

VERTICAL BONE AUGMENTATION USING THE AUTOGENOUS SPLIT BONE BLOCK GRAFT (KHOURY’S TECHNIQUE) IN THE ESTHETIC ZONE: A CASE REPORT

Sok Chea¹, THOUK saroth¹, Chan Sina², Young Tharoth²

University of Health Sciences, Faculty of Odonto-stomatology, Department of Periodontology
Sok Chea Dental Clinic, Phnom Phen, Cambodia
H/P : (855) 12818116
Email : prof.sokcheadentist@gmail.com

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Introduction:

Severe periapical infections in the anterior zone can lead to extensive vertical and horizontal bone defects. These defects pose a significant challenge for clinicians when placing dental implants and restoring the aesthetic requirements of both soft and hard tissues. Dental implants are a highly successful and predictable treatment for replacing single or multiple missing teeth (Albrektsson et al., 1986). For optimal outcomes, an implant must be positioned with at least 1 mm of bone on both the buccal and lingual aspects to maintain the crestal bone level and achieve good primary stability (Spray et al., 2000). However, insufficient bone height and width at the implant site can hinder proper implant placement. Implant placement in a deficient ridge is associated with higher failure rates and compromised aesthetic results (Esposito et al., 2006). Therefore, vertical augmentation of alveolar bone defects is critical to provide sufficient bone volume for implant placement and to meet aesthetic demands (Urban et al., 2016). Various ridge augmentation techniques have been developed, including particulate bone grafting with guided bone regeneration (GBR), distraction osteogenesis, and autogenous bone block grafts (Esposito et al., 2009). Additionally, different types of bone graft materials are available, such as allografts, xenografts, alloplasts, and autogenous grafts (Misch, 2015). Among these, autogenous bone grafts remain the most predictable and are considered the gold standard for alveolar ridge augmentation due to their osteoconductive, osteoinductive, and osteogenic properties (Buser et al., 1990; Chiapasco et al., 2006). However, conventional autogenous bone block grafts may contain fewer viable cells and exhibit greater resorption compared to autogenous split bone block grafts, such as those used in Khoury’s technique (Khoury & Hanser, 2015).

Case Presentation :

A 45-year-old female patient presented to Sok Chea Dental Clinic with a chief complaint of pain and swelling in the upper front teeth (#11 and #12) due to a periapical infection. The pre-operative CBCT (Figure 1-2) revealed significant alveolar bone resorption in the region of teeth #11-#12. The treatment options presented to the patient included a removable prosthesis, a fixed prosthesis (bridge), and an implant-supported fixed prosthesis following extraction of teeth #11 and #12. The patient chose the implant-supported fixed prosthesis.



Figure 01 : Pre-operative clinical view showing a labial sinus track

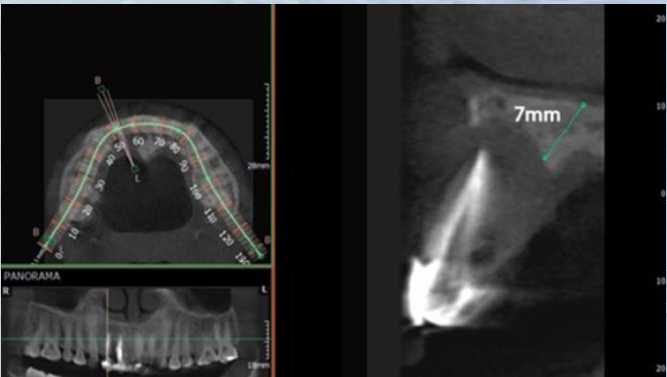


Figure 02 : Pre-operative CBCT extensive bone loss

Vertical Ridge Augmentation Procedure:

The procedure began with the extraction of the affected teeth, followed by meticulous debridement of the extraction site (Figure 3-4). A connective tissue graft was then harvested from the hard palate and rotated to the extraction site to ensure adequate vascularity and soft tissue thickness, providing optimal coverage for the subsequent bone augmentation eight weeks after teeth extraction. Wound closed after rotating connective tissue to the labial site. (Figure 5)

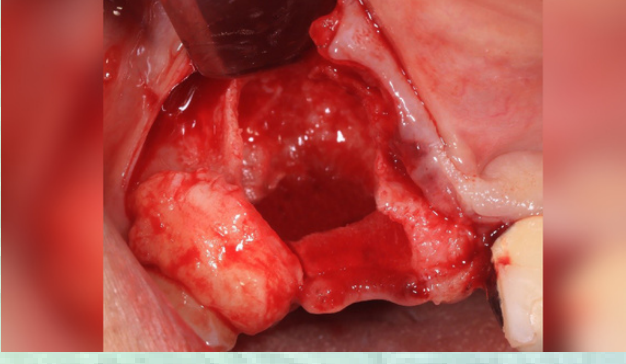


Figure 03 : Extensive alveolar bone defect after surgical debridement

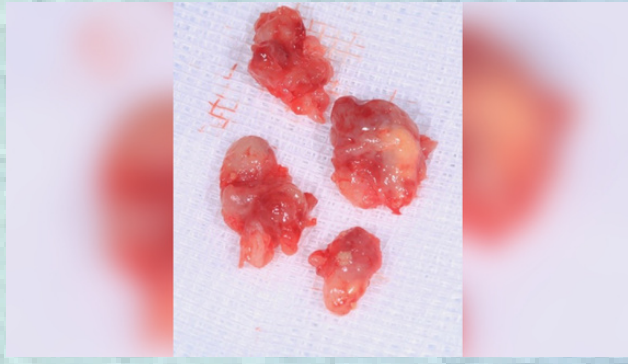


Figure 04 : Root fragments and granulation tissue

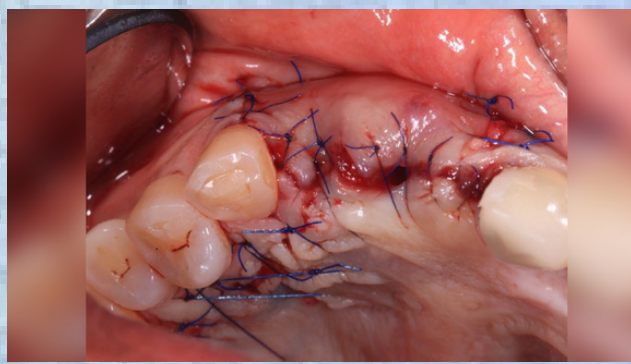


Figure 05 : Wound closed after rotating connective tissue to the labial site.

Donor Site :

The bone defect was mapped on CBCT images before harvesting the bone block. The external ramus was selected as the donor site. After administering local anesthesia with 4% Articaine, an incision was made from the retromolar pad forward to the first molar along the mucogingival junction. A full-thickness flap was then elevated using a periosteal elevator until the external ramus was exposed (Figure 6-7). Two vertical cuts were made using a microsaw with a straight handpiece to outline the bone block, followed by a horizontal cut made with an angled handpiece (Figure 8). After completing the cross-cut between the vertical and horizontal cuts, the external ramus was decorticated with a cortical drill. The bone block graft was gently separated using a chisel and mallet (Figure 9-10). The autogenous bone block harvested from the mandibular ramus was split into two parts and thinned to approximately 1 mm (Figure11) using a bone scraper, creating two thin bone shells. The resulting autogenous bone chips were mixed with Platelet-Rich Growth Factors (PRGF) and processed in a steaming device to prepare sticky bone and a solid fibrin membrane (Figure 12-13). The donor site was sutured using a continuous locking suture (Figure 14).



Figure 06 : Pre-operative clinical view on retromolar.



Figure 07 : External Ramus was exposed



Figure 08 : Osteotomy was done to harvest the block graft



Figure 09 : Chisel was gently used to pop out the graft



Figure 10 : Bone Block was harvested



Figure 11 : Bone Block was split with microsaw

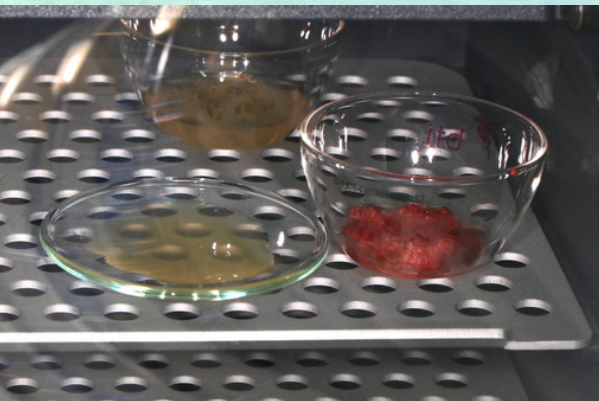


Figure 12 : Platelet-Rich Growth Factors (PRGF)



Figure 13 : Two autogenous bone plates and autogenous bone chips



Figure 14 : The donor site was sutured using a continuous locking suture

Recipient Site :

After administering local anesthesia with 4% articaine, a crestal incision was made with two vertical releasing incisions, providing excellent visibility of the operative site. The flap was fully elevated with a periosteal elevator until the boundaries of the bone defect were clearly visible (Figure 15-16).Based on the configuration of the bone defect, the first autogenous bone plate was fixed with micro-screws on the palatal aspect of the defect (Figure 17), and the second autogenous bone plate was fixed on the buccal aspect, leaving a 6 mm space between the palatal and buccal plates(Figure18). Sticky autogenous bone chips were then packed into the space between the two bone plates(Figure19). Finally, a fibrin membrane was placed over the graft, and a periosteal releasing incision was made to achieve tension-free with primary closure(Figure20). A seven days antibiotic therapy was prescribed along with analgesics. Cold packs were used in order to reduce post-operative oedema. There were no post operative complications and the sutures were removed 14 days after the surgery.



Figure 15 : Clinical view eight weeks after extraction and connective tissue graft

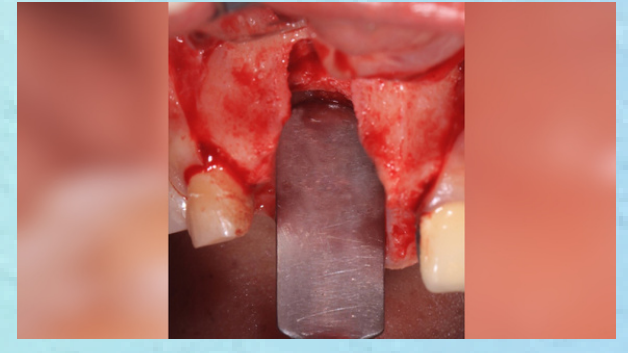


Figure 16 : Extensive vertical bone defect



Figure 17 : Bone plate was fixed on palatal aspect with microscrews

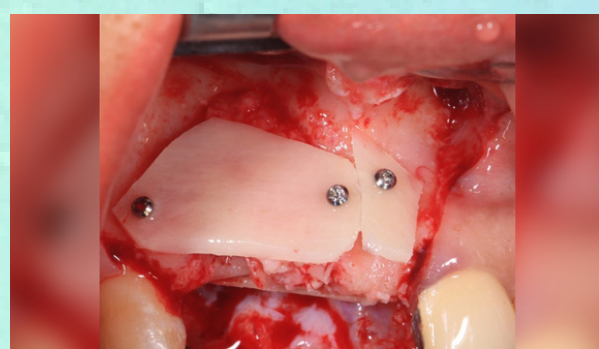


Figure 18 : Bone plate was fixed on labial aspect with microscrews

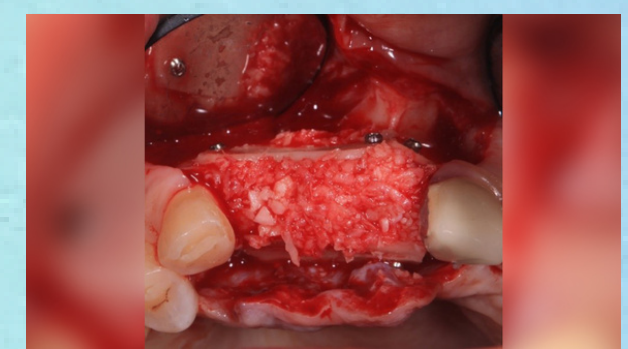


Figure 19 : Autogenous bone chips were packed in between two bone plates

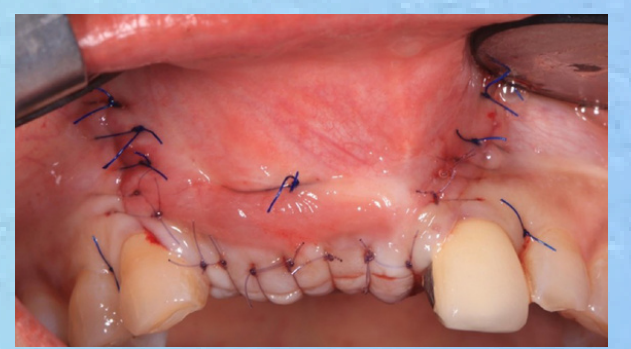


Figure 20 : Graft was covered with good primary closure with tension free.

Implant Placement :

A follow-up CBCT was taken 4 months postoperatively (Figure21) . The scan revealed a labio-palatal width of 8.77 mm at the crestal level (Figure 22) and an apico-coronal height of 17.96 mm (Figure22 a,b), indicating a vertical bone gain of 10.96 mm from the baseline measurement of 7 mm. Intraorally, the mucosa appeared healthy, with adequate alveolar ridge height. Table 1 shows the differences in labio-palatal width and apico-coronal height between the baseline and post-augmentation measurements.

Four months after bone augmentation, the graft was re-exposed for implant placement. Upon exposure, the author noted that the graft had undergone excellent revascularization (Figure23). Two NeoBiotech implants (4/11.5 mm) were then placed with the aid of a surgical guide, achieving good primary stability (Figure 24-25). A two-stage procedure was performed to ensure optimal healing over the following three months (Figure26,27).

Table 01

	Labio-palatal	Apico-coronal
Baseline	0	7 mm
Post. Augmentation	8.77 mm	17.96 mm
Differences	8.77 mm	10.96 mm

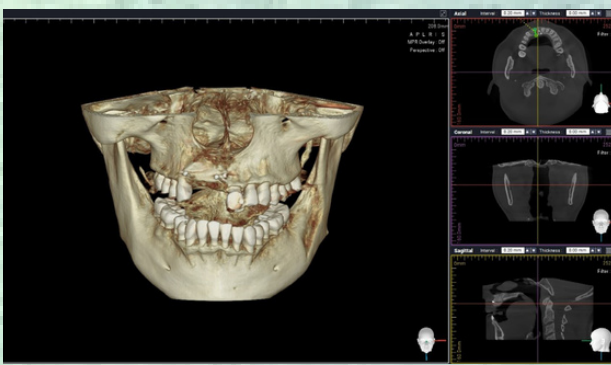


Figure 21 : CBCT images 4 months after bone augmentation

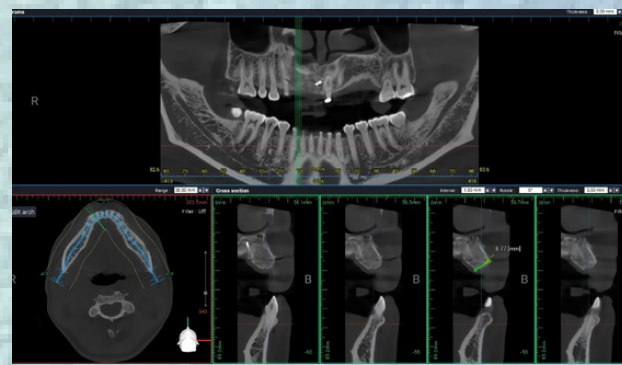


Figure 22 a,b: CBCT cross section images showing bone width was achieved: 8.77 mm and an apico-coronal height of 17.96 mm

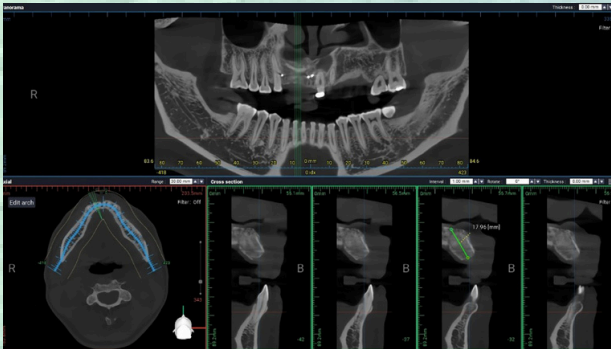
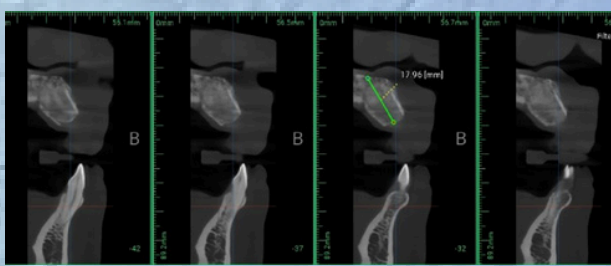


Figure 23 : CBCT cross section images showing vertical bone gains 10.96mm from the baseline of 7 mm

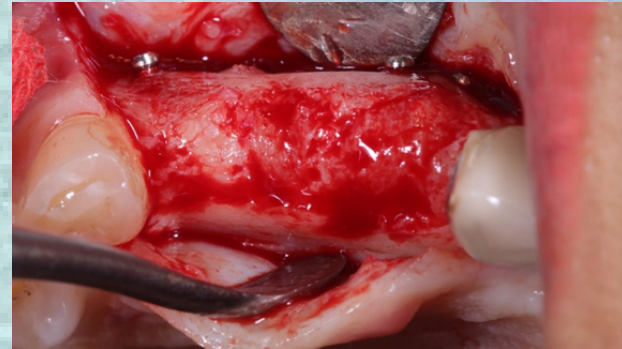


Figure 24 : Clinical View 4 months after bone augmentation

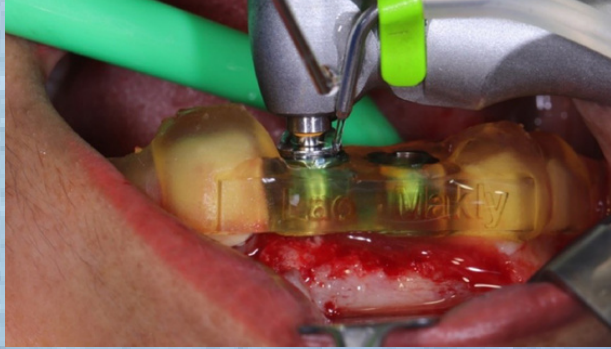


Figure 25 : NeoBiotech surgical guide

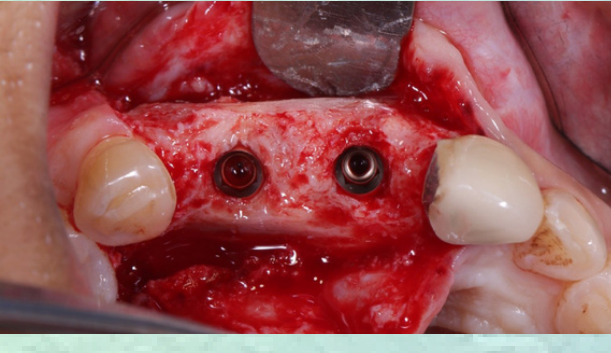


Figure 26 : Two NeoBiotech implants were placed (4/11.5mm)

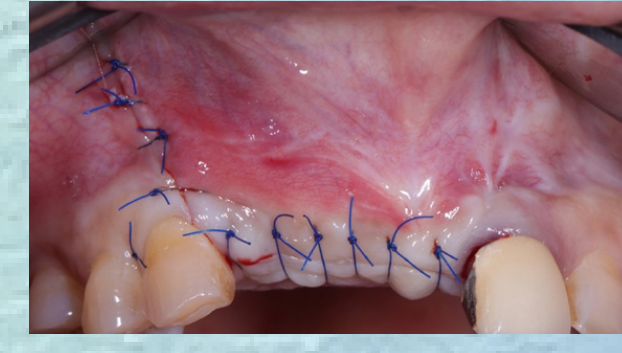


Figure 27 : Flap was closed with interrupted sutures

Implant exposure :

Three months after implant placement, a second-stage surgery was performed to expose the implants. Before connecting the healing abutments and placing the fixed temporization, a rotational flap was created to ensure adequate attached tissue around the implants (Figure 28 a,b,29).

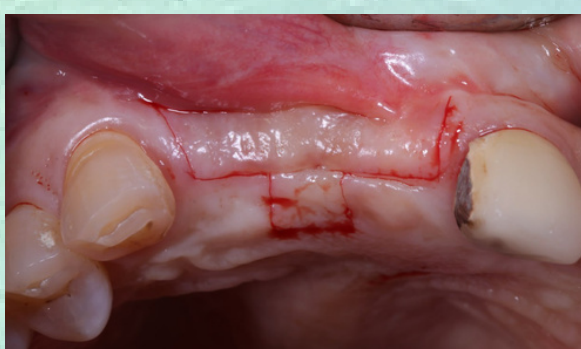


Figure 28 a,b : Implant exposure three months after implant placement

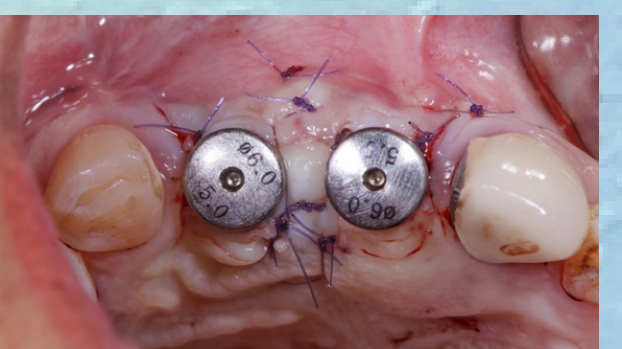


Figure 29 : Four weeks after temporization

Prosthodontic Procedure :

To meet the patient's esthetic demand for a full-mouth restoration and to transform her Class III occlusal relationship into Class I, the author decided to perform full-mouth preparation of the natural teeth in order to slightly raise the occlusal vertical dimension and fabricate full-contour zirconia crowns for the upper teeth. An intraoral scanner was used to obtain the definitive impression, which was then processed using a CAD/CAM digital laboratory workflow to fabricate the crowns (Figure 30,31,32,33).



Figure 30 : Peri-implant soft tissues were stable and well-contoured after eight weeks temporization



Figure 31 : Intraoral scanner was used to obtain the definitive impression



Figure 32 : Panoramic X-ray after definitive restoration



Figure 33 : Clinical Photos after definitive restoration

Discussion:

For a vertical bone defect in the anterior esthetic zone, the author performed vertical bone augmentation using an autogenous split bone block graft (Khoury’s technique). This method was selected because, as an autologous graft, it eliminates the risk of disease transmission and host rejection [10]. Furthermore, autogenous bone possesses both osteoinductive and osteogenic potential, promoting faster bone regeneration compared to allografts or particulate grafting materials [11,12]. In this case, a microsaw was used to harvest the graft from the external ramus rather than a piezoelectric device or round bur. The microsaw is easier to handle, allows faster harvesting, and minimizes thermal and mechanical trauma to the donor site. It also provides a narrow and precise cut, reducing bone loss during graft preparation [13]. According to Khoury and colleagues, the autogenous bone plates should be slightly larger than the defect to ensure full coverage and support. The two cortical plates are positioned approximately 6 mm apart and fixed with microscrews to achieve rigid stability [14]. The gap between the plates is then filled with autogenous bone chips mixed with platelet-rich growth factors (PRGF) to create a sticky bone graft, which is easy to manipulate and enhances bone regeneration through the release of growth factors [15,16]. A PRGF membrane was placed over the graft to promote soft tissue healing and enhance angiogenesis [17]. Finally, a periosteal releasing incision was performed to achieve tension-free primary closure, which is essential for optimal healing and graft integration [18].

Conclusion:

Despite the technical difficulties and challenges that implant surgeons and restorative clinicians may face, dental implants in the anterior aesthetic zone are an ideal treatment modality for replacing missing teeth. However, the clinician must have a strong foundation in surgical and restorative principles to manage the inherent complications of this procedure.

Consent :

All written informed consent for publication and clinical images was obtained from the patient

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