Multidisciplinary approach for treating vertical ridge defect: case report

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ABSTRACT

Background: The outcomes of trauma may have a ridge defect, and it would be hard to replace it with a simple dental implant treatment technique. In some cases, horizontal and vertical bone augmentation therapy is needed for implant placement.

Case Presentation: The case report described a 24-year-old female diagnosed with a severe bony defect and was managed in collaboration with an orthodontic and periodontic treatment plan. Alveolar bone augmentation was approached using Misch's fashion, an autogenous block graft harvested from intra-oral (ramus). Moreover, Khoury's split bone block technique was applied to reconstruct the seat.

Conclusion: For complicated abnormalities, autogenous bone is still the best choice. Autogenous bone is the gold standard for bone grafting due to its biocompatibility, absence of antigenicity, and osteoconductive and osteoinductive qualities. Further graft extenders or growth factors may result in better outcomes.

Keywords: Vertical ridge defect, treatment, augmentation, autogenous graft.

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Background

This is essential for placing dental implants with proper alveolar bone width and height [1]. The outcomes of trauma may have a ridge defect, and it would be hard to replace it with a simple dental implant treatment technique [1]. In some cases, horizontal and vertical bone augmentation therapy is needed for implant placement [1]. Placing dental implants in the correct three-dimensional alveolar bone position is essential to avoid disharmony with adjacent teeth [2]. Treatment options for alveolar bone reconstruction (GBR) are onlay/inlay bone graft, guided bone regeneration with resorbable or nonresorbable membrane such as collagen and titanium membrane, respectively, maxillary sinus augmentation, alveolar ridge split, bone block graft, and osseodistraction [3].

The case report described the severe bony defect, managed with an orthodontic and periodontic treatment plan. Alveolar bone augmentation was approached using Misch's fashion, an autogenous block graft harvested from intra-oral (ramus) [4]. Moreover, Khoury's split bone block technique was applied to reconstruct the sit [5].

Case Presentation

A 24-year-old female patient. Orthodontics referred her to the Periodontics Department in King Saud Medical City to seek an implant placement.

The patient had been treated in a private clinic, and a traumatic extraction was done for tooth #15. The patient had ended up with severe alveolar bone loss in the area of #15. Therefore, it caused a critical attachment loss for tooth #16, and it has a limited amount of buccal keratinized tissue and mobility grade II, which resulted in a poor prognosis (Figure 1).

Tooth #14 was in better shape than tooth #16, although it had a 4 mm gingival recession on the distal side.

A cone-beam computed tomography (CBCT) was requested to evaluate the amount of remaining bone. It shows a severe vertical alveolar bone loss class II from Seibert's classification (Figure 2).

Her medical history was reviewed; the patient was unaware of medical illness or dental allergies. The orthodontics and periodontics departments jointly developed the treatment plan. Initially, oral hygiene instruction was given to the patient, and scaling and root planning were performed. Then, it was decided to extract the hopeless

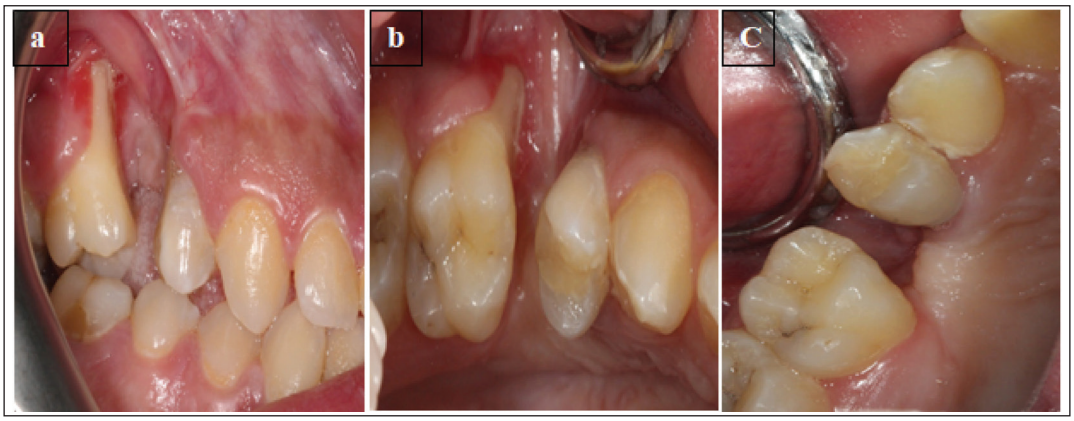

Figure 1. *Tooth #15 traumatic extraction, which ends up with a severe alveolar bone loss on the area of #15, causing a critical attachment loss for tooth #16.*

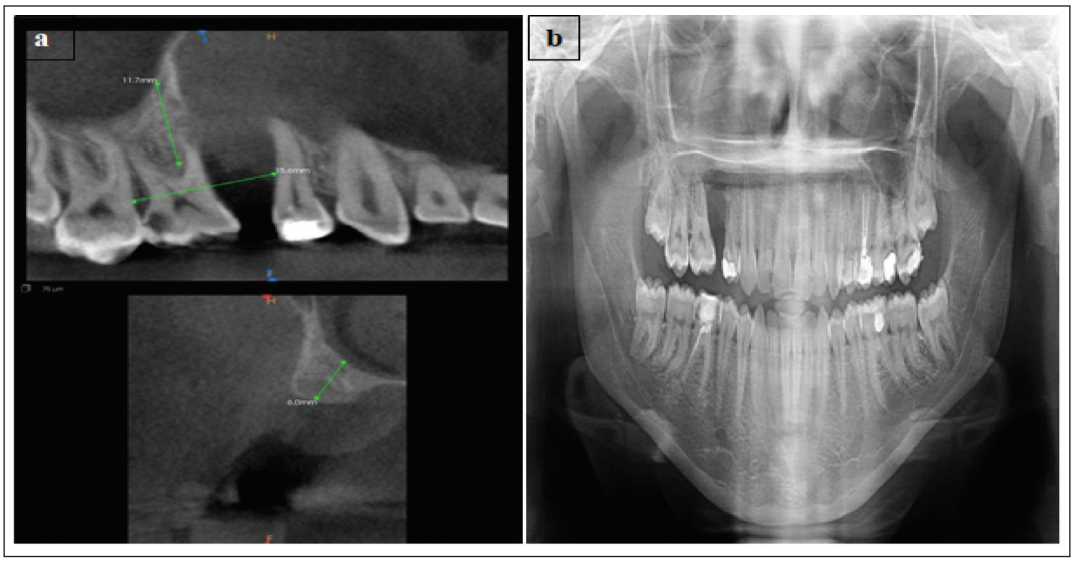

Figure 2. *A CBCT shows a severe vertical alveolar bone loss class II from Seibert's classification.*

tooth #16. A traumatic extraction and socket preservation were done using xenograft (Bio-Oss) and collagen membrane (Figure 3).

The treatment plan from the ortho department was to use mesial tooth #17 to minimize the mesiodistal space to reduce the alveolar bone defect. Moreover, moving tooth #17 is needed to allow tooth #18 to erupt. After six months of orthodontic movement, the mesiodistal space of missing #15 and #16 was 5 mm; furthermore, tooth #18 had discharged (Figure 4). At that time, the alveolar bone augmentation was planned to use an autogenous block graft to establish a vertical gain.

The patient was admitted to the OR; the surgery was performed under general anesthesia. Local anesthesia was given using Lidocaine 2% with 1:80,000 epinephrine to decrease postoperative pain, improve hemorrhage control, and reduce the need for anesthesiologist intervention.

Recipient site

A crestal incision was made using a 15-scalpel blade on the area of #15 and 16, and an intracrevicular incision was done in the adjacent teeth #13, 14, 16, 17, and 18 with one vertical incision was made on the mesial side of #13.

Teeth #14 and 17 were hopeless and tuned up for extraction after the mucoperiosteal flap reflected. All granulation tissues were removed, and the area was irrigated with saline. Decortication was performed on the site of #15 and 16. The mesiodistal alveolar defect was measured.

Donor site

The vestibular incision was conducted on the mesiobuccal of tooth #46 with a crestal incision on the area of #48 using a 15-scalpel blade. The mucoperiosteal flap was reflected, and the mandibular ramus bone was exposed. Two verticals with one horizontal osteotomy were executed on the right mandibular ramus by utilizing a Piezoelectric device to harvest a bone block. Particulate cancellous bone was scooped from the area, intending to mix it with xenograft later. The bone block was removed with a bone chisel and mallet. After that, the league was split into two pieces using a disc (Figure 5).

Fixation of the blocks was done using Martin's screws in the recipient site. The first block was fixed on the buccal

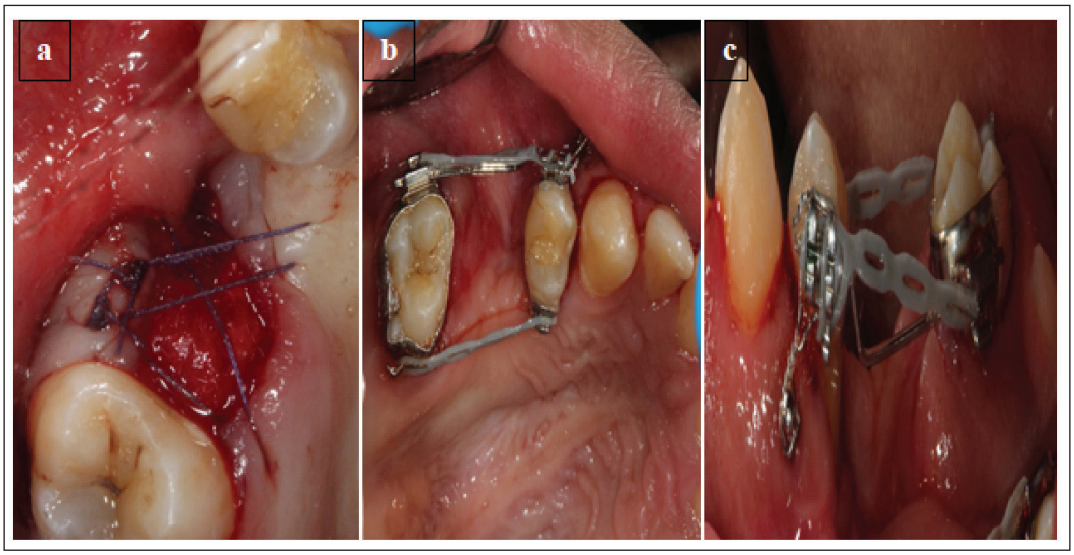

Figure 3. *A traumatic extraction and socket preservation using xenograft (Bio-Oss) and collagen membrane.*

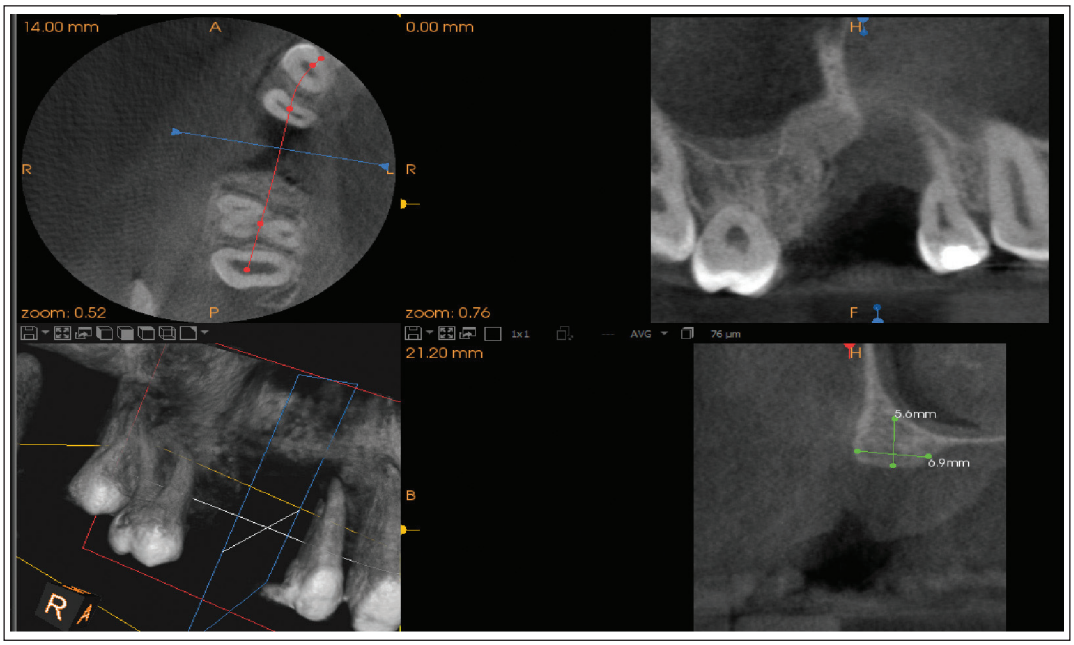

Figure 4. *The mesio-distal space of missing #15 and #16 was 5 mm.*

side of areas #14, 15, 16, and 17, while the other was on the palatal side of the same size (Figure 6). Mixing particulate autogenous bone graft (ABG) with xenograft filled the bucco-palatal gap between the two blocks. A rich fibrin membrane was implemented above the block graft and under the mucoperiosteal flap.

The mucoperiosteal flap was released by cutting the periosteum layer to free it from tension; then, the flap was repositioned and sutured utilizing polyglactin 910 "Coated VICRYL." The horizontal matter technique was applied to achieve primary wound closure, as well as the continuous locking suture method.

Postoperative instructions were given to the patient. Medications prescribed to the patient were: Amoxicillin 500 mg with 125 calvunate acid three times/day for one week, Paracetamol 500 mg PRN, and Chlorhexidine 0.2% 15 ml for 30 seconds two times/day for two weeks. CBCT was taken after the surgery was done. It shows the mean width of the graft, 9 mm and the mean height, 15 mm (Figure 7). The follow-up visit was after two weeks for suture removal. The surgical site was intact (Figure 6e).

Discussion

Multidisciplinary medication, done prudently with an effective approach that adheres to mechanical and biological concepts, favors success in oral rehabilitation therapy [6]. Dental implants' excellent rates of success and predictability have been growing in therapies that vary from the most basic to the most complicated mouth rehabilitation

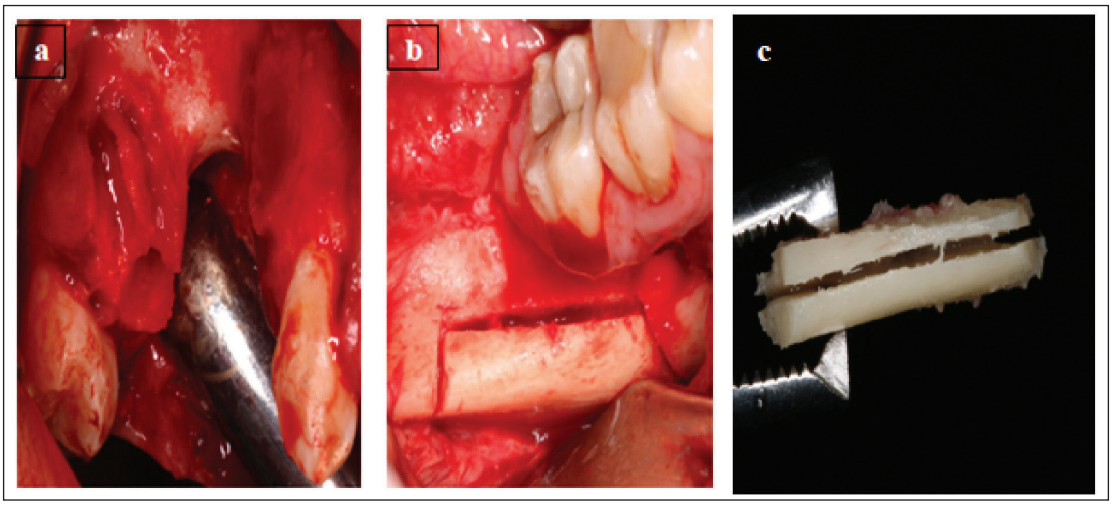

Figure 5. *The bone block was removed using a bone chisel and mallet. After that, the league was split into two pieces using a disc.*

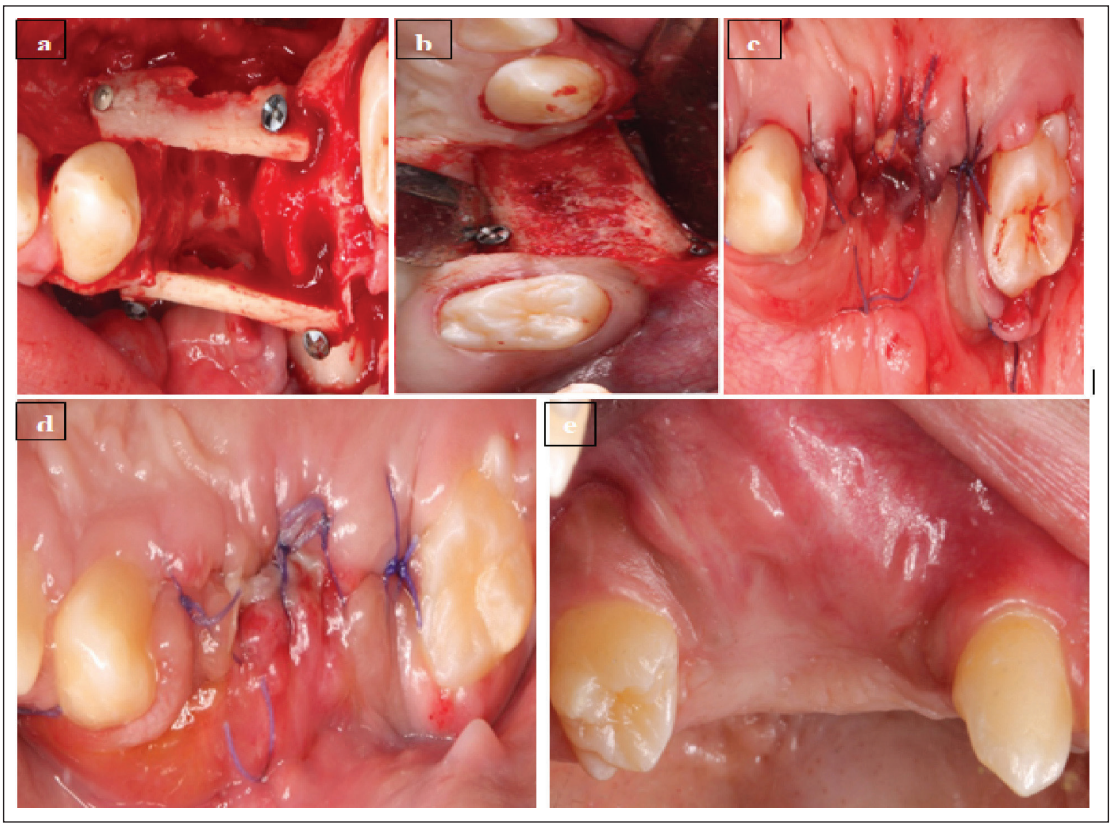

Figure 6. *Fixation of the blocks was done using Martin's screws in the recipient site. The surgical site was intact.*

[6]. Herein, we presented a case report of 24 a 24-year-old female, showing the multidisciplinary approach for treating vertical ridge defects.

Local alveolar ridge deficiencies are defined as inadequate soft tissue and bone volume within the alveolar process. The edentulous void may be caused by tooth loss, extraction trauma, or congenital abnormalities that eventually contribute to alveolar bone loss. This loss of alveolar bone produces overlaying soft tissue incursion during healing, resulting in contours. It also causes food impaction and difficulty speaking due to saliva percolation [7]. Prosthodontists may confront difficulties when treating partially edentulous patients with alveolar ridge deficiencies, for patients to attain aesthetics, kinetics, phonetics, and mastication, a prosthodontist must replace the lost tooth and seal the ridge defect [2]. Many ridge deficiency classifications have been described for both hard and soft tissue problems.

Siberts (1983) proposed a ridge defect classification to examine faults in form, function, and aesthetics. This

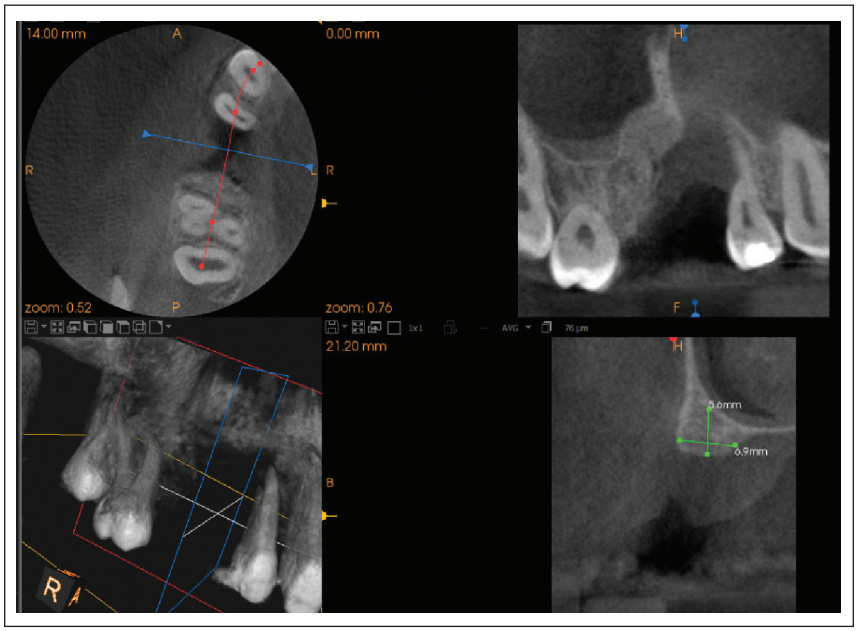

Figure 7. *CBCT was taken after the surgery was done. It shows the mean width of the graft as 9 mm and mean height as 15 mm.*

classification considers both hard and soft tissues [8]. Sibert's class I faults are ridges with a missing horizontal dimension. Sibert's class II faults are ridges with insufficient vertical extent [8]. Ridges with insufficient horizontal and vertical diameters are examples of Sibert's class III faults [8]. Investigations on the prevalence of alveolar ridge deformities using Seibert's categorization have yet to be conducted.

Cone beam computed tomography (CBCT) is the primary technique for assessing alveolar bone structure in three dimensions [9]. It provides axial, reformatted panoramic, and serial transplanar images at the appropriate spot. CBCT of the jaws aids in detecting bone morphology at the edentulous location and planning the augmentation surgery, the block size needed, and the donor site's practicality at the mandibular symphysis. The approach has a higher picture resolution of 0.123 mm, better image quality, and significantly lower radiation exposure than traditional computed tomography (CT) [9]. Herein, we depended mainly on CBCT to diagnose alveolar ridge defects and to follow up on the case after augmentation therapy. In the diagnosis stage, it showed a severe vertical alveolar bone loss class II from Seibert's classification.

Ridge augmentation, as proposed by Aghaloo and Moy [10] is one method of treating alveolar ridge abnormalities. Vertical and/or horizontal ridge augmentation is a procedure used to repair a one-wall defect that receives blood flow primarily from the recipient's bone and little from the soft tissue above. During flap elevation, a barrier membrane may injure and impede soft tissue. As a result, if a large amount of bone transplant is performed vertically or horizontally, only specific bone replacements could be remodeled into viable bone tissue with an estimated amount of 3 mm [10]. Due to a lack of blood flow, the other parts would remain juvenile woven bone for an extended period before being replaced by fibrous granulation tissue. As a result, for successful dental implantation, the healing process of ridge augmentation should be thoroughly understood [10].

Bone grafting is a periodontal tissue regeneration technique that can be coupled with GBR or enamel matrix derivatives [11]. Bone transplants are used to replace periodontitis-induced subgingival deficiencies and improve bone shape to stop the progression of periodontitis and prevent the recurrence of periodontitis. Bone grafting may minimize probing depth, enhance clinical attachment levels, and regenerate periodontal tissues (no integration) with bone growth, cementum, and partially functional periodontal ligament development in bone deficiencies compared to flap surgery. Furthermore, bone grafting is performed to create bone before or contemporaneous with implant insertion [11].

Currently, bone grafting substances are used in four bone grafting methods for periodontal treatment: (1) autologous bone, (2) allogeneic bone (bone from other families), (3) heterologous bone, and (4) artificial bone [12].

Autologous bone grafting is a transplantation technique that involves harvesting bone from the patient's body and transplanting it into a bone defect [12]. The bone is taken from both intraoral and extraoral locations. The intraoral bone harvesting locations include the graft site, buccal shelf, edentulous jaw crest, exostoses, maxillary tuberosity, mandibular angle, mastoid, and extraction socket. Bone swaging is also done, which involves cutting a slit in the bone adjacent to the defect with a rotary cutting instrument and pulling the bone into the defect. Conversely, extraoral bone is obtained from

bone marrow and iliac bone [13]. Autogenous bone has osteogenic and osteoinductive capability and is immune-free. Its benefits include total resorption and replacement with new bone via bone remodeling. However, in some circumstances, surgical invasiveness and constraints on the place and volume of bone extracted make obtaining the required amount for transplantation difficult [13].

Allografts are derived from members of the same species. After intensive screening, these transplants are carefully selected, processed, and stored in bone banks. Allografts are not a material of first choice in dentistry [14]. Their osteoinductivity and the risk of immunological rejection, blood incompatibility, and disease transmission remain controversial [14]. Although allogeneic materials have advantages similar to autogenous bone and are more readily available, they have a high processing cost and the previously described problems of disease transmission, immunological rejection, and religious difficulties [14].

Animal-derived materials, such as xenografts, are commonly employed in dentistry and have been well-studied for over three decades [15]. One advantage of xenogeneic materials is their chemical resemblance to human bone, with a calcium/phosphate ratio of 1.67, which is identical to human bone, their disadvantage stems from ethical, religious, and health concerns, such as disease transmission risk [15]. Dentists' preferred material is xenografts. Bio-Oss® is one of the most widely published xenogeneic materials and is well-known among dentists. Bio-Oss® is derived from bovine HA, and one of its distinguishing features is its chemical composition, which is identical to human HA. Its calcium/phosphate ratio of 1.67 is the same as human bone [15]. Regarding our case, the alveolar bone augmentation was planned to use an autogenous block graft to establish a vertical gain. Mixing particulate ABG with xenograft filled the bucco-palatal gap between the two blocks.

Misch's technique, which uses ABGs in conjunction with endosteal implants, allows for restoring patients with severe bone atrophy or high expectations [5]. The extent of the deficiency determines the approach used, whether it is horizontal or vertical, anatomical features, and the size of the area to be augmented [5].

A novel technique, which has been named the split bone technique, was developed by Dr. Khoury. It differs from the former approach because the bone block is split and fixed to the ridge with osteosynthesis screws so that a void is created between them and filled with particulate autogenous bone [6]. Such a technique has become the most prominent among most surgeons [1,6]. There is no need to use extra-oral bone, even in extensive reconstructions. Despite its increasing popularity, there has yet to be extensive literature regarding the subject in the literature [6]. The split bone technique provides a long-term stable bone because the amount of cancellous bone and mesenchymal cells within the graft turn into host bone predictably under local osseous stimuli [6].

Conclusion

For complicated abnormalities, autogenous bone is still the best choice. Autogenous bone is the gold standard for bone grafting due to its biocompatibility, absence of antigenicity, and osteoconductive and osteoinductive qualities. Further graft extenders or growth factors may result in better outcomes, but more studies are essential to assess them and supply evidence-based care.

What is new?

The alveolar bone resorption process that goes along with trauma could be challenging. The outcomes of trauma may have a ridge defect, and it would be hard to replace it with a simple dental implant treatment technique. In some cases, horizontal and vertical bone augmentation therapy is needed for implant placement.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

None.

Consent for publication

Written informed consent was obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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Summary of the case

1	**Patient (gender and age)**	A 24-year-old female patient
2	**Final Diagnosis**	Vertical ridge defect
3	**Symptoms**	Severe alveolar bone loss in the area of #15, and critical attachment loss for tooth #16
4	**Treatment procedures**	Alveolar bone augmentation using Misch's fashion, and Khoury's split bone block technique to reconstruct the seat.
5	**Medications**	Postoperative medications prescribed to the patient were: Amoxicillin 500mg with 125 calvunate acid three times/day for one week, Paracetamol 500mg PRN, and Chlorhexidine 0.2% 15ml for 30sec two times/day for two weeks.
6	**Specialty**	Dental public health