process of implant insertion and the prosthetic work. After the residual root of tooth #10 being extracted for one month, the intraoral wound had healed well, with no graft exposure observed during the healing period (A). Four implants were placed at the #10, #12, #13, and #14 sites (B). An X-ray image obtained 6 months later revealed ideal osseointegration (C). The prosthetic work was finished at this time (D).

Figure 4: The alveolar bone changes. Five months later, CBCT images showed that the width of alveolar bone at #10(A), #11 (D) and #12 (G) sites had increased significantly, and the labial undercut area at the #10 (B), #11(E) and #12(H) sites had disappeared. Eighteen months after alveolar augmentation, the autogenous buccal bone blocks showed good volume maintenance (C, F and I). Moreover, the labial site of two implants had high bone density, as determined using CBCT images (C and I).

significantly (Figure 4B, E & H), and the labial undercut area at the #11 and #12 sites had disappeared (Figure 4E & 4H). Eighteen months after alveolar augmentation (Figure 4C, F & I), the autogenous buccal bone blocks showed good volume

maintenance. Moreover, the labial site of the implant had high bone density, as determined using CBCT images. This implied that the cortical bone had regenerated.

Discussion

Dental implant technology is well acknowledged as an ideal prosthetic treatment for edentulous or partially edentulous individuals. However, alveolar resorption occurs following tooth loss [9], hindering the placement of implant in an ideal position. It should be noted that, in this case, the width of alveolar ridge was reduced severely at the implant site, and the embedded tooth in the maxillary region hindered the placement of implant. Therefore, the initial treatment plan for this patient comprised alveolar ridge augmentation as well as extraction of the embedded tooth to create a favorable alveolar bone condition. During the second surgical procedure, GBR was planned to prepare for implant placement [10].

Bone grafting is an effective method to address insufficient bone volume. However, its use depends on the defect morphology, location of the recipient site, the available bone, and the locations of vital structures [11]. Autologous bone block grafting may be the best choice for thickening an atrophied residual alveolar ridge [12], which is usually harvested from the hip, maxillary tuberosity, mandibular symphysis, external oblique ridge of the mandible, or the ribs [2,7,13,14]. However, autografting procedures are associated with donor site morbidities [15] and require additional surgical intervention [6]. For small-to medium-sized alveolar defects, an intraoral donor site would be more easily accepted by doctors and patients, as their use is said to be less invasive and to reduce surgical and anesthetic time. In addition, procedures using intraoral donor sites can be carried out in the outpatient operating theater [5,7]. The external oblique ridge of the mandible was designated the donor site for alveolar ridge augmentation in the initial treatment plan in this case.

Analysis of the CBCT image indicated that the buccal bone wall of embedded tooth was approximately 2 cm×1 cm×2 mm in size. We thus decided to utilize the buccal bone plate of the embedded tooth as a source of autologous bone graft for alveolar ridge augmentation. This allowed us to avoid additional surgical intervention and new donor site morbidity. This decision was in conformity with the principle of surgery [16] (Figure 2), and the patient consented to the treatment plan. Even if the plan had failed, we could use the external oblique ridge of the mandible as the alternative donor site.

Previous report indicates that bone grafts require 6

months to 1 year of reconstruction before the implants can be placed [17]. Bone graft resorption may range from 20% to 50% after 6 months [18]. However, when we re-opened the mucosal flap, we found the generated newborn and solid bone tissues at the graft sites of the #11 and #12 teeth, where the width had increased by 3-4 mm (Figure 3B). Six months later, the alloplastic particulate bone had been reconstructed completely and was difficult to separate from the graft bed. After alveolar augmentation for 18 months, a continuous white line of dense bone was found in radiographic images, suggesting that the cortical bone had been regenerated during alveolar augmentation (Figure 4).

In this case, alveolar bone reconstruction might benefit from the use of an adjacent donor site, which could facilitate the recruitment of osteoblasts, vascular cells, and various growth factors required for bone remodeling [19]. Theoretically, even without the presence of embedded tooth, we could also harvest a bone block of the same size at the apical zone of anterior maxillary for alveolar ridge augmentation. Nevertheless, this approach requires validation in future animal studies and clinical randomized controlled trials.

Conclusion

This case report demonstrates that the apical cortical bone in the anterior maxillary region could be used as onlay bone graft for alveolar ridge augmentation without untoward aesthetic or functional deficits at the donor site.

Ethics Approval and Consent to Participate

The treatments complied with all committee regulations approved by the Ethics Committee of the First Affiliated Hospital of Dalian Medical University and were approved by the patient herself.

Consent for Publication

All authors have read and approved the manuscript.

Availability of Data and Materials

Not applicable

Competing Interests

The authors deny any conflicts of interest related to this study.

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Not applicable

Authors' Contributions

Gang Chen and Haitao Huang conceived and designed the study. Jingyan Yang, Lei Deng and Sheng Wang performed the prosthetic work of patient. Gang Chen wrote

the paper. Lei Deng, and Haitao Huang reviewed and edited the manuscript.

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Authors' Information (Optional)

Not applicable

References

1. de Wijs FL, Cune MS (1997) Immediate labial contour restoration for improved esthetics: a radiographic study on bone splitting in anterior single-tooth replacement. *Int J Oral Maxillofac Implants* 12(5): 686-696.
2. Chiapasco M, Zaniboni M, Boisco M (2006) Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants. *Clin Oral Implants Res* 17: 136-159.
3. Sullivan JP (2013) Implant placement in the aesthetic zone following an autogenous bone graft from an intraoral site: a case study. *Prim Dent J* 2(4): 49-55.
4. Chappuis V, Cavusoglu Y, Buser D, von Arx T (2017) Lateral Ridge Augmentation Using Autogenous Block Grafts and Guided Bone Regeneration: A 10-Year Prospective Case Series Study. *Clin Implant Dent Relat Res* 19(1): 85-96.
5. Pohl V, Pohl S, Sulzbacher I, Fuerhauser R, Mailath-Pokorny G, et al. (2017) Alveolar Ridge Augmentation Using Dystopic Autogenous Tooth: 2-Year Results of an Open Prospective Study. *Int J Oral Maxillofac Implants* 32(4): 870-879.
6. Nkenke E, Neukam FW (2014) Autogenous bone harvesting and grafting in advanced jaw resorption: morbidity, resorption and implant survival. *Eur J Oral Implantol* 7: S203-17.
7. Sakkas A, Schramm A, Karsten W, Gellrich NC, Wilde F (2016) A clinical study of the outcomes and complications associated with zygomatic buttress block bone graft for limited preimplant augmentation procedures. *J Craniomaxillofac Surg* 44(3): 249-256.
8. Khamees J, Darwiche MA, Kochaji N (2012) Alveolar ridge augmentation using chin bone graft, bovine bone mineral, and titanium mesh: Clinical, histological, and histomorphometric study. *J Indian Soc Periodontol* 16(2): 235-240.
9. Zmyslowska E, Ledzion S, Jedrzejewski K (2007) Factors affecting mandibular residual ridge resorption in edentulous patients: a preliminary report. *Folia Morphol (Warsz)* 66(4): 346-352.
10. Younis M, Elshahat A, Elhabbaa G, Fareed A, Safe I (2014) Onlay bone graft maintenance using guided bone regeneration, platelet rich plasma, and their combination. *J Craniofac Surg* 25(6): 2237-2240.
11. Anitua E, Alkhraisat MH, Miguel-Sanchez A, Orive G (2014) Surgical correction of horizontal bone defect using the lateral maxillary wall: outcomes of a retrospective study. *J Oral Maxillofac Surg* 72(4): 683-693.
12. Anitua E, Murias-Freijo A, Alkhraisat MH (2015) Implant Site

- Under-Preparation to Compensate the Remodeling of an Autologous Bone Block Graft. *J Craniofac Surg* 26(5): e374-7.
13. Di Bari R, Coronelli R, Cicconetti A (2013) Radiographic evaluation of the symphysis menti as a donor site for an autologous bone graft in pre-implant surgery. *Imaging Sci Dent* 43(3): 135-143.
 14. Thaller SR, Kim S, Tesluk H, Kawamoto H (1990) The split calvarial bone graft donor site: the effects of surgicel and hydroxyapatite impregnated with collagen. *Ann Plast Surg* 25(6): 435-439.
 15. Rocchietta I, Fontana F, Simion M (2008) Clinical outcomes of vertical bone augmentation to enable dental implant placement: a systematic review. *J Clin Periodontol* 35(8 Suppl): 203-215.
 16. Rallan M, Rallan NS, Goswami M, Rawat K (2013) Surgical management of multiple supernumerary teeth and an impacted maxillary permanent central incisor. *BMJ Case Rep* 2013.
 17. Coatoam GW, Mariotti A (2003) The segmental ridge-split procedure. *J Periodontol* 74(5): 757-770.
 18. Cordaro L, Amade DS, Cordaro M (2002) Clinical results of alveolar ridge augmentation with mandibular block bone grafts in partially edentulous patients prior to implant placement. *Clin Oral Implants Res* 13(1): 103-111.
 19. Moghadam HG (2009) Vertical and horizontal bone augmentation with the intraoral autogenous J-graft. *Implant Dent* 18(3): 230-238.

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