

# Surgical Management of the Partially Edentulous Atrophic Mandibular Ridge Using a Modified Sandwich Osteotomy: A Case Report

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*Loss of posterior mandibular teeth resulting in insufficient posterior vertical bone height can pose a problem in implant therapy. In the case reported, a modified sandwich osteotomy was used to solve this problem. INT J ORAL MAXILLOFAC IMPLANTS 2005;20:799-803*

**Key words:** atrophic mandible, sandwich osteotomy

Despite advances in the treatment of failing dentition, loss of posterior teeth in both the maxilla and mandible is common. Extensive resorption of the alveolar ridge in a vertical direction may make implant placement difficult and prosthetic rehabilitation compromised or impossible. Restoration of the atrophic mandibular ridge can be resolved in a number of ways. Surgical procedures involving autogenous bone, alloplastic materials,<sup>1-8</sup> and recently, alveolar distraction osteogenesis have been proposed.<sup>9</sup> Reconstruction of vertically atrophied ridges with onlay bone grafts has been well documented, but the results have not been promising. Different donor sites (symphysis menti, calvaria, iliac crest) have been used as sources of autogenous bone. Vermeeren and associates<sup>10</sup> demonstrated bone resorption up to 50% even when autogenous onlay grafts were used. Rigid fixation of the graft material is imperative to prevent microrotation, which can result in non-union or fibrous union of the graft material.

Guided bone regeneration was proposed in a 1991 report by Dahlin and colleagues.<sup>11</sup> The use of expanded polytetrafluoroethylene membranes is a treatment option for posterior mandibular reconstruction that has been used with varying degrees of success, as reported by various authors.<sup>12,13</sup> Tinti and

coworkers<sup>14</sup> commented that vertical augmentation is a highly sensitive technique, predictable only when the surgical protocol is followed strictly.

Vertical ridge augmentation of the atrophic maxilla and mandible by means of a titanium mesh and autogenous bone grafts has been used successfully and has gained popularity since its introduction.<sup>15,16</sup> The titanium mesh used must be fixed by titanium screws, and infection is a common complication<sup>15</sup> that may cause loss of grafted bone, resulting in failure. Visor osteotomy was first described in 1975 by Harle<sup>17</sup> to increase the absolute height of the atrophic edentulous mandible. In this technique, the alveolar ridge of the mandible is osteotomized and moved on the visor principle. The 2 bony parts require fixation with wires. When the procedure is applied to vertical ridge augmentation in the posterior mandible, the mandible is split vertically and, unfortunately, the width of the ridge is reduced. The sandwich technique, which uses graft material positioned between osteotomized bony segments, was developed by Schettler<sup>18</sup> in 1974. Stoelinga and colleagues<sup>19</sup> combined the visor osteotomy and sandwich techniques to augment the severely atrophic edentulous mandible with success. Eufinger and associates have made use of computer-aided design and manufacturing and have suggested using computer-assisted alloplastic sandwich augmentation of the atrophic anterior mandible.<sup>19</sup>

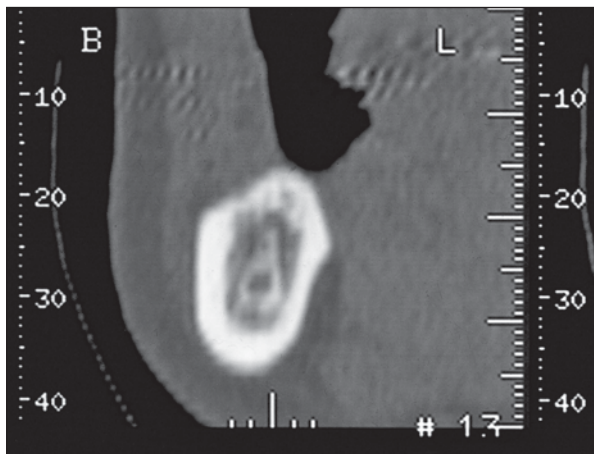
Using the aforementioned principles, a new surgical method based on the previous sandwich osteotomy technique, the use of an interpositional bone graft harvested from the chin or iliac crest to increase the vertical dimension of the ridge is described.

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**Fig 1a** Preoperative radiograph revealing atrophy of the mandibular ridge.



**Fig 1b** Serial CT scan showing that the mandible is atrophic, with a measured height of approximately 5 mm.

## CASE REPORT

A 43-year-old female patient presented with an atrophic right mandible and requested implant therapy. Clinical examination revealed a right knife-edged mandibular ridge that was not suitable for immediate implant placement in terms of ridge height and width. Augmentation of the ridge using an iliac crest bone block under general anesthesia was suggested to the patient. The patient gave her written informed consent, and a preoperative radiograph and computerized tomographic (CT) scan were obtained (Figs 1a and 1b).

A sulcular incision was made above the mucogingival reflection in the edentulous area (Fig 2). The flap was raised with the lingual periosteum intact to expose the buccal surface of the atrophic mandible, and the mental nerve was identified. One vertical and 1 oblique bone cut were then made 2 mm above the mental foramen (Figs 2c and 2d). The osteotomy was completed with the use of an osteostome. The posterior part of the oblique bone cut was left intact, so that a greenstick fracture was achieved. The cranial segment was then moved upward to leave space for the bone graft, with no disturbance of the lingual

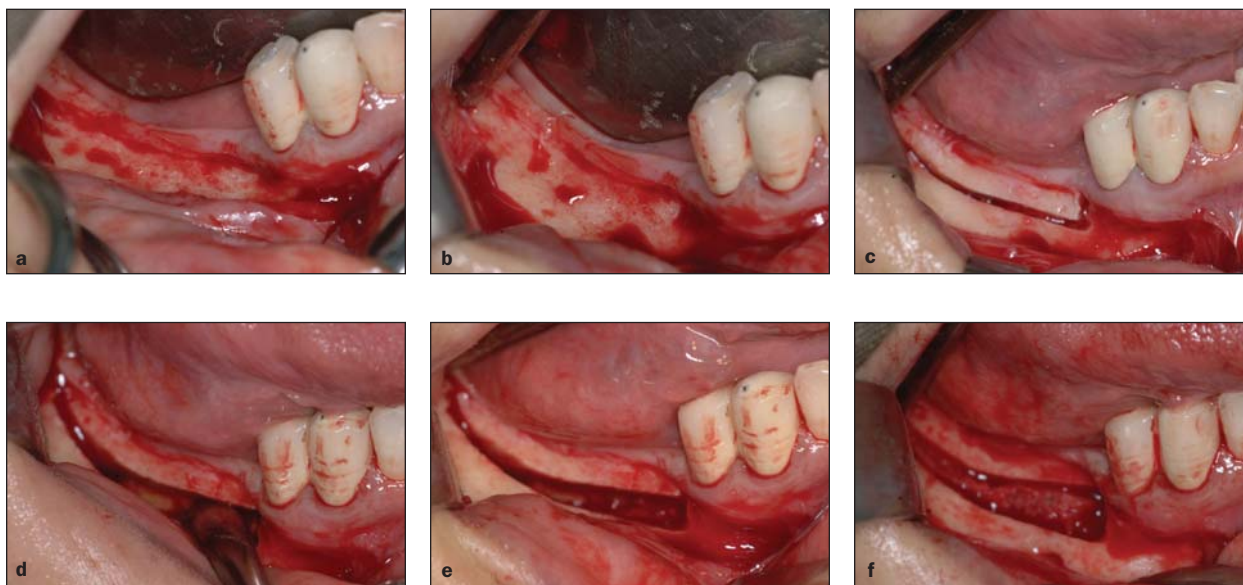
periosteum (Fig 2e). A bone graft was harvested from the iliac crest and placed as an interpositional graft, without any fixation between the basal segment and the cranial segment (Fig 2f and 2g). The wound was then closed primarily with 4-0 vicryl suture.

A postoperative radiograph and CT scan (Figs 3a and 3b) were obtained to assess the new vertical height of the mandible. Two XiVe implants (Densply Friadent CeraMed, Lakewood, CO) measuring 4.5 mm in diameter and 11 mm in length and 1 XiVe implant measuring 4.5 mm in diameter and 8 mm in length were placed after 3 months of healing in the grafted area (Fig 4). At the same time, 2 XiVe implants were immediately placed in the premolar region because of recurrent periapical infection of the mandibular right premolars.

The patient was followed monthly. Neurosensory function was tested on each visit, and no neurosensory disturbances were recorded.

## DISCUSSION

The modified sandwich osteotomy offers a new approach to the management of the patient with a



**Figs 2a to 2g** Clinical photographs showing the modified sandwich osteotomy.

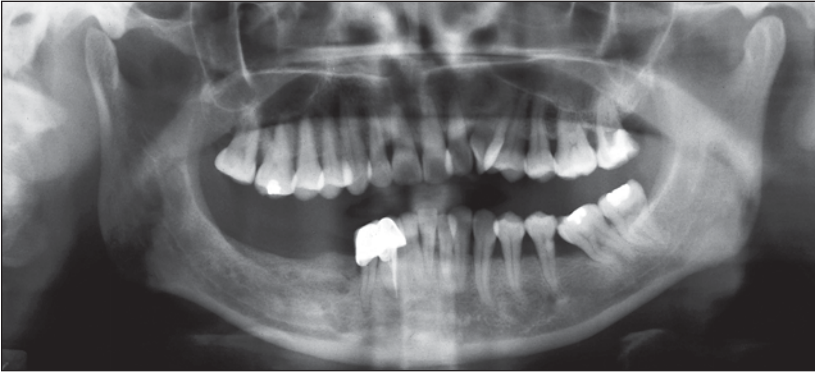


deficiency in vertical ridge height localized in the posterior mandible. Neither rigid fixation nor the use of a barrier membrane is required. The method involves a mucoperiosteal flap with good vascularization of the cranial segment. There is no limit to the bone defect in regard to height, as long as it extends from the canine region to the molar region with the loss of 3 to 5 teeth.

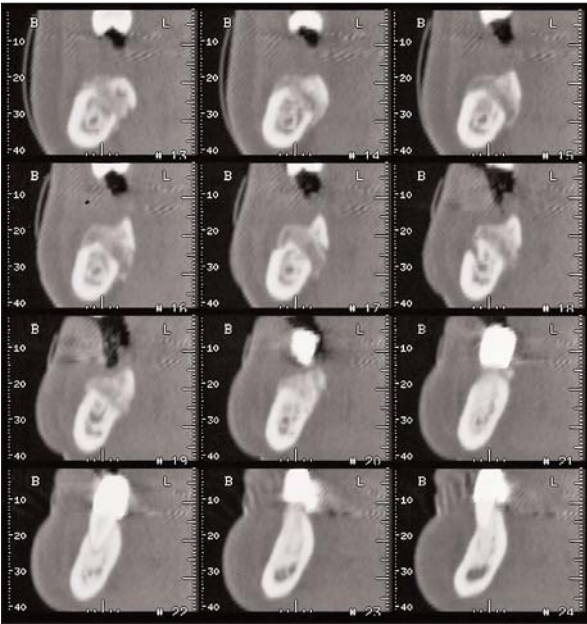
The method has the advantage of assuring a good vascular supply to the interpositional graft, and it may result in less resorption. If mandibular symphyseal bone is chosen as the graft harvest site, the operation can be performed under local anesthesia. There is no need for rigid fixation of the bone graft, as the greenstick fracture of the posterior part of the osteotomy cut can help maintain the position of the interpositional graft. This method can also increase the horizontal dimension of the atrophic alveolar process, as shown in the CT scan. The disadvantage of the procedure is that the degree of augmentation of vertical dimension is limited by the lingual periosteum. Harle<sup>17</sup> first reported the use of a visor osteotomy to augment the atrophic mandible. In that report, the mandible was sagittally split from the mid-body on one side to the same position on the

opposite side. The present method, in contrast to Harle's method, is an oblique splitting of the partially edentulous posterior mandible. The Harle segment, elevated in a visor fashion, needed to be fixed by circumferential wire, whereas in the present case, neither wiring nor a plate-and-screws system was needed.

Stoelinga and colleagues<sup>8,19</sup> reported their experience with augmentation of the atrophic mandible with an interposed bone graft used in combination with particulate hydroxyapatite. Their method utilized autogenous iliac bone graft placed in a subcortical position in the edentulous mandible to achieve the vertical height augmentation. The graft material was also secured by wire. For the area beyond the mental foramen, a mixture of hydroxyapatite particulate and cancellous bone chips in a 1:1 ratio was used to fill in the pouch after the mucoperiosteum in the posterior area was elevated superiorly. However, the loss of height, which Stoelinga and colleagues postulated to be related to condensation of the hydroxyapatite rather than resorption, was significant. Ongoing resorption of the body of the mandible over longer periods may give rise to further decreases in height. Hence, the use of hydroxya-



**Fig 3a** Postoperative radiograph demonstrating that mandibular height was increased in the premolar and molar regions.



**Fig 3b** Postoperative serial CT scan demonstrating that mandibular height and width were both increased.

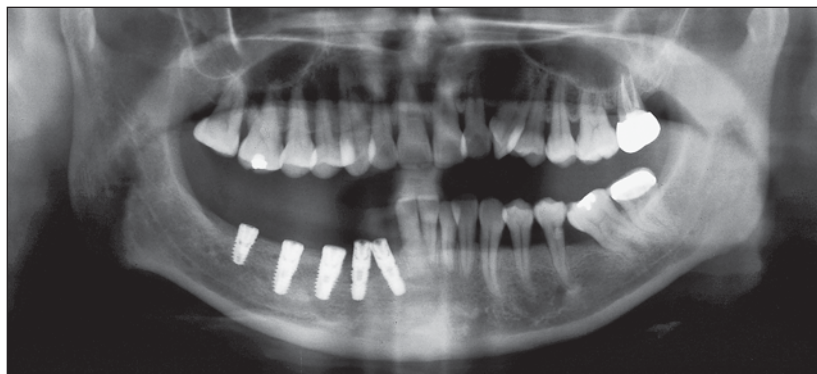
patite with vertical augmentation of an atrophic partially edentulous mandible is not recommended. Bell and Buckles<sup>21</sup> and de Koomen and colleagues<sup>22</sup> have also described methods to augment the anterior segment or the body of the mandible by horizontal osteotomy or sagittal osteotomy respectively. In the present case, the rate and amount of resorption cannot be formulated as yet, but other studies on the sandwich osteotomy with interpositional bone graft have reported a reduced rate of bone resorption, particularly when the technique is used in the posterior regions.

Using the visor sandwich osteotomy described by Egbert and coworkers,<sup>1</sup> up to 8 of 20 patients had subjective sensory disturbance of varying degrees. In the present case, no neurosensory disturbance whatsoever was reported after the 6-month follow-up visit.

## CONCLUSION

The modified sandwich osteotomy offers a simple method for augmenting a partially edentulous atrophic mandibular ridge to increase both ridge height and width. The method can be performed under local anesthesia if symphyseal bone is used. No neurosensory disturbance was demonstrated in this case. By making use of the elasticity of the osteotomized segment, the need for rigid fixation is eliminated. In conclusion, this modified sandwich osteotomy can be safe and effective when used appropriately.

**Fig 4** Three implants were placed in the premolar and molar regions after sufficient ridge height was achieved.



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