Localized Vertical Maxillary Ridge Augmentation Using Symphyseal Bone Cores: A Technique and Case Report

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Vertical augmentation of the alveolar ridge is intended to restore resorbed alveolar ridges. This procedure is important for the placement of dental implants in a favorable position and also to enhance restoration esthetics. This article presents an approach for vertical ridge augmentation in the anterior maxilla utilizing symphyseal bone cores. A patient presented with 2 localized bony defects around the maxillary lateral incisors. Following extraction of these teeth, vertical bone defects of 7 mm on the right and 6 mm on the left were observed in relation to the cementoenamel junction of the adjacent teeth. Two bone cores were harvested from the mandibular symphysis using a trephine. These bone cores were tapped into 2 predrilled osteotomy sites with corresponding diameters until stabilization was achieved. The 2 sites were grafted with demineralized freeze-dried bone allograft and a titanium-reinforced expanded polytetrafluoroethylene membrane. After 5 months, the membranes were removed and vertical ridge augmentation of 5 mm on the right and 4 mm on the left was observed. The width of the ridge was increased as well. Two implants were placed in favorable positions, restored after 6 months, and followed successfully for 1 year after loading. This technique represents a viable approach for augmentation of deficient alveolar ridges prior to the placement of dental implants. (INT J ORAL MAXILLOFAC IMPLANTS 2003;18:293–298)

Key words: *alveolar ridge augmentation, bone cores, dental implants, mandibular symphysis*

The successful placement and restoration of dental implants is dependent on the presence of adequate bone dimensions and quality at the edentulous site. Alveolar bone loss can result from tooth extraction, infection, trauma, and pathology and can prevent implant placement in favorable positions and angulations. Furthermore, the alveolar ridge morphology directly affects the soft tissue appearance, which is important for the esthetics of the definitive restoration.[1,2] These considerations are particularly important in the anterior maxilla, an area that presents an esthetic challenge to the surgeon and restorative dentist and exhibits anatomic limitations such as facial bony undercuts and proximity of the nasal cavity and incisive canal.

Alveolar ridge loss can be classified according to Seibert and Cohen as horizontal, vertical, or a combination of vertical and horizontal bone loss.[3] The pattern and dimensions of bone loss also provide some information regarding the prognosis of surgical repair.

Horizontal bone loss is usually the most amenable to surgical augmentation, while a combination of horizontal and vertical bone loss offers the lowest predictability for surgical correction. Ridge dimensions affect implant length and width. However, the position of the alveolar crest in relation to the occlusal plane is also extremely important for successful results, because large discrepancies (vertical and horizontal) between the alveolar crest and the occlusal plane will result in unfavorable crown-to-root ratio and excessive loading forces on the implants.

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Vertical ridge augmentation to correct large defects can be achieved by means of onlay bone grafts. These grafts are harvested from extraoral sites such as the iliac crest and are often used to correct large ridge defects.[4,5] The harvesting of autogenous bone from extraoral sites is often associated with complications and morbidity of the donor site and may require hospitalization. Documented successful cases of vertical ridge augmentation utilizing distraction osteogenesis have been published, although longitudinal controlled studies are not available.[6,7] Conversely, vertical ridge augmentation involving smaller defects can be accomplished by autogenous bone harvested from intraoral sites and by guided tissue regeneration with or without the use of grafting materials.[8]

Successful vertical ridge augmentation in humans was reported by Simion and coworkers.[9] The study included 5 partially edentulous patients. Implants protruded 4 to 7 mm above the original bone level, and the exposed threads were covered with titanium-reinforced expanded polytetrafluoroethylene (e-PTFE) membranes. No grafting material was used. In that report, vertical ridge augmentation was successful up to 4 mm. Successful results have also been observed when grafting material such as autogenous bone and allogeneic bone (demineralized freeze-dried bone allograft [DFDBA]) has been placed.[10]

In another study, placement of autogenous bone graft under the membrane resulted in an average of 4.95 mm of vertical bone gain, although one of the treated cases demonstrated vertical bone gain of 7 mm.[11] These results were supported by a retrospective evaluation of 48 consecutively placed implants.[12] More recently, favorable results were observed in a retrospective study that evaluated 123 Brånemark System implants (Nobel Biocare, Göteborg, Sweden) placed at the time of vertical ridge augmentation and followed for a time period of up to 5 years. The authors concluded that the regenerated bone reacted to implant placement similarly to non-grafted bone.[13]

The purpose of the present case report was to present a surgical technique of vertical ridge augmentation in the anterior maxilla utilizing bone cores harvested from the mandibular symphysis.

CASE REPORT

A 42-year-old, systemically healthy female patient presented with pain and mobility of the maxillary lateral incisors. The examination revealed gingival recession, mobility, and probing depths of up to 8 mm around these teeth (Fig 1a). Advanced bone loss around these teeth was detected radiographically (Figs 1b and 1c). The teeth were treatment-planned for extraction. The patient objected to a definitive removable partial denture and to preparation of adjacent teeth as abutments for a fixed partial denture. Therefore, implant-supported crowns were the preferred treatment plan.

The maxillary lateral incisors were extracted and an interim partial denture was fabricated. Following the extractions, a combination of vertical and horizontal ridge deficiency was observed at the 2 extraction sites. Based on clinical and radiographic evaluations, 10 mm of vertical bone was present at the extraction sites; however, the alveolar crest was located approximately 7 mm apical to the cementoenamel junction (CEJ) of the adjacent teeth. Placement of implants so apically in relation to adjacent teeth would have resulted in an extremely unfavorable crown-to-root ratio and would also lead to an unesthetic restoration. Therefore, it was decided to augment the bilateral ridge defects using mandibular symphyseal bone cores.

The procedure was performed under local anesthesia (lidocaine 2% with adrenaline 1:100,000). A full-thickness flap with vertical releasing incisions was reflected and the bony defects were evaluated. Vertical bone defects of 7 mm on the right and 6 mm on the left were observed in relation to the CEJ of adjacent teeth. In addition, horizontal ridge deficiency was evident as well. After the bony defects were evaluated and measured, the symphysis was exposed by an incision in the alveolar mucosa, 3 to 4 mm beyond the mucogingival junction between the mandibular premolar teeth. A trephine bur with an internal diameter of 4.5 mm and external diameter of 5.5 mm was used to remove 2 bone cores, each 8 mm in length (Fig 2). The osteotomy was performed at least 5 mm apically to the mandibular incisors under copious irrigation. A 4.3-mm twist drill was used to create an osteotomy in the recipient sites to a depth of 3 mm (Fig 3a). The bone cores were then tapped into the osteotomy created by the twist drill so as to add height to the ridge and achieve stabilization (Fig 3b).

DFDBA was placed to increase the width of the ridge, and a titanium-reinforced e-PTFE membrane was placed over the 2 sites. Primary closure of the soft tissue was achieved. The symphysis was closed in layers using resorbable and silk sutures. Amoxicillin 500 mg 3 times a day for 7 days and chlorhexidine mouthwash were prescribed. Care was taken to prevent any pressure by the interim partial denture on the augmented sites. The postoperative course was uneventful.

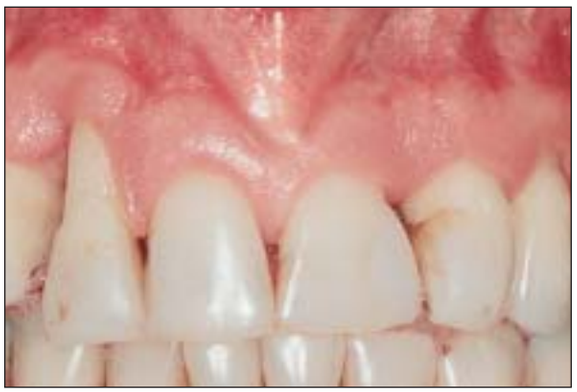
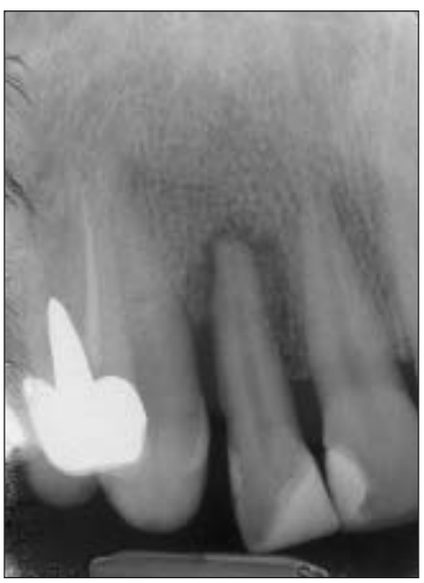
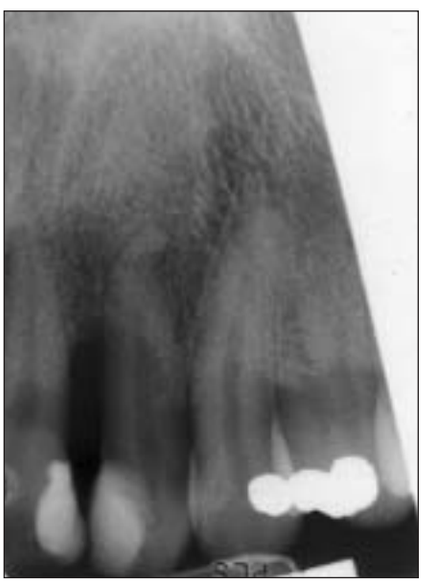


Fig 1a *(Right)* The patient at the time of initial clinical examination.

Fig 1b *(Below left)* Periapical radiograph of the maxillary right lateral incisor. Notice the severe bone loss.

Fig 1c *(Below right)* Periapical radiograph of the maxillary left lateral incisor showing severe bone loss.





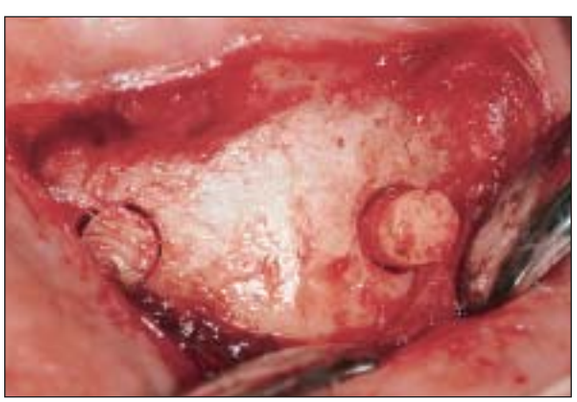


Fig 2 Exposure of the symphysis and harvesting of the corticocancellous bone cores.

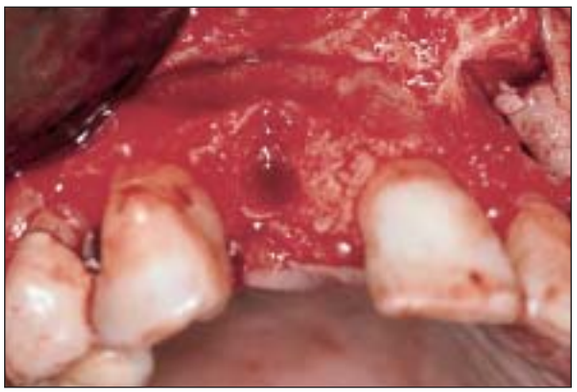


Fig 3a Preparation of the osteotomy utilizing a 4.3-mm twist drill.

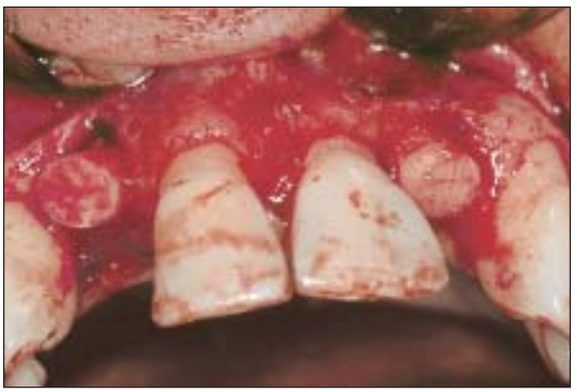


Fig 3b The 2 bone cores were tapped into the prepared osteotomy site until stabilization was achieved.

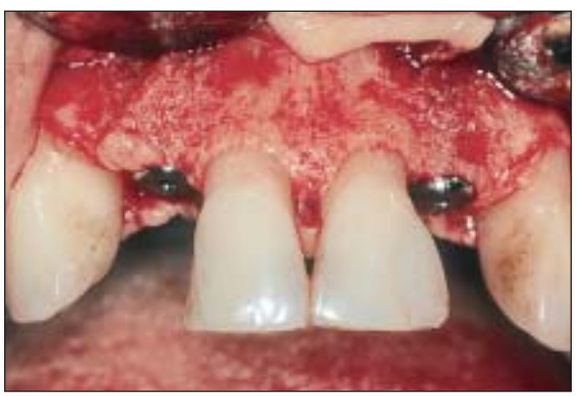


Fig 4 Grafted sites immediately after membrane removal and implant placement. Notice the restored vertical dimensions of the alveolar ridge and the favorable position of the implants in relation to the CEJ of the adjacent teeth.

Following 5 months of healing, the augmented maxillary sites were exposed in similar fashion to the first surgical procedure. The membranes were removed and the augmented sites were measured. Ridge width was 6 mm bilaterally. Vertically, the alveolar crest was located 2 mm apical to the CEJ of adjacent teeth; thus a vertical augmentation of 5 mm on the right and 4 mm on the left was achieved. The sites were prepared to accommodate placement of 2 implants. The 3.75×13-mm implants (Nobel Biocare USA, Yorba Linda, CA) were placed in favorable positions and angulations and were secured at 40 N/cm (Fig 4). Following a healing period of 6 months, the implants were uncovered and successfully restored. After restoration, the implants were followed for a period of 1 year without any problems or complications (Figs 5a to 5c).

DISCUSSION

The surgical correction of vertical alveolar ridge defects can be performed prior to or simultaneously with implant placement. The advantages of the 1-stage approach, in addition to the lower number of surgical procedures required and reduced overall healing time, is that the implants provide stabilization to the bone graft material that is placed (or the blood clot when no grafting material is used). Furthermore, they support and provide a tenting effect to the membrane that is utilized to exclude the non-osseous tissue from the grafted site. Generally, the 1-stage approach has proven to be predictable and effective.[10] Placement of autogenous bone graft under the membrane has produced better results than placement of allograft or no graft at all.[9–11] When membranes were placed with allograft (DFDBA) or blood clot only, vertical ridge regeneration of more than 5 mm was never achieved. Conversely, when membranes were placed with autogenous bone chips, regeneration of up to 8 mm was reported.[10]

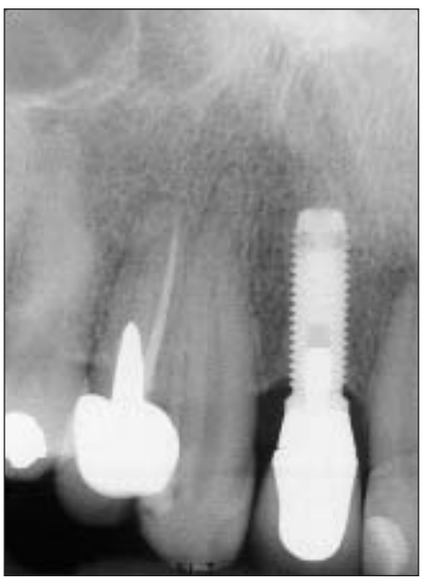
A distinctive disadvantage of the 1-stage approach is that failure of the grafting procedure may lead to concomitant implant failure. Furthermore, graft failure may result in an implant that is osseointegrated in its apical part but not supported by bone in its coronal part. This, in turn, may lead to unfavorable loading forces on the implant and to compromised esthetics. Vertical ridge augmentation can also be used to correct bone loss around previously placed implants; however, the predictability and long-term efficacy of this procedure are yet to be determined.[14]

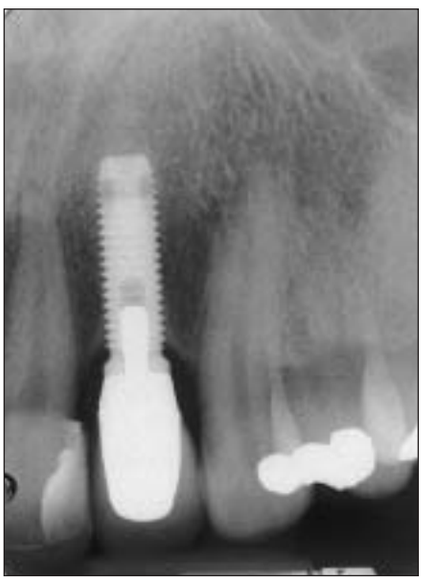
In the case presented herein, implants were placed utilizing the 2-stage approach after the vertical ridge

Fig 5a *(Right)* Definitive restoration 1 year after loading.

Fig 5b *(Below left)* Periapical radiograph taken after 1 year of loading of the implant placed in the site of the extracted maxillary right lateral incisor.

Fig 5c *(Below right)* Periapical radiograph taken after 1 year of loading of the implant placed in the site of the extracted maxillary left lateral incisor.





augmentation was found to be successful. The grafting procedure was performed in the anterior maxilla, which is an area that presents esthetic challenges. The 1-stage approach was not used in this case, since complete or partial failure of the graft could have resulted in soft tissue recession around the implant and compromised esthetics. In addition, the vertical ridge deficiency was 7 mm, which is at the upper range of success for vertical ridge augmentation. Therefore, placement of the implants after graft maturation was, in this case, more predictable.

The symphysis was selected as the donor site because it provided excellent bone quantity and quality in comparison to other intraoral donor sites. In addition, the bone could be harvested in the form of bone cores, which facilitated stabilization in the recipient sites. The surgical approach to the symphysis is relatively simple, but certainly not without risks. Incision dehiscence, chin ptosis, loss of mentalis muscle support, loss of vitality of the mandibular anterior teeth, damage to the roots of the mandibular anterior teeth, and mental nerve injury are documented complications to this approach.[15–17] Careful preoperative evaluation and meticulous surgical technique are paramount for a successful outcome.

Stabilization of the bone cores and prevention of any pressure from the temporary restoration are extremely important, as graft mobility can result in nonunion and pressure may result in graft resorption. Tension-free primary closure of the recipient site is also crucial for successful outcome. Premature membrane exposure was found to be associated with diminished success.[12] In most reports, titanium-reinforced e-PTFE membranes have been used; however, resorbable membrane can be utilized as well.[18]

CONCLUSION

Vertical ridge augmentation can be achieved using symphyseal bone cores. The symphysis is an excellent source of autogenous bone of good quantity and quality in comparison to other intraoral donor sites. The bone cores can be stabilized by tapping into the recipient site and thus add height to the ridge and provide a tenting effect to the membrane used. Utilizing this approach, implant placement was performed after a healing time of approximately 5 months. Vertical ridge augmentation of up to 5 mm could be achieved based on the results of the case presented herein.

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