

# Use of Horizontal Alveolar Distraction Osteogenesis for Implant Placement in a Narrow Alveolar Ridge: A Case Report

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*Although alveolar distraction is a promising method for ridge augmentation involving the atrophic maxilla or mandible for implant placement, techniques of horizontal and oblique alveolar distraction for expanding a narrow alveolar ridge have not been established. A case of horizontal alveolar distraction for implant placement using a titanium mesh plate and a distraction screw is reported. Horizontal alveolar distraction was performed on a patient with an extremely atrophic alveolar ridge in the anterior mandibular region. Two transport segments using horizontal osteotomies were prepared, and 2 horizontal alveolar distraction devices were inserted. After a 7-day waiting period, the devices were activated and alveolar widening was performed labially (0.225 mm twice a day for 14 consecutive days). Three months after consolidation, the distraction devices were removed. The distracted areas were completely filled with newly formed solid bone tissue. Two months after the device was removed, 4 endosseous implants were placed and an implant-supported definitive prosthesis was placed. This method of horizontal alveolar distraction appears to be clinically useful for the placement of implants in atrophic or knife-edged alveolar ridges. INT J ORAL MAXILLOFAC IMPLANTS 2004;19:291–294*

**Key words:** alveolar ridge augmentation, bone augmentation, distraction osteogenesis, endosseous dental implantation

Ilizarov established the concept of distraction osteogenesis (DO) for orthopedic surgery in the early 1950s.<sup>1,2</sup> Subsequently, the idea was introduced to the field of oral and maxillofacial surgery by McCarthy and coworkers in 1992.<sup>3</sup> Currently, DO is accepted as a promising method for augmentation of atrophic alveolar ridges.<sup>4–6</sup> Until now, however, most reports on DO for alveolar processes have dealt with vertical DO, and there have been relatively few reports on horizontal DO for expansion of a narrow alveolar ridge.<sup>7</sup> Recently, a hori-

zontal DO system has been developed using a titanium mesh plate and a distraction screw. The use of horizontal DO for implant placement in a patient with a narrow, atrophic alveolar ridge of the anterior mandible is described in this report.

## CASE REPORT

A healthy 51-year-old woman presented with a chief complaint of masticatory dysfunction. She had been using removable partial dentures in both arches and had been suffering from instability of the mandibular denture because of advanced periodontitis involving the abutment teeth (mandibular right lateral incisor and canine). After these teeth were extracted, she insisted on having an implant-supported prosthesis instead of a removable denture. Computerized tomography (CT) (Aquilion; Toshiba Medical, Ohtawara, Japan) revealed that her anterior alveolar ridge was extremely thin—just 2 mm wide at a level 3 mm from the apex of the alveolar crest (Fig 1).

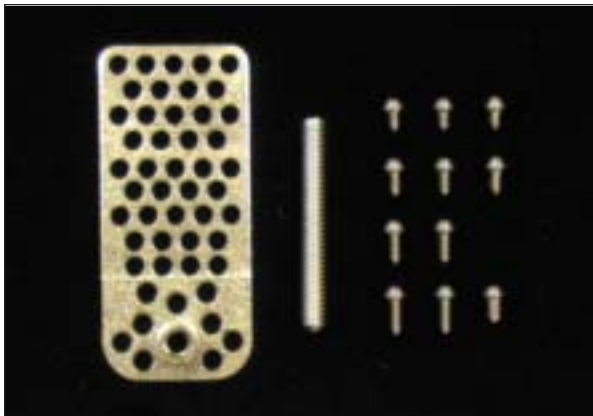
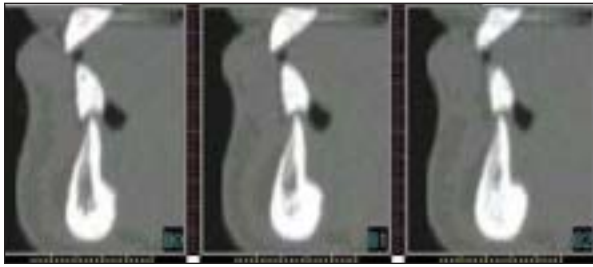
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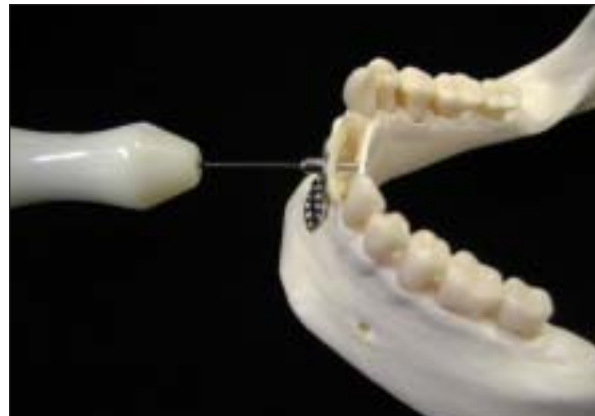
**Fig 2a** Horizontal distraction device (Alveo-Wider).

The initial plan was to perform bone grafting for implant placement. However, the patient refused to undergo bone grafting. Therefore, horizontal DO of the anterior mandibular ridge was chosen to augment the alveolar ridge after conventional placement of implants in the posterior molar region bilaterally. Two months after the implants were placed in the molar regions, the horizontal DO was performed. The patient was given local anesthetic and intravenous sedation. A crestal incision was made and extended vertically mesial to the first molar region. The mucoperiosteum was reflected, exposing the labial surface of the mandible.

First, a vertical osteotomy was performed using a reciprocating bone saw. This was followed by a horizontal osteotomy to the depth of the buccal plate using an oscillating saw. Finally, a splitting osteotomy was completed using a reciprocating bone saw and a thin-bladed osteotome, and the transport bone was then displaced labially by a horizontal green stick fracture apically. In this manner, a transport bone segment was made from the central incisor to the canine region bilaterally.

A horizontal distraction device, consisting of a 0.3-mm-thick commercially pure titanium mesh plate and a pure titanium distraction screw 2 mm in diameter and 12 mm in length (Alveo-Wider; Okada Medical Instrument Supply, Tokyo, Japan) (Figs 2a and 2b), was attached bilaterally using a

**Fig 1** Preoperative CT images of the anterior mandibular region.

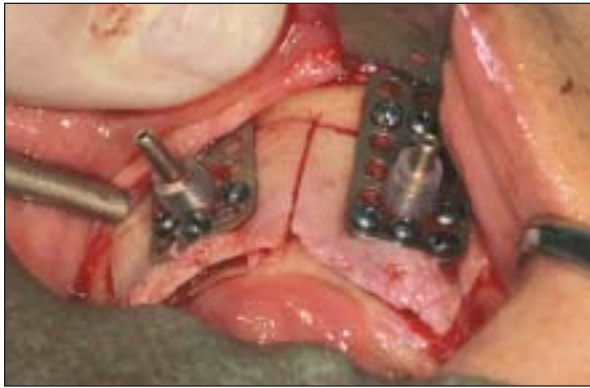


**Fig 2b** The distraction device is activated by turning the distraction screws.

titanium microscrew (1.2 mm in diameter) placed in each transport segment and stabilized to the remaining mandible (Fig 3a). The wounds were closed with 4-0 Gore-Tex sutures (Johnson & Johnson, Somerville, NJ) with the distraction screws penetrating from the flaps (Fig 3b).

After 7 days to allow for periosteal healing and early revascularization, the distraction devices were activated by turning the distraction screws 0.225 mm twice a day for 14 consecutive days on the left side and for 12 days on the right side. In all, the alveolar process of the anterior mandibular region was widened to 6 mm at a level 3 mm from the apex of the alveolar crest on both sides. During distraction, there were no apparent problems, except for a small dehiscence observed in the middle of the flap. The patient was instructed to rinse her mouth daily with chlorhexidine chloride solution.

After consolidation for 3 months, the devices were removed, and it was confirmed that the distracted areas were completely filled with newly formed bone. Postdistraction CT (Newtom, Verona, Italy) confirmed that the alveolar process had widened to 5.8 to 6 mm at 3 mm from the apex of the alveolar crest (Fig 4). Two months after the distraction device was removed, four 3.5×13-mm standard Astra Tech implants (Astra Tech, Mölndal, Sweden) were placed in the distracted areas. Good initial stability was achieved (Fig 5).



**Fig 3a** Placement of distraction device.



**Fig 3b** The distraction screw penetrated into oral cavity after the wound was closed.



**Fig 4** (Above) Postdistractive CT images after removal of the distraction devices.



**Fig 5** (Right) Placement of implants into the distracted areas.



**Fig 6a** Connection of abutments.



**Fig 6b** Definitive prosthesis.

Four months after implant placement, the implants were uncovered and abutments were connected (Fig 6a). A bone-anchored fixed definitive prosthesis was then fabricated and put in place (Fig 6b). No significant marginal bone resorption was seen around the implants 12 months after implant placement. The patient has been using this prosthesis with satisfactory function and great pleasure.

## DISCUSSION

Ridge augmentation is required for a functional and esthetic implant-supported restoration for an atrophic, narrow alveolar process. Bone grafting with autogenous bone<sup>8</sup> or bone materials,<sup>9</sup> guided bone regeneration (GBR),<sup>10</sup> and ridge-expansion techniques<sup>11</sup> have been used for this purpose. However, these procedures have disadvantages, such as the need for surgical intervention and harvesting

bone, unpredictable bone resorption, and difficulty in soft tissue coverage. Recently, DO has been used for alveolar ridge augmentation.<sup>4-6</sup> The advantages of DO over bone grafts or GBR include the lack of need for a donor site and simultaneous lengthening of the surrounding soft tissues. Several vertical DO devices have been reported, and vertical DO is now accepted as a viable treatment modality.<sup>4-6</sup>

Until now, there have been few reports on horizontal DO devices, and no standard method of horizontal DO has yet been established. Compared with vertical DO, there are some technical difficulties with horizontal DO. First, a splitting osteotomy is necessary. A splitting osteotomy for a thin alveolar ridge can be extremely difficult, with the risk of cracking or fracturing the transport segment, even when the osteotomy is successful. Second, the transport segment must be freed from the periosteum, because the splitting osteotomy must be completed in addition to the horizontal osteotomy. In this case, a titanium mesh plate was used to stabilize the transport segment. The advantages of using a titanium mesh plate for this purpose are as follows. First, titanium mesh is strong enough for stabilizing the transport segment, even if the transport segment cracks or fractures after the splitting osteotomy. While there was a crack in the right transport segment in this operation, the crack had completely disappeared by the time the distraction device was removed. Second, a titanium mesh plate may prevent the transport segment from resorbing because of pressure transmitted via the labial soft tissue.

Further studies are necessary to determine whether a titanium mesh plate is appropriate for horizontal DO. Such studies are currently underway. In addition, clinical data on the optimal latency period, distraction speed, and consolidation period for horizontal DO are lacking. In distraction, 7 days is usually appropriate for the latency period. In this case, however, there was a small dehiscence in the middle of the flap. Considering soft tissue healing and revascularization of the transport segment, a slightly longer latency period might be necessary. Generally, the ideal rate of distraction in mandibular DO is 0.5 to 1 mm per day.<sup>4,12</sup> Premature ossification may occur with slower distraction rates, and ossification may be disturbed by fibrous tissue formation with faster distraction rates.

Horiuchi and coworkers<sup>7</sup> demonstrated that the optimal rate for horizontal DO is 0.5 mm per day, with distraction increments twice daily. A rate of 0.45 mm a day, which is similar to Horiuchi's rate, was used for this patient. Three months elapsed for consolidation before the distraction devices were

removed. When the DO devices were removed, complete ossification was observed clinically. Recently, Nosaka and associates<sup>13</sup> reported implant placement in horizontal DO using a similar distraction device in dogs. They demonstrated that osseointegration was achieved, even though the implants were placed into the distraction site during the consolidation period. These data strongly support the fact that horizontal DO, as shown in this study, can be a beneficial technique for implant placement in the narrow alveolar ridge. Further studies will determine the optimal consolidation period before implant placement for horizontal DO.

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