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**Review Article**

# BONE GRAFTS USED IN IMPLANT SURGERIES FOR VERTICAL ALVEOLAR AUGMENTATION-A LITERATURE REVIEW

**Vijay Ebenezer***

Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College & Hospital, Bharath University, Pallikaranai, Chennai, 600100

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**ABSTRACT**

Implant directly depends on the bony plateform for its long standing stability and retension. Most of the failures of implant could be due to the bone resorption and soft tissue inflammation caused by the various systemic and local factors. When in case of pathologic bony deficiency in alveolar bone grafts augmentation is necessary to increase alveolar vertical dimension following agents are essential and they are guided bone graft augmentation, on lay block grafting, interposition alveolar bone graft, alveolar distraction osteogenesis, iliac corticocancellous augmentation bone graft, and the sinus bone graft.



## INTRODUCTION

The difficulty in gaining and maintaining alveolar vertical augmentation is well established in the literature, but the various procedures that have been used have been complicated by relapse and resorption.[1-3] Augmentations without the placement of implants generally resorb unless a nonresorbable grafting material such as hydroxylapatite is used.[4-6] Alveolar vertical defects have been classified according to the size of the defect.[7] Deficiencies can range from 1 or 2 mm to more than 20 mm in height. In general monocortical grafts or guided bone graft augmentations are useful for smaller augmentations. Interpositional grafts work well for moderate-sized defects, whereas distraction osteogenesis is reserved for more extensive alveolar defects. Large bone mass deficiencies, where there is not enough bone to distract, require iliac bone graft reconstruction, though a vertical gain of 10 mm is difficult to achieve in these settings. Finally, there is the sinus bone graft, which functions as an "endosteal" expansion of alveolar vertical bone mass.

### *Guided Bone Graft Augmentation*

Vertical bone augmentation of deficient alveolar ridges can be obtained with guided bone regeneration techniques. These techniques allow vertical augmentation of up to 10 mm both in the posterior and anterior maxilla and mandible. A barrier membrane is placed and stabilized with tacks or screws in order to protect an autogenous bone graft usually harvested from the retromolar area in the mandible. The membrane is maintained in the site completely covered by the soft tissues for a period of at least 6 months. The implants can be placed either at the time of bone regeneration or at the membrane removal surgery.

### *Mandibular Block Autografts for Localized Vertical Ridge Augmentation*

Mandibular block autografts have been used extensively for alveolar ridge augmentation with great success and include the symphysis and ramus buccal shelf as donor sites. [8-10] The vertically deficient ridge presents the greatest challenge for reconstruction, and success with these grafts can be achieved with defects of up to 6 mm. The posterior maxilla and mandible are the most common areas of the mouth where this type of deficiency occurs. This section focuses on posterior maxillary and mandibular reconstruction in a staged manner prior to implant placement. Implants are placed in a submerged or nonsubmerged mode after appropriate healing time with the block grafts.

**Corresponding author:* **Vijay Ebenezer**
Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College & Hospital, Bharath University, Pallikaranai, Chennai, 600100

***Symphysial Block Graft Harvest***

The symphysis can provide a range of dense cortical cancellous bone ranging from 4 to 11 mm, in contrast to a typical ramus buccal shelf block graft that is 3 to 4 mm. These grafts can be used for predictable horizontal augmentation of 5 to 7 mm and vertical augmentation of up to and including 6 mm. The incision begins in the sulcus from second bicuspid to second bicuspid. An oblique releasing incision is made at the mesial buccal line angle of these teeth and continues into the depth of the buccal vestibule. A full thickness mucoperiosteal flap is reflected to the inferior border of the mandible. This allows for good visualization of the entire symphysis, including both mental neurovascular bundles. It also provides easy retraction at the inferior border and results in a relatively dry field. Contrast this with the vestibular approach, which results in more limited access, incomplete visualization of the mental neurovascular bundles, and more difficulty in superior and inferior retraction of the flap margins. Also, there is typically bleeding secondary to the mentalis muscle incision resulting in the need for hemostasis. Finally, wound dehiscence from the sulcular approach is rare. The vestibular incision can result in wound dehiscence and scar band formation.

***Ramus Buccal Shelf Block Graft Harvest***

There are three complete osteotomies and one bone groove that need to be prepared prior to graft harvest. A superior osteotomy is created with a 702L fissure bur in a straight handpiece. It begins opposite the mandibular second molar and continues posteriorly to the ascending ramus approximately 4 to 5 mm medial to the external oblique ridge. The length of this osteotomy depends on the graft size. The anterior extent of this bone cut can approach the distal aspect of the first inferior groove and should be carefully harvested so as to avoid injury to the inferior alveolar neurovascular bundle. The sharp ledge that is created at the superior extent of the ascending ramus is then smoothed with a large round fissure bur.

***Interpositional Bone Graft***

The interpositional bone graft is placed between a mobilized segmental osteotomy and the basal bone. A typical vertical gain is 4 or 5 mm in the maxilla but 5 to 10 mm in the mandible. The indication for the procedure is an alveolar defect where there is insufficient vertical height for placement of implants such as in the anterior maxilla or in the posterior mandible when a stable vertical augmentation is required, usually over a three- or four-tooth segment.

***Iliac Corticocancellous Grafting***

When the jaw is too deficient to do monocortical grafting or osteotomies, bone graft augmentation with iliac corticocancellous graft is needed. Major grafting is usually required when bone mass needs to be expanded in order to gain enough bone for osseointegration. A 5 mm maxillary advancement with a Le Fort I osteotomy fixated with resorbable bone plates was done. The anterior reconstruction relied on onlay corticocancellous block graft supported by particulate marrow. Graft preservation strategies such as barrier membrane and titanium mesh may be helpful, but in this case cortical grafts were placed laterally which minimizes the need for a barrier membrane.

## DISCUSSION

The period for consolidation of the bone graft varies with the grafting material used. Allogeneic bone actually slows down the consolidation process. The use of combination grafts including bovine xenograft, algipore, or various other alloplasts all form bone adequatefor osseointegration.[11]Though bone quality varies considerably as shown by human trephine biopsy results of the various grafting materials, the capabilities of the sinus graft to gain enough bone to form load-bearing osseointegration are remarkable. The 5-year failure rate of implants by almost any grafting technique is less than 20%.Though grafting material must be osseoconductive, inductivity is not required in order for bone to form. The sinus floor grows bone with blood clot alone. Whatever the technique, bone migrates “endosteally” up the side of the implant. If only a few millimeters of migration occur, in addition to the residual bone, there is often enough gain to form and maintain osseointegration. Therefore, the principal success of the sinus grafting is not one of implant macro- or microarchitecture or even the type of graft material, be it alloplast, allograft, or autograft, but the intrinsic bone-forming capacity of the sinus floor itself and to a lesser degree the investing sinus membrane[12] In cases of severe atrophy the surgeon must make every effort to use the best available technique and bone graft material possible in a highly compromised site. This setting argues for the use of particulate bone marrow harvested from the tibia or ilium and possibly adjuncts such as platelet-rich plasma.

## CONCLUSION

The difficulty of treating alveolar vertical defects requires the surgeon to be skilled in all of the above modalities. In skilled hands, various approaches can be used in treating the same type of defect. In most cases defect sites are not strictly vertically deficient. Skill in alveolar width augmentation, or combined treatment, is needed as well. With all of these measures, the ultimate restorative goal is to obtain orthoalveolar form, a concept that now encompasses a broad array of surgical innovation.

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