The Pre-Implant “Window-Osteotomy” Technique for the Atrophic Posterior Mandible

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INTRODUCTION

The grafting approach to atrophic posterior mandibles necessitates prolonged treatment and patient morbidity and is expensive and unpredictable.1–12 The use of short implants in this particular site can be a good alternative but this approach has not been supported by long follow-up studies,5,13–15 and cases in which available bone height is less than 5–6 mm appear tricky.16

The presence of considerable bone thickness in posterior mandibles, buccal to the mandibular canal, and the lingual course of the nerve bundle in the molar zone are highlighted in literature.17–21 Implant insertion lateral to the nerve is considered22 but often results in excessively buccal implant placement and great difficulty in obtaining a correct final occlusal relationship with the maxilla.

This article presents a technique used for the implant-borne prosthetic rehabilitation of a partially edentulous posterior mandible with a mean height ≤6 mm in the molar zone. The procedure allowed clinicians to insert 2 fixtures via a lateral approach with intraoperative verification of the position of the inferior alveolar nerve (IAN).

DESCRIPTION OF THE CASE

A 52-year-old woman requested a rapid fixed prosthetic rehabilitation of her partially edentulous left mandible, which had atrophied following the loss of teeth #21–18 due to severe periodontal disease (Figure 1).

Bone heights above the mandibular canal on the left side, measured by cone-beam computerized tomography (CBCT), were 6.5, 6.40, and 5.50 mm (Figure 2) at positions #20, #19, and #18, respectively. Mandibular thickness buccal to the mandibular canal in the molar zone, measured by CBCT, was ≥4.50 mm in each slice. We decided to place 3 implants at positions #21, #19, and #18 and to connect them with a prosthesis superstructure to replace the 4 dental elements (teeth #21–18); the implants at positions #19 and #18 were placed lateral to the mandibular canal.

The procedure started with a slightly lingual paracrestal incision in the edentulous zone, involving the gingival sulcus at positions #23–21, which was connected distally to a vertical incision in the vestibule in the third molar zone. The full-thickness flap was raised carefully; in all phases of the procedure, great care was taken to avoid applying tension to the ipsilateral mental nerve. After inserting the fixture at position #21 using a standard method, a cortical window osteotomy was performed on the buccal surface of the mandible at a location corresponding to positions #19–18. One OP1 Piezo surgical insert (Mectron, Carasco, Italy) was used to define a 2-cm-long/1.5-cm-high rectangular cortical fragment 4 mm under the crestal edge and 4 mm distal to the emergence of the mental nerve (Figure 3). The window osteotomy involved the thickness of the entire cortical layer to the spongiosa. The window fragment was removed using thin and curved chisels, exposing the spongious portion of the mandibular body (Figure 4).

After verifying that the nerve canal was lingual to the osteotomized area, as predicted from the CBCT evaluation, two 15-mm-long implants with 3.30-mm and 2.50-mm coronal and apical portions, respectively (Premium, Sweden and Martina, Padua, Italy), were placed with a low lingual inclination. The implant site was prepared with the use of the drill and, as the final tool, with the IM3P-15 Piezo surgical insert to prevent the neurovascular bundle from possible damage. The fixtures were engaged coronally in the bone 4 mm above the window osteotomy and apically in the cortical bone of the inferior mandibular edge; this bicortical involvement provided primary stability (Figure 5). The bone window fragment was replaced after making 2 concavities on its internal surface corresponding to the exposed portions of the fixtures to allow a good fit. The fragment was fixed with a titanium miniplate and 2 miniscrews (KLS Martin, Tuttlingen, Germany). All residual gaps were filled with bovine bone chips (Bio-Oss cancellous spongiosa, Geistlich Pharma, Wolhusen, Switzerland) (Figure 6). After the creation of periosteal releasing incisions, the flaps were sutured carefully with 4.0 Vicryl (FS-2, Ethicon, St Stevens-Woluwe, Belgium).

Ketoprofen was prescribed for 5 days. The postsurgical instructions included a soft diet for 2 weeks and appropriate oral hygiene with twice daily rinsing with 0.2% chlorhexidine digluconate mouthwash. The patient was instructed to avoid brushing and trauma to the surgical site and to avoid smoking for a few days postoperatively. The sutures were removed 10 days postoperatively.

The patient was followed clinically beginning 1 week after surgery, twice in the first month and once in the subsequent 3 months. Radiographic assessments were performed immediately after surgery (periapical) and 3 months later (panoramic).
Three months after the initial procedure, the implants were exposed and connected with an abutment screw inclined 15°. A temporary implant-supported acrylic-resin fixed bridge was connected to the implants until a cement-retained definitive prosthesis was inserted 2 months later. Clinical evaluation was performed, and intraoral periapical radiographs were taken at the times of temporary and definitive prosthesis loading; 3, 6, and 12 months after loading; and at the final follow-up examination; CBCT was performed 1 month after definitive prosthesis insertion. No postoperative complication occurred.

A CBCT image obtained 1 month after prosthesis loading revealed good bone healing with complete osseointegration of the fixtures and incorporation of the repositioned fragment (Figure 7). Twenty months after prosthetic loading, no clinical (Figure 8) or radiographic (Figures 9 and 10) sign of pathology was noted. The patient was satisfied with the functional and aesthetic outcomes of treatment.

**DISCUSSION**

The possibility of graft incorporation in the reconstruction of an atrophic posterior mandible is reduced by the scarce vascular support, the high cortical component, the scarcity of keratinized gingiva, and the superficial muscle attachment. Alternative protocols have been proposed.

**FIGURE 1.** Preoperative clinical and radiologic situation.

**FIGURE 2.** Preoperative cone-beam computerized tomography slice in the second molar zone.
The IAN lateralization (IANL), proposed in the 1990s, has been underused because of its high level of nerve morbidity ranging from 30% to 75%. The advantages of this technique are the immediate placement of a standard-length fixture in a prosthetic correct position at the time of surgery and the shortened waiting time for prosthetic loading.

Computer-aided design/computer-aided manufacturing technology has been used to reevaluate the use of blade implants. In one study, five 2-mm-thick customized blade implants were positioned with good results for up to 2 years after loading. However, this technology is very expensive and little known.

Very few studies have examined the use of short implants (<8 mm long), and these concerned the mandibular posterior region, where occlusal forces are particularly strong and dental hygiene is difficult.

**FIGURES 3–5.** Figure 3. Surgical intervention: after elevating a full-thickness flap and exposing the buccal surface of the mandible, the window osteotomy was made using the OP1 Piezosurgery insert (c). Schematic drawings of this surgical phase in the (a) frontal plane and (b) a 3/4 perspective. Figure 4. Surgical intervention: the window fragment was removed, exposing the trabecular portion of the mandibular body (c). Schematic drawings of this surgical phase in the (a) frontal plane and (b) a 3/4 perspective. Figure 5. Surgical intervention: implant placement in the molar zone in a buccal position with respect to the nerve, as shown (a and b) graphically and (c) clinically.
Tilted implants with buccal-lingual inclination have been considered. This technique may damage not only the IAN but also the lingual nerve and sublingual artery, and it involves increased strain at the coronal implant bone surface and the risk of crossbite occlusion.

Gowgiel analyzed 29 cadaver atrophic mandibles and quantified the distance between the neurovascular bundle and the buccal surface as 0.5 cm in the molar region. The possibility of placing standard 3.75-mm-diameter implants lateral to the canal was touched on in a recent anatomical report.

Our technical approach was derived from the need to rehabilitate an atrophic posterior mandible with insufficient bone height for short implant placement in a patient requiring a fast (no more than 4 months) and low-cost treatment. The technique required preoperative CBCT evaluation, which revealed sufficient bone thickness lateral to the IAN for the placement of a 3.50-mm-diameter implant.

The window osteotomy was adopted to verify the reliability of the computerized tomography (CT) data intraoperatively, as the margins of error in CT anatomical reproductions range from 0.1 mm for CBCT to 1.5 mm for conventional CT. For this reason, implant insertion with a computer-guided system, which requires stabilization of a surgical template in the mouth, is not recommended because of the neurologic risk.

The cortical window allowed the surgeon to control the direction of implant placement precisely. The exposure of the trabecular bone and identification of the lingual location of the IAN relative to the implant site permitted us to locate these as near as possible to the nerve bundle, maintaining the correct vertical fixture insertion, with no damage to the nerve based on the absence of impaired sensation.
The cortical window osteotomy gives the surgeon a clear idea of the thickness of the apical cortical bone, where the apex of the fixture must be engaged. Piezosurgery, particularly with the angulated OP1 insert, enabled a safe cortical osteotomy, avoiding a buccal approach perpendicular to the external mandibular surface: an approach from the occlusal plane prevents excessive traction on the soft tissues and mental nerve, reducing the risk of damage.

The visualization of the thickness in this zone of the mandibular body helps to determine the axis of insertion relative to the external buccal profile, preventing perforation of the mandibular contour and, contemporarily, the damage of the nerve bundle. The cortical engagement of the apical portion of the fixtures is safely allowed by the visualization of the real apical bone thickness available after the removal of the window fragment. This caution helps the operator to maintain drilling and implant insertion in the correct direction.

Since it is impossible to visualize the medial aspect of the drill during the implant site preparation, the use of the Piezosurgery instrumentation is recommended to prepare the implant site and avoid possible risk to nerve integrity. Furthermore, the use of a tapered fixture with a reduced apical diameter or a smaller diameter apically than coronally is recommended; it allows safer implant placement because it requires less bone thickness around the threads.

A blind approach may be too risky for the IAN integrity. Otherwise, the concern about the integrity of the nerve could force the operator to place the fixtures too far laterally from the alveolar canal or too tilted relative to the vertical axis of the mandibular body in the frontal plane with subsequent prosthetic problems.

The removal of the window fragment did not compromise primary stability thanks to the bicortical engagement of the

![Figure 8](https://example.com/figure8.jpg)

**Figure 8.** (a) Lateral and (b) occlusal views of the definitive prosthesis at the end of follow-up (20 months after loading).

![Figure 9 and 10](https://example.com/figure9-10.jpg)

**Figures 9 and 10.** Figure 9. Panoramic radiograph taken 3 months after the surgical intervention, just before the prosthetic phase. **Figure 10.** Periapical x-ray taken at the end of follow-up.
fixtures in the coronal ridge and inferior border of the mandible. A window osteotomy with placement of a narrow-taper fixture might be applicable to the treatment of all atrophic mandibles with distances ≥4.5 mm between the bundle and lateral surface.

In the future, computer-guided planning and navigation-supported systems will permit more precise management of similar cases. At present, this practice has an unpredictable error margin, which affects its accuracy.²

ABBREVIATIONS

CBCT: cone-beam computerized tomography
CT: computerized tomography
IAN: inferior alveolar nerve
IANL: inferior alveolar nerve lateralization

REFERENCES


200 Vol. XLII/No. Two/2016

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