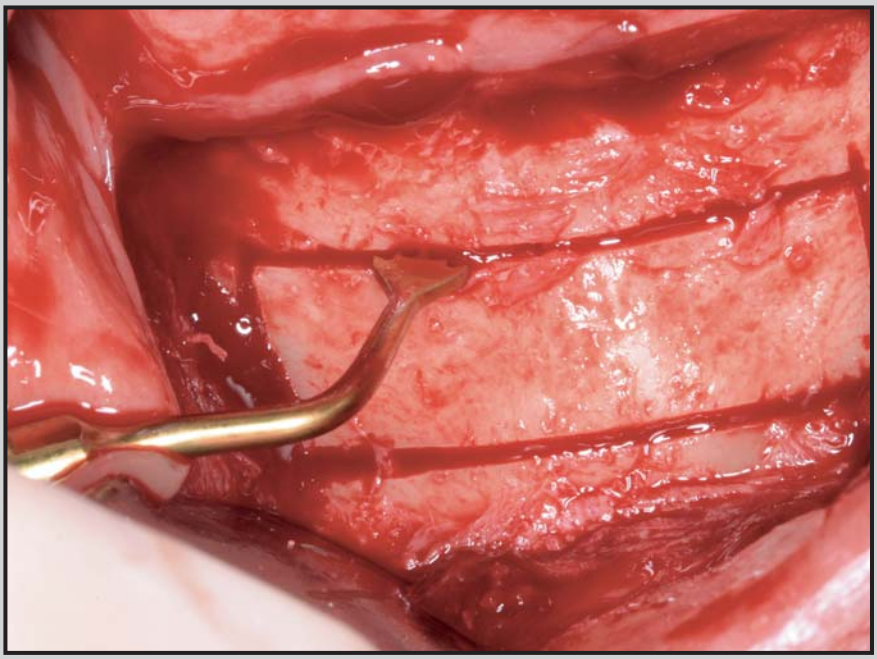

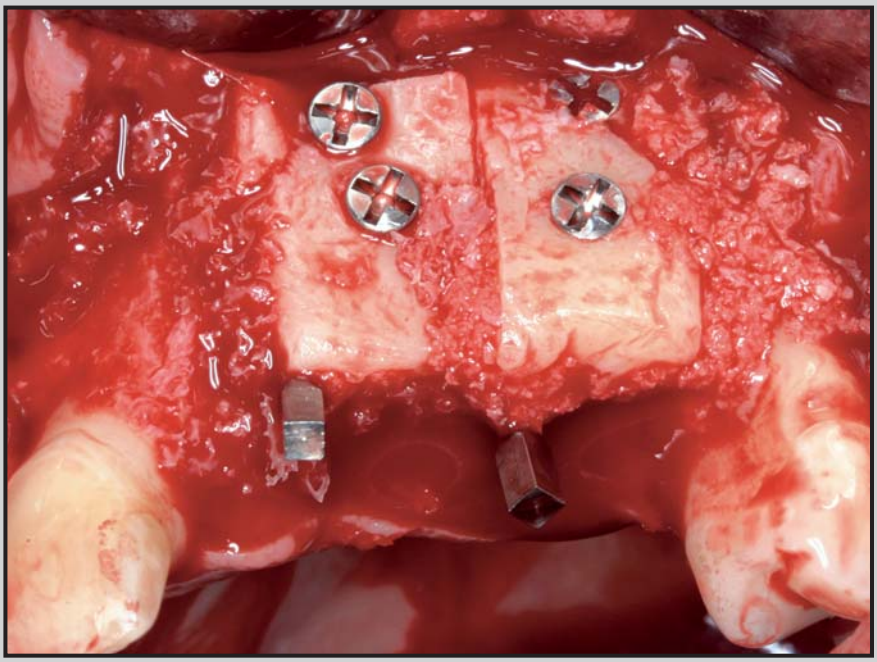

Piezoelectric Osteotomy for Intraoral Harvesting of Bone Blocks

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Grafting with intraoral bone blocks is a good way to reconstruct severe horizontal and vertical bone resorption in future implant sites. The Piezosurgery System (Mectron) creates an effective osteotomy with minimal or no trauma to soft tissue, in contrast to conventional surgical burs or saws. In addition, piezoelectric surgery produces less vibration and noise because it uses microvibration, in contrast to the macrovibration and extreme noise that occur with a surgical saw or bur. Microvibration and reduced noise minimize a patient's psychologic stress and fear during osteotomy under local anesthesia. The purpose of this article is to describe the harvesting of intraoral bone blocks using the piezoelectric surgery device. (Int J Periodontics Restorative Dent 2007;27:127–131.)

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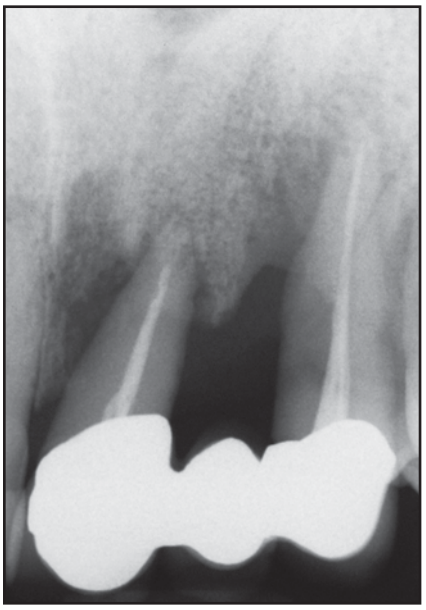
Placement of dental implants is difficult in alveolar ridges with severe horizontal and vertical bone resorption. To augment the severely atrophic ridge, grafting with bone blocks harvested intraorally has been recommended.[1–7]

To create the necessary osteotomy, clinicians have used various surgical burs or saws. These surgical instruments cut bone very effectively; however, they can cause soft tissue complications such as lacerations or burns during osteotomy if the surgeon does not pay close attention.[8] In addition, these surgical devices are loud and produce macrovibrations during osteotomy. The noise and macrovibrations can cause fear and stress in patients when surgery is performed with local anesthesia.

Piezoelectric surgery systems (Piezosurgery, Mectron) use ultrasonic microvibrations to create an osteotomy. These microvibrations make selective bone cuts possible.[9,10] The Piezosurgery device does not work on soft tissue, so the device causes little or no soft tissue trauma during intraoral bone harvesting. In addition, surgical access is easier in the deep oral cavity in comparison to surgical burs,



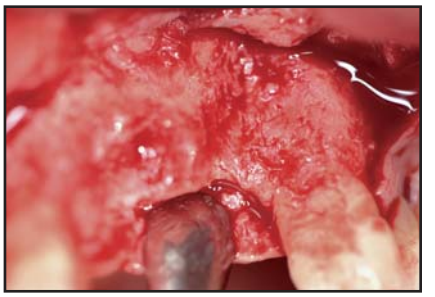


Fig 1a (left) *Patient 1. The intraoral radiograph shows severe bone resorption.*

Fig 1b (center) *Preoperative intraoral view after 6 weeks of healing of extraction sites. Note the severe vertical and horizontal bone resorption.*

Fig 1c (right) *The recipient site is exposed, and vertical and horizontal bone defects are observed.*

which use a straight handpiece. The Piezosurgery device makes a precise and tactile-controlled osteotomy.

The purpose of this study is to describe the efficacy and safety of piezoelectric surgery during intraoral harvesting of bone blocks.

Surgical procedure

Patient 1: Block graft in the anterior maxilla

A 48-year-old man presented for implant placement. The left central incisor and left canine were considered hopeless. An intraoral radiograph showed severe bone resorption at both sites (Fig 1a). The hopeless teeth were extracted and soft tissue healing was complete after 6 weeks. A preoperative intraoral view showed severe horizontal and vertical bone resorption (Fig 1b). The recipient site was exposed under local anesthesia with no intravenous sedation, and the severe resorption was apparent (Fig 1c). The chin was exposed to harvest a thick block of corticocancellous bone. Two horizontal and vertical osteotomy cuts were created with the piezoelectric saw (Figs 1d and 1e). The bone block was divided into two pieces with the piezoelectric saw. The blocks were fixed with two miniscrews (Jeil Corp) at the recipient sites.

Autogenous bone chips were collected from the cortex of the chin, above the superior osteotomy line and near the root apical areas of the mandibular anterior teeth, using the piezoelectric scalpel with a reverse trapezoid tip. The harvesting of autogenous bone chips was performed easily using a scraping action with the piezoelectric scalpel. The mandibular anterior teeth remained undamaged because the procedure was performed in cortical bone only, with micrometric and precise bone cuts (Fig 1f).

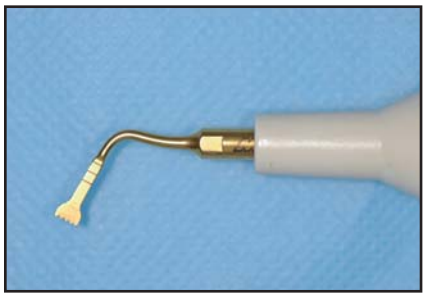
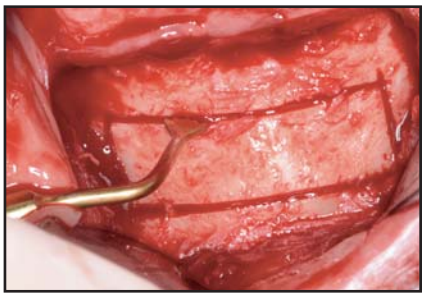


Fig 1d (left) *A piezoelectric saw connected to a handpiece is used for the osteotomy.*

Fig 1e (right) *Two horizontal and vertical cuts are performed using the piezoelectric saw. Note the clean and regular cuts of the osteotomy lines.*



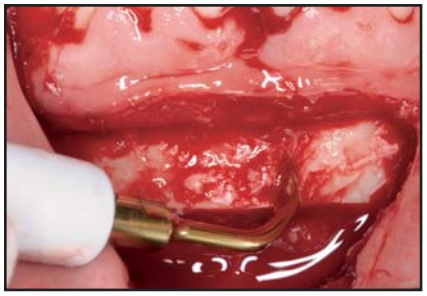
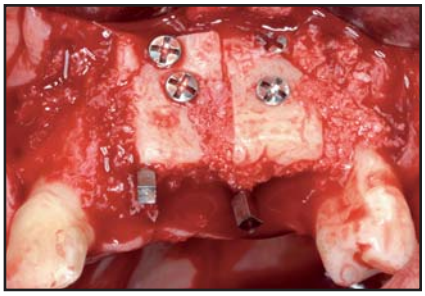


Fig 1f (left) *Harvesting of autogenous bone chips with the piezoelectric osteoplastic scalpel is performed in the cortex above the superior osteotomy line.*

Fig 1g (right) *The bone block is fixed with miniscrews at the atrophic recipient site for vertical and horizontal augmentation. Autogenous bone chips are grafted into the gap between the bone block and the recipient site. Two mini dental implants are placed on the day of surgery.*



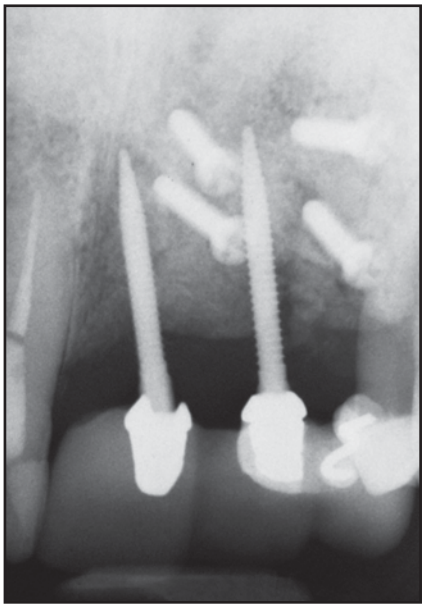


Fig 1h (left) *Postoperative periapical view showing provisional immediate prosthesis and bone graft.*

Fig 1i (center) *Favorable vertical and horizontal bone augmentation is seen after a 6-month healing period. The mini dental implants and miniscrews are removed at this stage. Implants are placed and a provisional prosthesis is delivered on the day of surgery.*

Fig 1j (right) *After 3 months of progressive loading, the definitive metal-ceramic prosthesis is cemented. Note the esthetic restoration.*

The bone chips were grafted into the gap between the bone block and the recipient site. Two mini dental implants (IMTEC Corp) were placed in the palatal bone to provide support for an immediate fixed prosthesis (Figs 1g and 1h). After a 6-month healing period, the grafted site was exposed. The mini dental implants were removed with a manual wrench. Favorable vertical and horizontal bone augmentation was observed (Fig 1i). Three hydroxyapatite-coated implants (Tapered Screw-Vent, Zimmer Dental) were placed, and a provisional prosthesis was delivered on the day of surgery. After 3 months of progressive loading, the definitive metal-ceramic prosthesis was cemented (Fig 1j). An esthetic result was achieved.

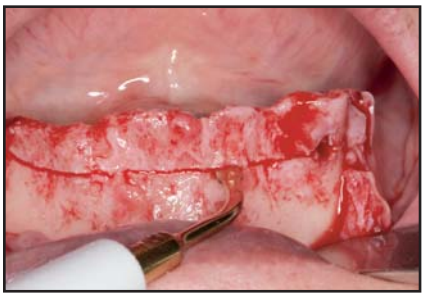


Fig 2a (left) *Patient 2. The anterior mandible is exposed and a very sharp alveolar crest is observed. A piezoelectric osteoplastic scalpel is used to remove the sharp alveolar crest and widen the narrow ridge. Note the clean, regular cut of the osteotomy line.*

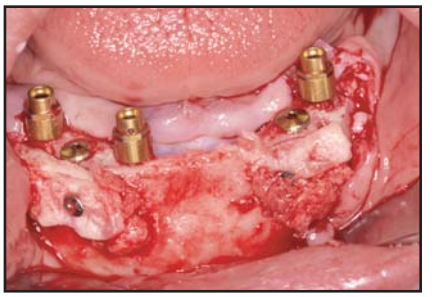


Fig 2b (right) *Two implants are placed. The bone block from the alveolar crest is fixed with a miniscrew adjacent to the implant site for horizontal bone augmentation. To provide the patient with an immediate prosthesis, three provisional implants are placed simultaneously. Crushed autogenous bone is placed into the gap between the bone block and the recipient site.*

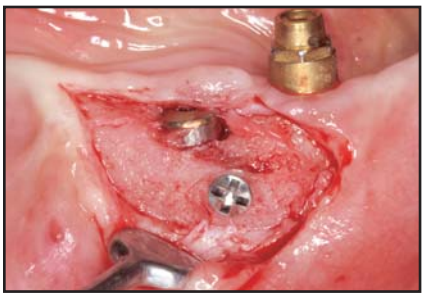


Fig 2c (left) *Implants are exposed after a 6-month healing period. Favorable horizontal bone augmentation is seen at the grafted site in the right mandible.*

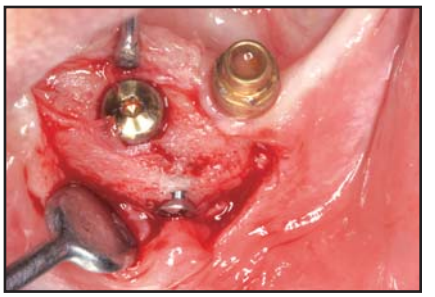


Fig 2d (right) *Favorable horizontal bone augmentation is observed in the left side.*

Patient 2: Horizontal augmentation in the anterior mandible

A 78-year-old female patient complained that her mandibular denture was unstable. An implant-supported overdenture was therefore planned. However, the preoperative computerized tomogram showed severe horizontal bone resorption. The anterior mandible was exposed, and a very sharp alveolar crest was observed. A piezoelectric osteoplastic scalpel was used to remove the sharp alveolar crest and widen the narrow ridge (Fig 2a). Two hydroxyapatite-coated Replace Select implants (Nobel Biocare) were placed. In addition, three provisional implants with ERA abutments (Sterngold Implamed) were placed to provide the patient with an immediate fixed prosthesis (not tissue supported).

Insufficient bone width was observed at the buccal aspect of the site, adjacent to the implants. A cortical autogenous block was harvested from the alveolar crest and fixed with one miniscrew for horizontal ridge augmentation (Fig 2b). Crushed alveolar bone was grafted into the gap between the bone block and the recipient site. Periosteal releasing incisions were made, and tension-free suturing was achieved.

The patient's old denture was modified and adapted to the attachments of the provisional implants on the day of surgery. The implants were exposed after a 6-month healing period. Favorable horizontal augmentation was seen at both grafted sites (Figs 2c and 2d). The definitive implant-supported overdenture used Locator attachments (Zest Anchors) and was delivered after 6 weeks of soft tissue healing. The provisional implants were removed just before delivery of the definitive overdenture.

Discussion and conclusion

The Piezosurgery System uses ultrasonic vibration to work only on hard tissue, not on soft tissue. Piezoelectric surgical devices do not cause soft tissue lacerations or burns during osteotomy. In addition, the Piezosurgery device reduces the frequency of membrane perforation during

osteotomy in sinus bone grafting and causes minimal or no damage to nerves and blood vessels during nerve lateralization procedures because of its ability to cut selectively.[11–15] Piezoelectric surgery systems make micrometric bone cuts deep in the oral cavity, resulting in precise and easy-to-control osteotomies, in contrast to rotary burs or reciprocation saws. The small handpiece and scalpel ease access to the oral cavity. The Piezosurgery system can split a very narrow ridge with minimal loss or perforation of bone.[9,16] In addition, this device reduces patient fear and stress during surgery performed under local anesthesia because it makes much less noise and vibration than conventional rotary instruments. The use of provisional implants with block grafts is very useful to the patient. Placement of provisional implants with block grafts means that patients can wear a prosthesis during the healing period, making recovery quicker. The provisional implants do not interrupt bone healing or osseointegration of conventional dental implants.[17]

Acknowledgments

The authors wish to thank Drs Vijay Pruthi and Jun for editorial assistance.

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