

## Vertical bone augmentation using bone cores from the mandibular symphysis area. Cases report

Veis Alexander\*, Katzouraki Dimitra, Barlas Irodis, Dabarakis Nickos.

Resorption of alveolar bone in the esthetic zone presents a challenge for the reconstructive dentistry. Inadequate bone volume for implant placement is usually observed following extraction of hopeless lower incisors due to periodontal, endodontal reasons or root cracks. In such cases vertical bone augmentation prior to implant placement should be considered. Although xenografts, alloplastic bone grafts, and allografts have been proposed for alveolar ridge augmentation, the use of a material with osteogenic and osseoinductive properties such as the autogenous bone still remains the gold standard for vertical bone augmentation procedures. This study presents two clinical cases that they were treated using a staged approach i.e. vertical bone augmentation and secondly implant placement in lower incisor region, using onlay bone grafts harvested from the proximal mandibular symphysis area. Collagen membranes were placed to cover the block graft in an effort to reduce the potential graft resorption. The initial achieved vertical height was 7.2 mm (case 1) and 6.85 mm (case 2) during graft placement and the final vertical bone gain 12 months post-restoration was 4.6mm and 6.2mm respectively. Although there are no similar studies using the same technique for direct comparison of graft resorption, our findings are in accordance with previous studies where block type autografts were used for vertical augmentation.

(J Osteol Biomat 2012; 2:83-89)

**Key Words:** vertical bone augmentation, autogenous bone grafts, block type grafts.

Department of Surgical Implantology & Roentgenology,  
Aristotle University of Thessaloniki, Greece

Correspondence to:

\* Veis Alexander, 5 Theochari Str., 54621 Thessaloniki, Greece  
tel. +302310269079, fax +302310269079, e-mail: aveis@dent.auth.gr

### INTRODUCTION

Resorption of alveolar bone in the esthetic zone presents a challenge for the reconstructive dentistry. It may compromise implant placement and jeopardize the aesthetic outcome. Both vertical bone augmentation and soft tissues enhancement at the defected site are usually necessary. A variety of different techniques employ usage of membranes and particulate bone grafts, distraction osteogenesis, and bone block grafting either alone or in combination with a membrane.<sup>1</sup> The proper time for implant placement, immediate post-extraction implant placement should be considered not only if implant stability can be achieved but in regards to the subsequent esthetically favourable outcome as well. The possibility of the implant's threads exposure following GBR techniques in conjunction with immediate implant placement was higher due to marginal bone/graft resorption and/or complications such as membrane exposure, during healing.<sup>2</sup> A staged approach is usually the therapy of choice in patients lacking adequate bone volume. Inadequate bone volume in lost or lower incisor region presents a site where the defect is confined by remaining bone partially or not at all. Vertical

bone augmentation prior to implant placement should be considered. Although xenografts, alloplastic bone grafts, and allografts have been proposed for alveolar ridge augmentation, the use of a material with osteogenic and osseoinductive properties such as the autogenous bone still remains the gold standard for vertical bone augmentation procedures in such cases. The proximity of the defected area dictates the mandibular symphysis region to serve as donor site. This choice reduces patient's morbidity since the whole surgery negotiates with one surgical site. The quality of the graft has been documented in several studies indicating that intraorally harvested intramembraneous bone grafts from the mandibular symphysis demonstrate less resorption, enhanced revascularization and better incorporation at the recipient site as compared with the extraorally harvested endochondral bone grafts.<sup>3</sup>

The purpose of this study was to present two clinical cases of vertical bone augmentation in lower incisor region, using bone cores harvested from the proximal mandibular symphysis area and used as onlay bone grafts. Dental implants were placed following the maturation of the grafted area.

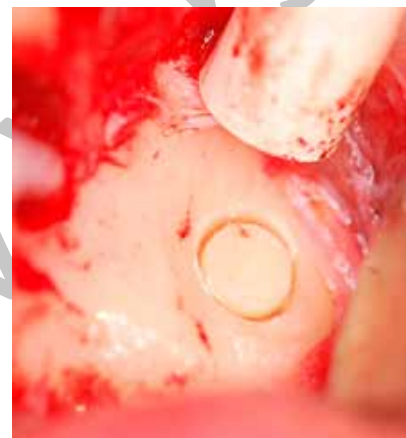
#### Case 1

A 38 years old woman exhibited bone loss due to root resorption and subsequent inflammation around the endodontic post of tooth # 31 (Figure 1). Medical history was clean without any limitation for bone regeneration and/or implant osseointegration procedures. The therapy plan included extraction of the hopeless tooth, au-

tologous bone grafting and in second stage implant placement. Following local anesthesia a midcrestal incision was designed continuing into the gingival sulcus. A full thickness flap was elevated with vertical vestibular releasing incisions distally of the proximal incisors that were advanced up to 10 mm beyond the apexes (Figure 1). After exposure of the mandibular frontal ridge, a 5mm trephine burr was aligned 5 mm below the apexes of the proximal incisors vertically to vestibular bone. Using copious irrigation the trephine was rotated with 600 rpm, inserted 10mm in depth (Figure 2) and removed leaving a round osteotomy confining the margins the bone core. The bone core was then carefully released, removed from the donor site and a hole was created axially in the centre of the core using a lag bur to allow a free passing of the retention screw (Figure 3). Additional particulate bone chips were harvested from the bottom of the donor site and kept together with the bone core in a sterile metallic dispenser. The recipient site was carefully adjusted through flattening of its bottom and the bone core was fixed firmly in place using a 1.2 mm in diameter and 10 mm in length fixation screw (Figure 4). A collagen resorbable membrane (Osseoquest Biomet 3i, Palm Beach Gardens, FL) was then placed beneath the reflected lingual flap and any dehiscence around the fixed bone core was filled with the particulate autologous bone graft (Figure 5). The osteotomy at the donor site was filled with surgical wax in order to control bleeding and enhance healing. The augmented area plus 3-4 mm of healthy surrounding bone were covered by the membrane. Periosteal re-



**Figures 1.** Initial radiographic view (taken from the panoramic x-ray) of the hopeless lower incisor #31 and the remaining osseous defect after extraction of the tooth.



**Figures. 2.** It is shown the use of a 5mm trephine burr to cut and retrieve a bone core from the mandibular symphysis area.

leasing incisions were made to allow a tension-free closure of the flaps over the membrane using a combination of mattress and interrupted sutures with Prolene (Johnson & Johnson) (Figure 6). Antibiotics (Amoxicilin 500 mg, Glaxo Smithkline AEBE) was prescribed for the following 8 days. Nimesulide 100 mg twice daily, was used for pain control (Boehringer Ingelheim AE). The patient was instructed to use 0.2 % chlorhexidine mouthwash twice daily for the first 3 weeks and ice packs were suggested to be used for 5h after surgery. The healing of the surgical area



**Figure 3.** Retrieved bone core together with particulate bone taken from the donor site



**Figure 4.** The bone core was stabilized in place at the base of the osseous defect.



**Figure 5.** Particulate autogenous bone graft was used to fill ant empty space around the bone core.

was uneventful and the sutures were removed 8 days after surgery. The patient was scheduled for recall visits every 3 weeks after suture removal to ensure adequate tissue healing.

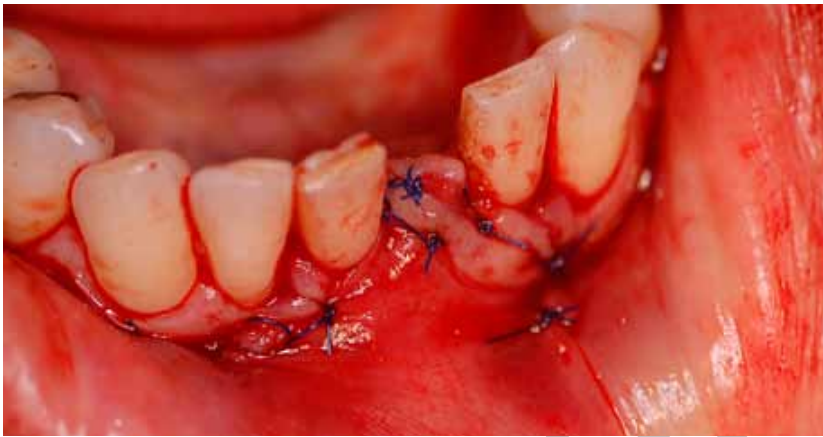
Graft incorporation, maturation and relative resorption can be seen in periapical digital x-rays in Figures. 7a (graft placement), and 7b after 6 months from surgery when the patient was scheduled for implant placement. Vertical bone height and relative graft resorption were measured according to a reference length of the retention screw. After six months of graft healing the vertical graft resorption was 2.2 mm (7.2 mm-5 mm, Figures. 7a and 7b). Due to 2.2 mm of resorption the head of the retention screw was protruding beneath the mucosa (Figure 8). The patient received the same as previously medication and the surgical site was reopened by means of a crestal and two vertical releasing incisions at the proximal natural incisors (Figure 9) and the retention screw was removed (Figure 10). An occlusal view

of the surgical area can be seen in Figure 11 where a relative resorption in a bucco-lingual direction was obvious after meticulous removal of soft tissues remnants leaving a 4 mm width of healthy augmented new bone. Following debridement, a 3.25 to 13 mm screw type dental implant (micro-mini Biomet 3i, Palm Beach Gardens, FL) was installed (Figure 12) with a 3 mm healing abutment in place according to a single phase surgical protocol. A digital periapical x-ray was taken after implant placement where the remaining 5mm of graft height can be seen in Figure 13. The restoration took place after 4 months of healing period. After 12 months post-restoration a clinical photo (Figure 14) and an x-ray were taken. The implant was used as a reference length to measure the final graft restoration. 0.4 mm of graft resorption was measured from the time of implant installation (remaining graft height=4.6 mm, Figure 15). The total vertical resorption from the graft placement was 2.6mm (7.2mm-4.6mm=2.6mm).

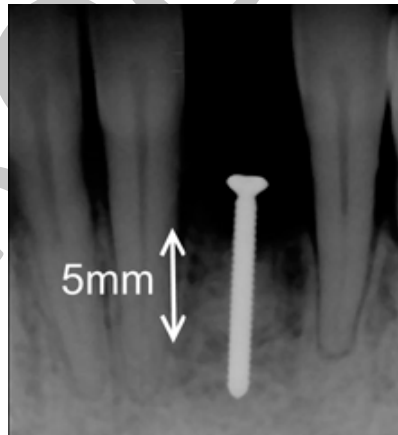
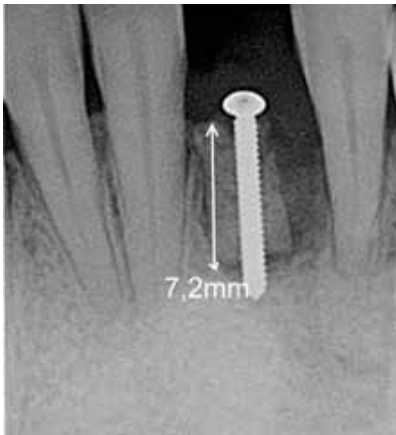
#### Case 2

A 28 years old woman with clean medical history came to our office complaining for swelling at the buccal area in front of tooth #31. The x-ray revealed extensive resorption around tooth #31, (Figure 16), and according to the dental history the resorption was due to traumatic pulp necrosis resulting to an endo-perio lesion. The tooth was extracted immediately, the extraction socket was cleaned and left for healing according to first intention for 6 weeks. Following the post-extraction healing period, vertical bone augmentation at the defected site was performed a bone core taken from the proximal chin area and as described in the previous case. The bone core was fixed at the bottom of the defect by means of a retention screw and all the empty spaces were filled with autologous particulate bone as it seems in the x-ray (Figure 17), immediately after installation. As in the previous case a collagen resorbable membrane (Osseoquest Biomet 3i, Palm Beach Gardens, FL) was used





**Figure 6.** A collagen membrane was used to cover the augmentation material and subsequent suture of the tension free flap.

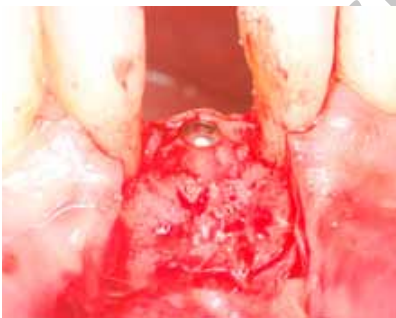


**Figures 7a.,7b.** Periapical digital x-rays show the graft during placement (7,2mm in height) and after six months of healing (5mm in height).

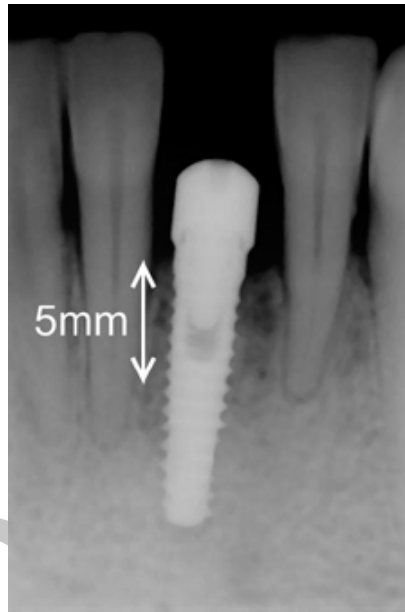
to cover the augmentation area. The maturation of the graft can be seen in radiographs (Figures 18 and 19) after 3 and 6 months respectively and the vertical graft resorption was measured 0.35mm (6.85mm-6.5mm). During implant placement surgery, the graft retention screw was removed (Figure 20) and as in previous case an implant (3.25 to 13 mm screw type micro-mini implant Biomed 3i) was placed according to a single phase protocol. Figure 21a and 21b show the x-rays of the implant at the installation day and 12 months



**Figure 8.** Clinical view of the augmented area after six months. The head of the retention screw is protruding beneath the mucosa.



**Figures 9, 10, 11.** Clinical view of the augmented area after flap reflection, removal of the retention screw and coronal view of the augmented area.



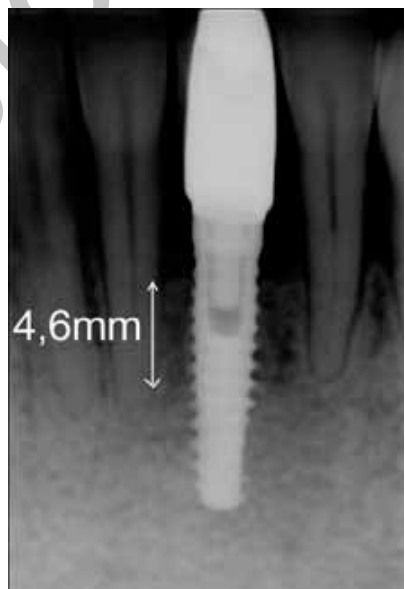
**Figures 12, 13.** Implant placement following a one phase protocol and a post-installation periapical x-ray.

after the restoration revealing a vertical bone resorption 0.3mm (6.5mm-6.2mm). The total graft resorption from the time of graft placement up to the 12 months post-restoration recall was 0.65mm (6.85 mm-6.2 mm).

**Discussion**

Prosthetic rehabilitation with dental implants in aesthetic area in field of severe osseous defects is still a challenge in implant dentistry. In such cases technique sensitive bone augmenta-

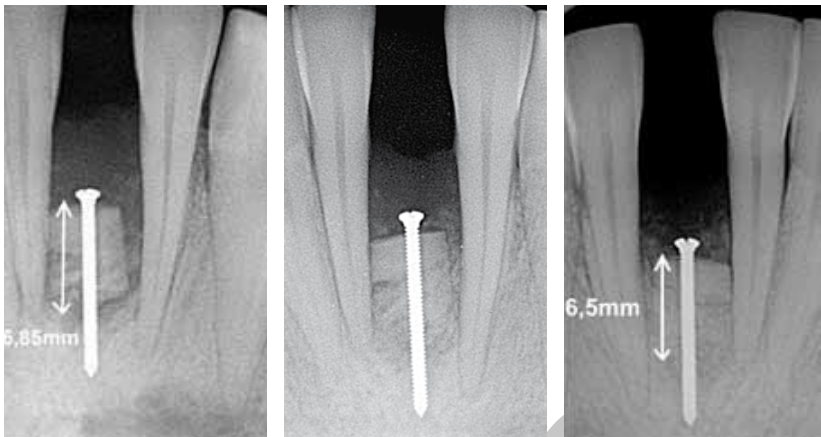
tion procedures in horizontal and vertical directions are routinely needed and the treatment philosophy should include a two stage surgery i.e. first the lost bone reconstruction and in a second stage the implant placement.<sup>4</sup> Especially for the rehabilitation in the lower incisors area there are certain local parameters that may compromise the overall result. The inherent buccolingual thin ridge results in fast bone resorption following periodontal tooth extraction and lack of lingual and/or buccal cortical plates.<sup>5</sup> Such defects are not sufficiently confined by bone except and the osteogenetic sources at the recipient site are the bottom of the defect and perhaps any remaining bony walls around the mesial and distal proximal teeth. Moreover, the biotype of the mucosa at the lower incisor region is usually thin and scalloped leading to the need of complicate flap manipulation including mobilization and/or enhancement using connective soft tissue grafts.<sup>6</sup> Dehiscences and mem-



**Figures 14,15.** Clinical and radiographic views 12 months post-restoration. A total 4.6mm vertical augmentation outcome can be seen in fig. 21.



**Figure 16.** Extensive bone resorption can be seen in the initial x-ray around the incisor #31.



**Figures 17,18,19.** X-rays during graft placement and 3 and 6 months of healing. The initial vertical bone gain was 6.85mm reduced to 6.5mm after 6 months of healing.

brane/graft exposure present usual complications during vertical bone grafting procedures.<sup>7</sup> In the previous cases collagen membranes were placed to cover the block graft in an effort to reduce the potential graft resorption. The initial vertical height was 7.2 mm (case 1) and 6.85

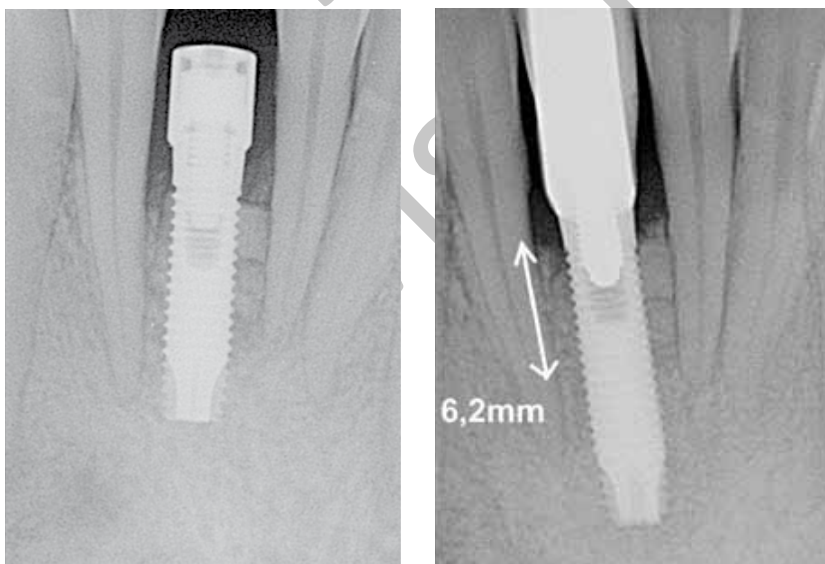
mm (case 2) during graft placement and the final vertical bone gain was 4.6 mm and 6.2 mm during the 12 months recall respectively. The relative vertical resorption was 2.6mm and 0.6mm respectively. Although there are no similar studies using the same technique for direct comparison of graft



**Figures 20.** Clinical views of the retention screw removal and the implant installation after 6 months of graft healing.

resorption, our findings are in accordance with previous studies where block type autografts were used for vertical augmentation. Cordaro et al<sup>8</sup> found a height reduction from 3.2 mm to 2.1 mm (i.e. 34%) when chin grafts that were placed in maxilla. Lower resorption was found by Proussaefs et al.<sup>9</sup> (from 6.12 mm to 5.12 mm, 16.3%) using ramus grafts. Similarly, Chiapasco et al.<sup>10</sup>, published mean 0.6 mm resorption of ramus graft before implant placement being in agreement with the vertical graft resorption found in case 2.

The final vertical bone gain was different in the presented cases due to higher resorption rate found in case 1. It should be mentioned that the major amount of resorption was calculated during graft healing period (2.2mm) while it was and significantly lower from implant installation up to 12 months post-restoration (0.4mm). Although the technique that was use in both cases was quite similar followed by uneventful healing, variations in topography of the recipient site, the



**Figure 21a, 21b.** X-rays during implant installation and up to 12 months post-restoration. The total vertical bone gain was 6.2mm as it seems in fig. 27b.



biotype of the mucosa and/or the patient's care may influence the overall regeneration outcome. Moreover, the implants achieved successful endosseous integration since as it was stated the failure rates are comparable to those observed in native bone.<sup>5</sup>

#### Conclusions

Vertical bone augmentation in lower incisors region, although presents a technique sensitive procedure, can be successful when a staged approach is used. Autogenous bone cores harvested from the proximal mandibular symphysis area present an excellent bone graft that provides osteogenic and osteoinductive capabilities. Resorbable membranes can be used to minimize the potential graft resorption. Dental implants can be successfully placed in a second stage following the graft maturation.

#### Acknowledgements

The authors declare that they have no financial relationship with any commercial firm that may pose a conflict of interest for this study.

#### REFERENCES

1. McAllister BS, Haghghat K. Bone augmentation techniques. *J Periodontol* 2007;78(3):377-96.
2. Becker W, Dahlin C, Becker BE, Lekholm U, van Steenberghe D, Higuchi K, Kultje C. The use of e-PTFE barrier membranes for bone promotion around titanium implants placed into extraction sockets: a prospective multicenter study. *Int J Oral Maxillofac Implants* 1994;9(1):31-40.
3. Proussaefs P, Lozada J. The use of intraorally harvested autogenous block grafts for vertical alveolar ridge augmentation: a human study. *Int J Periodontics Restorative Dent* 2005;25(4):351-63.
4. Artzi Z, Nemcovsky CE, Tal H, Weinberg E, Weinreb M, Prasad H, Rohrer MD, Kozlovsky A. Simultaneous versus two-stage implant placement and guided bone regeneration in the canine: histomorphometry at 8 and 16 months. *J Clin Periodontol* 2010;37(11):1029-38.
5. Bernstein S, Cooke J, Fotek P, Wang HL. Vertical bone augmentation: where are we now? *Implant Dent* 2006;15(3):219-28.
6. Cosyn J, De Bruyn H, Cleymaet R. Soft Tissue Preservation and Pink Aesthetics around Single Immediate Implant Restorations: A 1-Year Prospective Study. *Clin Implant Dent Relat Res* 2012 [Epub ahead of print]
7. Triaca A, Minoretti R, Merli M, Merz B. Periosteoplasty for soft tissue closure and augmentation in preprosthetic surgery: a surgical report. *Int J Oral Maxillofac Implants* 2001;16(6):851-6.
8. Cordaro L, Torsello F, Accorsi Ribeiro C, Liberatore M, Mirisola di Torresanto V. Inlay-onlay grafting for three-dimensional reconstruction of the posterior atrophic maxilla with mandibular bone. *Int J Oral Maxillofac Surg* 2010;39(4):350-7.
9. Proussaefs P, Lozada J, Kleinman A, Rohrer MD. The use of ramus autogenous block grafts for vertical alveolar ridge augmentation and implant placement: a pilot study. *Int J Oral Maxillofac Implants* 2002;17(2):238-48.
10. Chiapasco M, Zaniboni M, Rimondini L. Autogenous onlay bone grafts vs. alveolar distraction osteogenesis for the correction of vertically deficient edentulous ridges: a 2-4-year prospective study on humans. *Clin Oral Implants Res* 2007;18(4):432-40.