

# Horizontal Alveolar Distraction of the Mandibular Canine Regions for Implant Placement

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**Abstract:** Horizontal alveolar augmentation by distraction osteogenesis is an alternative method for reconstructing atrophic alveolar bone. A 65-year-old woman with atrophy of the alveolar rim in the anterior lower jaw, which had inadequate width for implant placement, was presented. Under general anesthesia, vertical and horizontal osteotomies of the buccolabial cortical bone were performed in the canine regions bilaterally. Modified horizontal distraction devices were stabilized to the mandible. Distraction proceeded from the seventh postoperative day at a rate of 0.450 mm twice a day for 6 days. After 3 months, distraction osteogenesis occurred and increased the alveolar width from 2 to 7 mm. Two implants were placed in the distracted areas. Marginal bone resorption around the implants was not observed 12 months after implant placement.

**Key Words:** Horizontal alveolar distraction, mandible, dental implant

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Horizontal bone augmentation is a necessary and indispensable procedure for successful implant placement in a narrow alveolar ridge.<sup>1</sup> Modalities to augment horizontal bone defects include autogenous onlay bone graft<sup>2</sup> guided bone regeneration, alloplastic augmentation,<sup>3</sup> and alveolar split grafting.<sup>4</sup> Although these modalities are well established, there are certain disadvantages related to these conventional methods such as donor site morbidity, unpredictable bone resorption,<sup>5</sup> infection of the membrane, and difficulty in soft tissue coverage.<sup>1</sup>

Horizontal alveolar augmentation by distraction osteogenesis (DO) is an alternative method for reconstructing alveolar atrophy.<sup>6</sup> This technique has the advantages of bone formation without grafting and simultaneous lengthening of the soft tissues.<sup>7</sup> However, most reports on DO for an alveolar process have been on vertical DO, and there have been relatively few reports on horizontal DO for expansion of a narrow alveolar ridge. Recently, a horizontal DO system has been developed using a titanium mesh plate and a distraction screw by Takahashi et al.<sup>8</sup>

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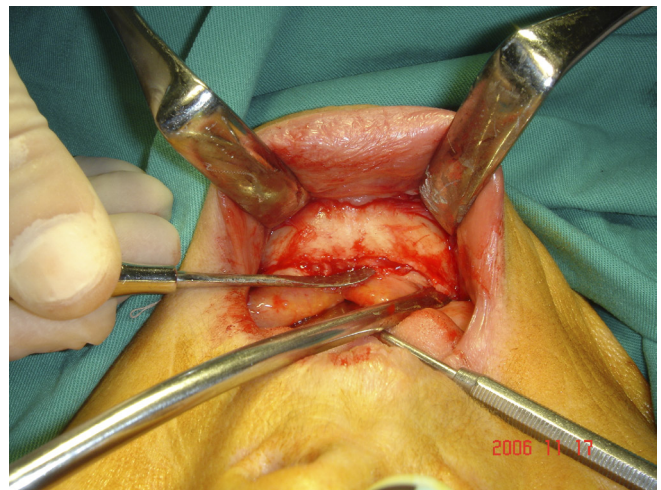
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In this report, horizontal alveolar distraction of a narrow mandibular ridge was achieved with a modified application of a horizontal alveolar distractor, followed by the placement of 2 endosseous implants.

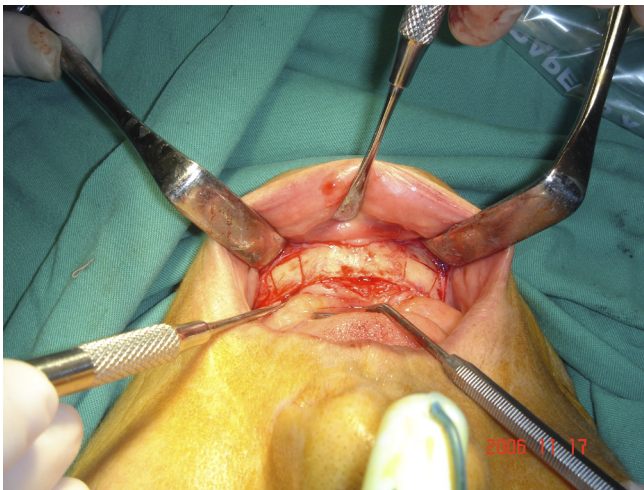
## PATIENTS AND METHODS

A healthy 65-year-old woman with a chief complaint of masticatory dysfunction was presented. She had been using removable total dentures in both arches and had been experiencing instability of the mandibular denture. Clinical examination revealed that her anterior alveolar ridge was extremely thin. The apex of the alveolar ridge was 2 mm wide on the canine regions (Fig. 1). A horizontal DO of the anterior mandibular ridge was planned to augment the alveolar ridge with placement of an implant in the canine regions bilaterally.

Under general anesthesia, crestal mucoperiosteal incision was made and extended to the molar region. The labial surface of the mandible was exposed. The osteotomy procedure was modified from that of Takahashi et al.<sup>8</sup> Vertical and horizontal osteotomies of the buccolabial cortical bone were performed using Piezosurgery instruments in the canine regions bilaterally (Fig. 2). This was followed by a splitting osteotomy with an osteotome, and the transport segment was then displaced labially by a green stick fracture apically, but a complete fracture occurred because of the cortical layer being too dense. Horizontal distraction devices (modified from those of Takahashi et al.<sup>8</sup>), consisting of a 0.3-mm-thick titanium mesh plate (Medartis, Basel, Switzerland) and a pure titanium distraction screw (Bahadır, Samsun, Turkey) 2 mm in diameter and 12 mm in length, were stabilized to the mandible and the free bone



**FIGURE 1.** Intraoperative view of the alveolar width.



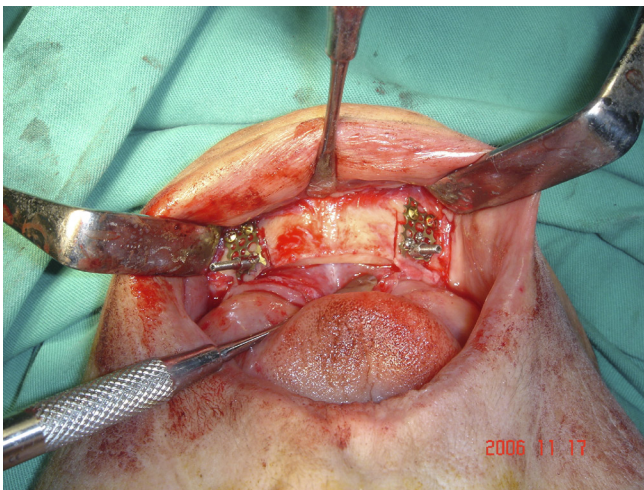
**FIGURE 2.** Osteotomy lines of the buccolabial cortical bone.

segments with titanium microscrews (Bahadır; 1.2 mm in diameter, Fig. 3). The wounds were then closed primarily. The postoperative regimen included amoxicillin plus clavulanic acid, 1 g every 12 hours for 6 days; ibuprofen, 100 mg every 12 hours for 3 days; and 0.2% chlorhexidine mouth rinses, every 12 hours for 1 week. The patient is instructed to avoid brushing and trauma to the surgical site. The sutures were removed after 7 days.

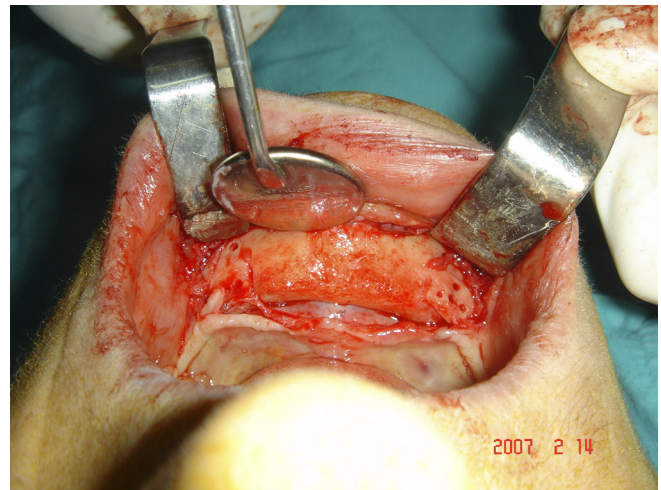
After 7 days of latency period, the distraction devices were activated by turning 0.450 mm twice a day for 6 consecutive days. The width of the alveolar process of the canine regions were measured 7 mm at the end of the activation period. The healing was uneventful.

After 3 months, the devices were removed, and the new bone formation in the distraction area was confirmed (Fig. 4). Two 4.1 × 10-mm implants (ITI, Straumann, Switzerland) were placed in the distracted areas (Fig. 5). The primary stabilization was excellent.

Three months after implant placement, an overdenture prosthesis was placed. No significant marginal bone resorption was seen around the implants 12 months after implant placement (Fig. 6). The patient has been using her prosthesis with satisfaction.



**FIGURE 3.** Stabilization of the distractors to the mandible.

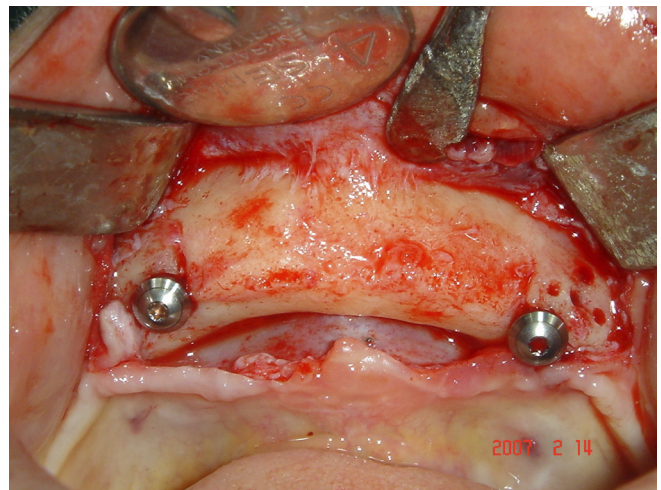


**FIGURE 4.** New bone formation in the distracted areas 3 months after the operation.

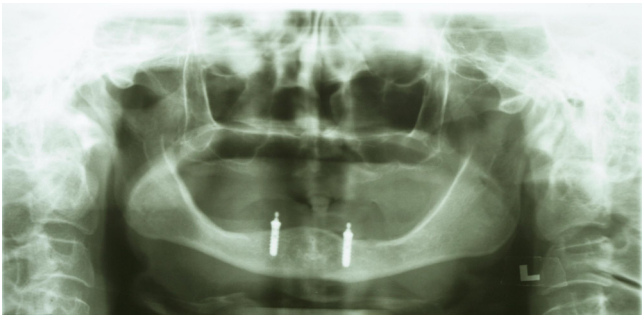
## DISCUSSION

Reconstruction of the atrophic alveolar process is a challenging issue related to the deficiencies in both the bone and the attached mucosa. Experimental<sup>1</sup> and clinical<sup>9</sup> studies have reported bone formation and soft tissue augmentation achieved with DO. Alveolar DO has been well established as an effective new technique of ridge augmentation, and the vertical alveolar DO technique is now applied widely to correct alveolar ridge defects or atrophy.<sup>10</sup> However, a horizontal DO for narrow alveolar ridge cases is still rare.<sup>8</sup>

The advantages of horizontal distraction are simultaneous expansion of soft tissue, high degree of dimensional stability, abbreviated overall treatment time, and no graft requirement.<sup>11</sup> Development of miniature distraction devices has made horizontal alveolar DO practical clinically. However, there are some technical difficulties with horizontal DO. First, horizontal osteotomy is difficult in a narrow alveolar crest in the mandible. It is necessary to put in place the saw properly on the tip of the crest not to lose the alveolar height for further implant placement. Second, the placement of the miniature devices in place may be troublesome and time consuming.



**FIGURE 5.** Insertion of the implants to the distracted bone.



**FIGURE 6.** Twelve months postoperative radiographic view of the implants.

Various horizontal distraction devices with different procedures have been used for the widening of the alveolar process. Oda et al<sup>12</sup> distracted a narrow maxillary ridge with a modified application of a distractor that consisted of a transport plate and a distraction rod. This technique has the risk of the slipping and the submergence of the distraction rod along the lingual cortical bone causing an uncontrolled distraction vector. Nevertheless, the authors successfully augmented the alveolar ridge. Takahashi et al<sup>8</sup> introduced a horizontal DO device that consisted of a titanium mesh plate and a distraction screw to be used in the anterior mandibular region. The advantages of using a titanium mesh are stabilization of the transport segment and the prevention of the transport segment from resorbing via the transmission of the pressure of the labial soft tissue.<sup>8</sup> This technique requires a splitting osteotomy that has the risk of cracking or fracturing the transport segment. In our case, a horizontal distractor modified from that used by Takahashi et al<sup>8</sup> was used. Although the same osteotomy protocol as that of Takahashi et al was used here, separate osteotomies were made bilaterally in the canine regions. During the osteotomy procedure, both of the transport segments were fractured because of the highly dense structure of the buccal cortex of the mandible, and the fracture was completely filled with bone after 3 months. Because the alveolar bone in the lower osteotomy site is thicker in the canine regions than in the anterior region, this complication should be expected. How-

ever, the transport segment can be held in place by the titanium mesh that is fixed to the mandible below the lower osteotomy line.

In conclusion, horizontal DO seems to be a useful augmentation technique for implant placement in a narrow alveolar ridge. It increases both hard and soft tissues, and using a mesh plate is appropriate for horizontal distraction of the mandibular canine region.

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