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FEATURES OF THE USE OF A BONE BLOCK TAKEN FROM THE ZONE OF THE ZYGOMATIC-ALVEOLAR BUTTRESS

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Abstract
Limited maxillary defects are commonly grafted with bone blocks harvested from the symphysis or the ramus; harvesting a second surgical site in the mandible increases both operative time and patient's postoperative morbidity. To overcome these disadvantages, the zygomatic buttress (ZB) was suggested as an alternative maxillary source of autogenous bone. This intraoral donor site has a natural convex shape and can be accessed along with the recipient site through the same flap design. We report a case series describing this uncommon technique of bone harvesting from the zygomatic buttress to reconstruct limited alveolar defects in the maxilla.

Keywords: plastic surgery, cleft lip, surgical revision, pediatrics.

Introduction

Sufficient alveolar bone volume is required to install the implant in the prosthetically and aesthetically correct three-dimensional position. However, unfavorable conditions for alveolar ridge formation often occur, and a grafting procedure is required to increase the width of the alveolar bone before implant placement. Several bone substitute materials such as allogeneic, xenogeneic and alloplastic materials have shown successful results, but autogenous bone remains the gold standard for alveolar bone reconstruction [1].

The two most common intraoral donor sites for treating limited maxillary defects are the mandibular symphysis and the ramus. This entails the need for a second surgical site, longer operative time, and increased postoperative patient morbidity. To overcome these disadvantages, the zygomatic pillar (ZB) has been proposed as a source of autogenous bone [2]. A comprehensive surgical technique describing the use of a ZB graft for limited maxillary reconstruction is rare in the literature.

The issue of the size of the removed block was decided on the basis of modeling the situation dictated by the conditions in the oral cavity and the condition of the bone tissue of the receiving bed. For this purpose, the size and topography of the alveolar ridge defect, the degree of atrophy of the alveolar process, the type of bite, the shape of the chewing surface, etc. were determined using models, and during the examination using computer tomography, the following indicators were assessed:

- the condition of the jawbones and bone density in the donor and recipient areas, the type of trabecular pattern and the presence of an endplate;
- the height and thickness of the alveolar process of the maxilla in relation to the floor of the alveolar socket of the maxillary sinus;

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- the condition of the marginal sections of the alveolar process around the remaining teeth;
- the shape of the elements of the temporomandibular joint.

In the preoperative phase, thorough sanitation of the oral cavity and the necessary orthopedic preparation were carried out. At the same time, the future localization of the implant and its superstructure was taken into account and carried out by the same team (orthopedist – dental technician) that carried out the prosthetics after dental implantation.

After researching and determining the diagnosis, a treatment plan was created that included bone grafting surgery, implantation, and subsequent orthopedic treatment.

The ZB is formed by the union of the zygomatic process of the upper jaw and the maxillary process of the zygomatic bone. It is responsible for maintaining the forces acting on the upper jaw. The quality, density and natural convex shape of ZB compensate for the limited number of bones that can be collected in this region. Furthermore, easy access to the donor site and proximity to the recipient site allows performing only one flap, reducing both operative time and postoperative morbidity [3, 4].

The ZB block can be fixed in direct contact with the recipient site as described in the "overlay technique" or removed from the alveolar ridge as defined in the "shell technique" for retention and contouring [3, 5].

The purpose of this series is to describe five cases of bone extraction from the zygomatic pillar for reconstruction of limited maxillary defects.

Patient selection

This study included five patients who required maxillary implant placement and had inadequate alveolar bone thickness of 2 to 4 mm. To restore thin alveolar ridges prior to implant placement, transplantation procedures using ZB-derived bone blocks were planned (Table 1). All patients signed informed consent before surgery and all work was performed in accordance with the Declaration of Helsinki. Since the study was retrospective, the Ethics Committee of Saint Joseph's University of Beirut IRB granted written approval to conduct the study.

Inclusion criteria were: partial or complete edentulism of the maxilla, insufficiency of the horizontal alveolar ridge and the absence of an accompanying medical history.

Exclusion criteria were as follows: smoking, pregnancy, breastfeeding, systemic diseases and poor oral hygiene.

Surgical technique

After infiltration, a linear cruciform incision was made along the edentulous ridge under local anesthesia and continued with intraosseous incisions around adjacent teeth and two mesial and distal vertical incisions for clearance. Distal vertical release was continued to a horizontal incision in the maxillary vestibule, 3–5 mm above the mucogingival junction. Full-thickness wide trapezoidal flaps were elevated to expose the thin maxillary flaps (2 to 4 mm) and the ZB (Pic. 1).

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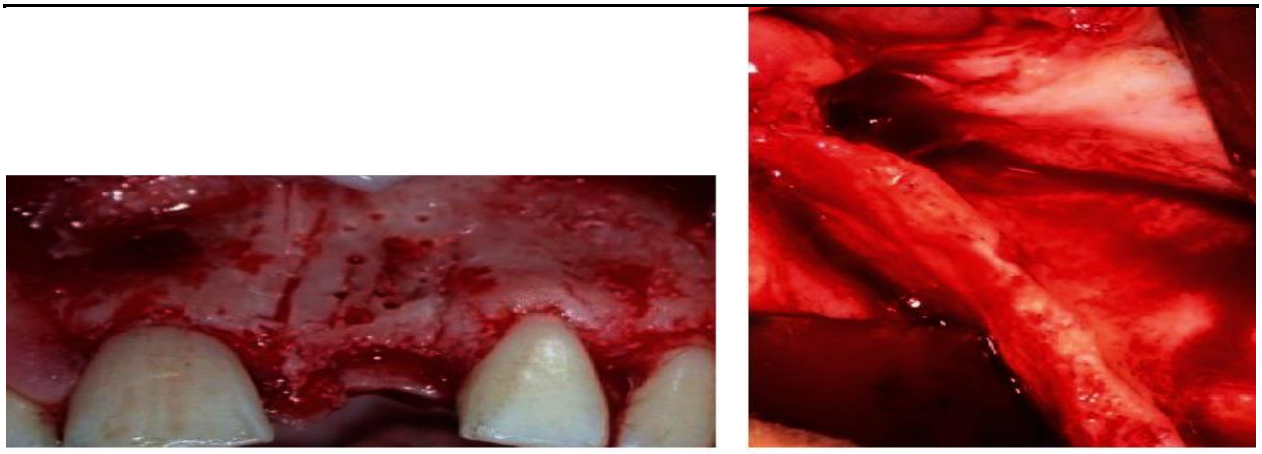
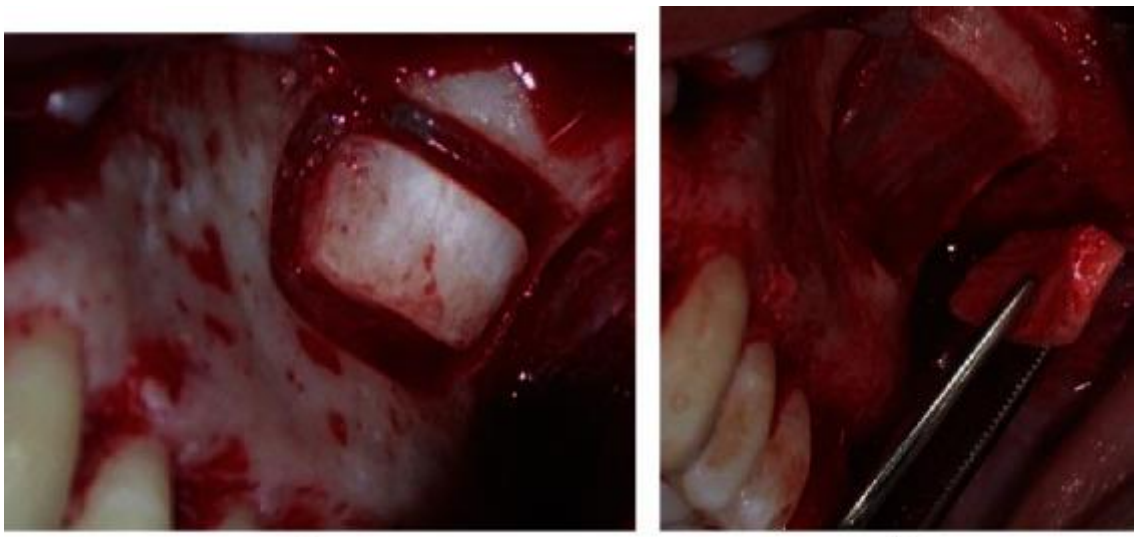


(a) (b)

Picture 1

Preoperative appearance of the defective areas of the recipient maxilla: (a) Case No. 1: Partially edentulous anterior area; (b) Case No. 2: completely edentulous posterior region.

Bone blocks of approximately 1.5 cm2 were extracted from the ipsilateral tail of the ZB using piezosurgery (Mectron®; Carasco-GE, Loreto, Italy) (Pic. 2).



(a) (b)

The “graft overlay technique” was used in 2 cases (Table 1): Thick corticocancellous bone blocks made of ZB were fixed without further shaping in direct contact with the concave alveolar defects using two titanium mini osteosynthesis screws (SmartDrive®; KLS Martin Group). , Tuttlingen, Germany). (Pic.3). Autogenous bone fragments were collected with a bone scraper (Safescraper® Twist; CGM SpA, Divisione Medicale META, Reggio Emilia, Italy) from the outer surface of the cortex of the same area and mixed with inorganic bovine bone particles (Bio-Oss®, Geistlich Pharma AG, Wolhusen, Switzerland). Apply equal amounts to cover the outside surface of the blocks.

In three additional cases, the “shell technique” was used (Table 1): thin cortical bone blocks were removed from the ZB and secured with titanium screws away from the recipient sites (Pic. 4). In one of these cases, a simultaneous elevation of the sinus floor was performed to provide sufficient bone height for subsequent implant placement. In another advanced edentulous case, bone blocks harvested from a bilateral ZB were secured to the right and left recipient sites using the cup/tent

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technique. A 50:50 mixture of bone particles (autogenous + xenogenous) was used to fill the spaces between bone blocks and alveolar ridges.

Discussion

To ensure that there is sufficient bone volume prior to implant placement, bone grafting is usually necessary. Among many bone substitute materials, autogenous bone remains the gold standard for alveolar bone reconstruction. Retromolar and symphyseal intraoral donor sites are indicated for large mandibular reconstructions, while ZB has been described as a relatively new intraoral donor site for small and limited bone augmentations in the maxilla [1, 6].Gellrich et al. stated that 1.5 to 2 cm2 of bone could be removed from this area without compromising the strength of the midface. This amount of bone harvested is sufficient to reconstruct only medium-sized alveolar defects (enough for 1 or 2 implants) [3]. Kainulainen et al. also measured the volume of 40 blocks taken from the ZB of 20 older cadavers. The bone was either drawn into a syringe or placed in a tube to displace water to quantify its volume. On average, a syringe volume of 0.59 ml was used to determine bone volume and 0.53 ml for water displacement. It is important to note that the grafts in this study were obtained from older cadavers with moderately atrophic facial bone [4].

The ZB technique has several advantages. A study of ten patients reported an average horizontal bone gain of 1.82 ± 0.16 mm 4 months after ZB-based bone grafting. These transplanted areas showed similar bone density values to native alveolar bone [7]. This ZB also ensures good bone quality and correct convex morphology in maxillary defects. In several studies, bone removed from the ZB was transplanted without further shaping and was able to successfully restore a pronounced alveolar ridge contour [5].

In this series, in two cases of limited anterior maxillary defects, a zygomatic shaping graft was used, ideally restoring the original convex alveolar contour without the need for additional bone or soft tissue graft. The ZB method has minimal postoperative donor site morbidity because muscle detachment is not required to access the site [3].It was reported that patients transplanted from the ZB experienced minor postoperative difficulties such as pain and swelling, while patients transplanted from the retromolar region experienced more complications, including transient postoperative paresthesias of the mandibular and lingual nerves [1, 5, 8]. In addition, access to the ZB region is relatively easy and provides excellent visibility compared to other intraoral donor sites such as the retromolar region. In addition, the proximity between the donor and recipient sites helps simplify the transplantation steps and shorten the operation time [4].

The main limiting factors of this bone harvest site are its close relationship to the infraorbital foramen and the membrane of the Schneider sinus. Using piezosurgical devices instead of rotary instruments may reduce the risk of membrane perforation. Kainulainen et al. found 33% membrane perforations in 40 surgical sites where round drills were used, while Gellrich et al. found a total of 28% perforations in 273 locations using piezosurgery [4, 5].

However, membrane perforation had no influence on the overall success of this method. In the present series, bone harvesting was performed using a piezoelectric device to minimize the risk of complications. There was no case of membrane perforation.

Another important anatomical point to consider when harvesting bone from the ZB is the infraorbital foramen, where the infraorbital nerve (ION) and artery (IOA) exit the skull. Gellrich et al. suggest direct visualization of the infraorbital region to avoid nerve damage [3]. However, this complication is rare.Sakkas et al. 1.7% of cases of transient infraorbital nerve paresthesia

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during suture removal were reported (2 cases out of 113), and in all cases there was complete recovery at the time of implant placement [8]. In another retrospective study with 273 patients, no cases of nerve injury were found [5]. This is consistent with our series, in which no cases of infraorbital nerve injury were noted. In fact, the flap retractors were positioned away from the surgical site to avoid stretching, compression, or tearing of the IONA and IOA. This minimized the risk of bleeding or paresthesia of the ipsilateral upper lip and/or lower eyelid.

The same precautions were taken when making vertical cuts that could intersect IOA and ION. It is therefore recommended not to widen the vertical incisions and to cut through the periosteum with Metzenbaum scissors before closing the wound without tension.

Complications associated with this procedure may include infection, pus drainage, wound and incision line dehiscence, swelling, and graft mobilization. In a study of complication rates with this technique, Sakkas et al. more postoperative complications at recipient sites (17.6%) than at donor sites (3.5%). In addition, a significantly higher incidence of postoperative complications was found in smokers [8]. In the current report, all patients were nonsmokers and no complications were reported, confirming previous findings. A systematic review assessing complications during bone harvesting from the mandible found high complication rates in the symphysis and ramus [9], while several studies describing bone harvesting from the jaw showed very low complication rates and failures, which did not have a significant impact This method was successful [4, 5, 8]. Therefore, the ZB appears to be a safe place for intraoral collection.

Conclusion:

The zygomatic area offers the opportunity to obtain bone with a natural convex shape, which is ideal for the reconstruction of both the anterior and lateral parts of the alveolar process of the maxilla. With this technique, augmentation is possible both horizontally and vertically. The use of piezosurgical technology minimizes the risk of surgical complications.In addition, this technique is less traumatic, less painful and contractures are excluded. With this technique, patients experience virtually no discomfort in the postoperative period. The use of allogeneic bone material and a collagen membrane prevents early resorption of the autograft. According to our review of domestic literature, no previous publication has considered the zygomatic veolar buttress area as a donor area for limited bone augmentation.

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