

Sinus Augmentation at the Time of Molar Tooth Removal: Modification of Jensen Technique

Michael S. Block, DMD

When a maxillary molar tooth needs to be removed, the treatment plan often includes subsequent dental implant placement. However, there may be less than 5 mm of bone available in the central fossa region of the proposed implant site. This report describes a technique to use a precise osteotomy within the maxillary molar socket to mobilize a segment of bone and superiorly raise it to provide increased alveolar bone height using grafting. This technique eliminates the need for lateral window surgery.

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When a maxillary molar tooth needs to be removed, the treatment plan often includes subsequent dental implant placement. However, owing to invagination of the sinus into the furcation of these non-restorable teeth, there may be less than 5 mm of bone available in the central fossa region of the proposed implant site. If the molar tooth with less than 5 mm of bone is removed and the root sockets are grafted, there will still be a lack of vertical bone for simultaneous implant placement and sinus elevation methods through the implant preparation site. Jensen et al¹ reported a technique that used osteotomes to create an island of bone within the maxillary molar extraction socket. This mobilized bone was gently tapped to raise it superiorly, creating increased vertical height of the alveolar bone in the molar extraction site. In their report, no grafts were placed and patients had implants placed after bone had formed. This technical note describes a modification of the technique to have more precise control of the osteotomy of the bone bordered by the root sockets. This technique eliminates the need for lateral window surgery.

The concept is a relatively low-morbid method to restore a maxillary molar site that has a tooth in need of removal with limited vertical alveolar height of bone present before tooth removal. By intentionally intruding the bone superiorly and grafting the deepened socket, the result is sufficient bone for routine implant

placement or to provide at least 7 mm of bone height that can be elevated again when the implant is placed.

Preoperative evaluation of patients who need their second premolars or molars removed will have a routine medical history and physical examination. A cone-beam computed tomographic scan is used to determine bone quantity in the tooth site. Molar tooth roots can protrude through the sinus floor, which after root removal can increase the prevalence of sinus membrane perforation from adhesion of the membrane to the sinus floor. In addition, the presence of septi or convoluted bone surfaces increases the incidence of lateral window complications owing to the difficulty in raising the sinus membrane.

Jensen et al reported their experiences with intentional intrusion of the inter-radicular bone after the extraction of 20 maxillary molar teeth. They used straight osteotomes to create the osteotomies and elevated the bone with gentle tapping. When found, sinus perforations were covered with oxidized cellulose. After 4 months of healing, implants were placed and later restored successfully. The technique increased vertical dimension approximately 4 mm on average and allowed placement of longer endosseous implants.

As an extension of their technique, a precise bone cutting method using a piezosurgery device is used, and after elevation of the bone, a graft is placed. The

Private Practice, Metairie, LA

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Address correspondence and reprint requests to Dr Block: Center for Dental Reconstruction, 110 Veterans Memorial Boulevard, Metairie, LA 70005-4948; e-mail: drblock@cdmola.com

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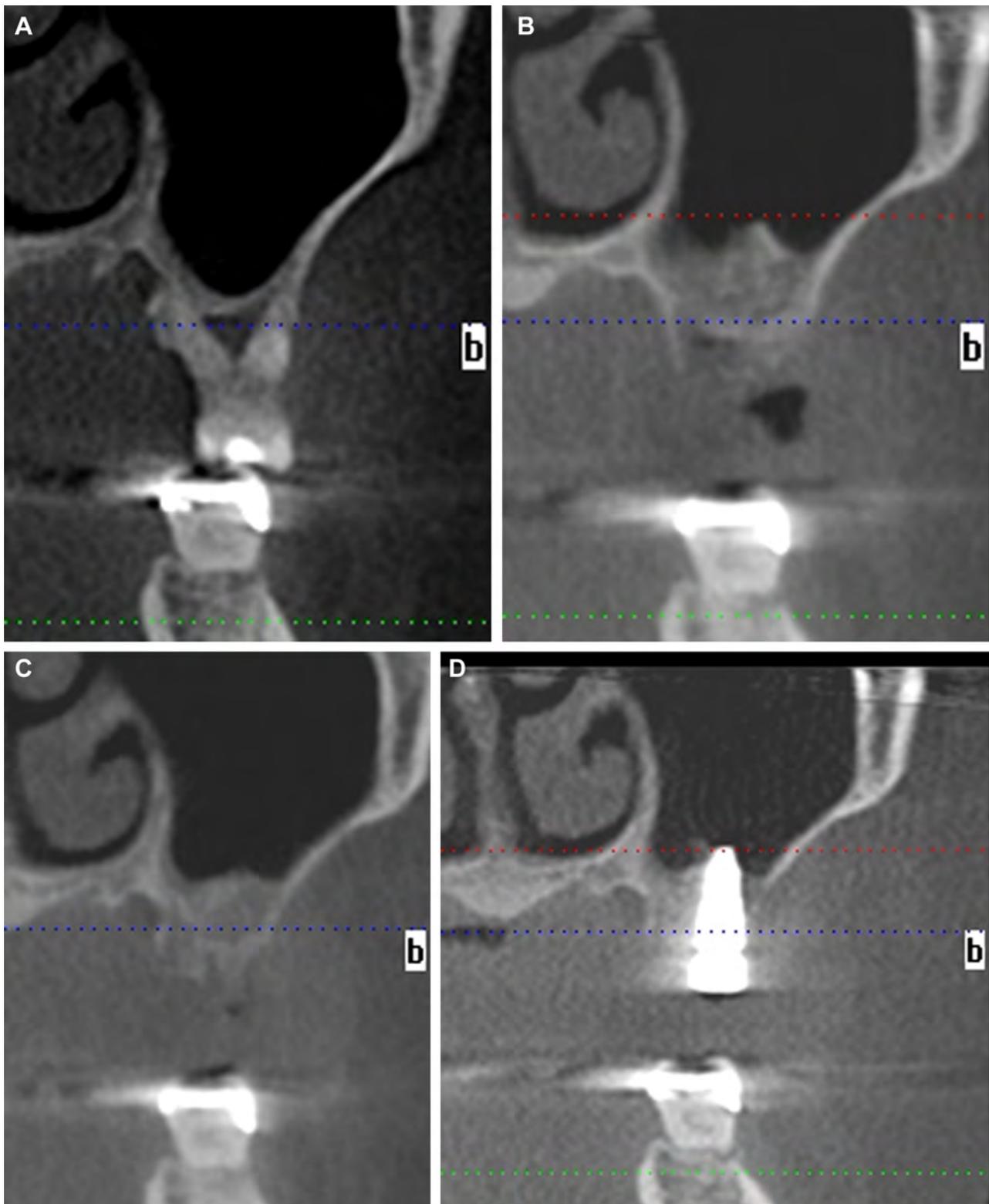


FIGURE 1. A, Preoperative cross-section showing 2.5 mm of bone present in the furcation of a maxillary molar before tooth removal. B, Cross-section immediately after extraction and intrusion showing vertical height augmentation with greater than 14 mm of ridge height. C, Three-month follow-up cross-section image showing 12 mm of ridge height. D, Implant placement 5 months after tooth removal and intrusion with graft procedure.

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FIGURE 2. A, Occlusal view of first molar sockets after roots were removed. Note the presence of the intact sinus membrane at the apical region of the buccal roots. B, Occlusal view after piezosurgery serrated tip was used to create osteotomies connecting the root sockets. C, Occlusal view after gently elevating the furcation bone superiorly. D, The allograft in place. E, The flap was released and closed with resorbable sutures.

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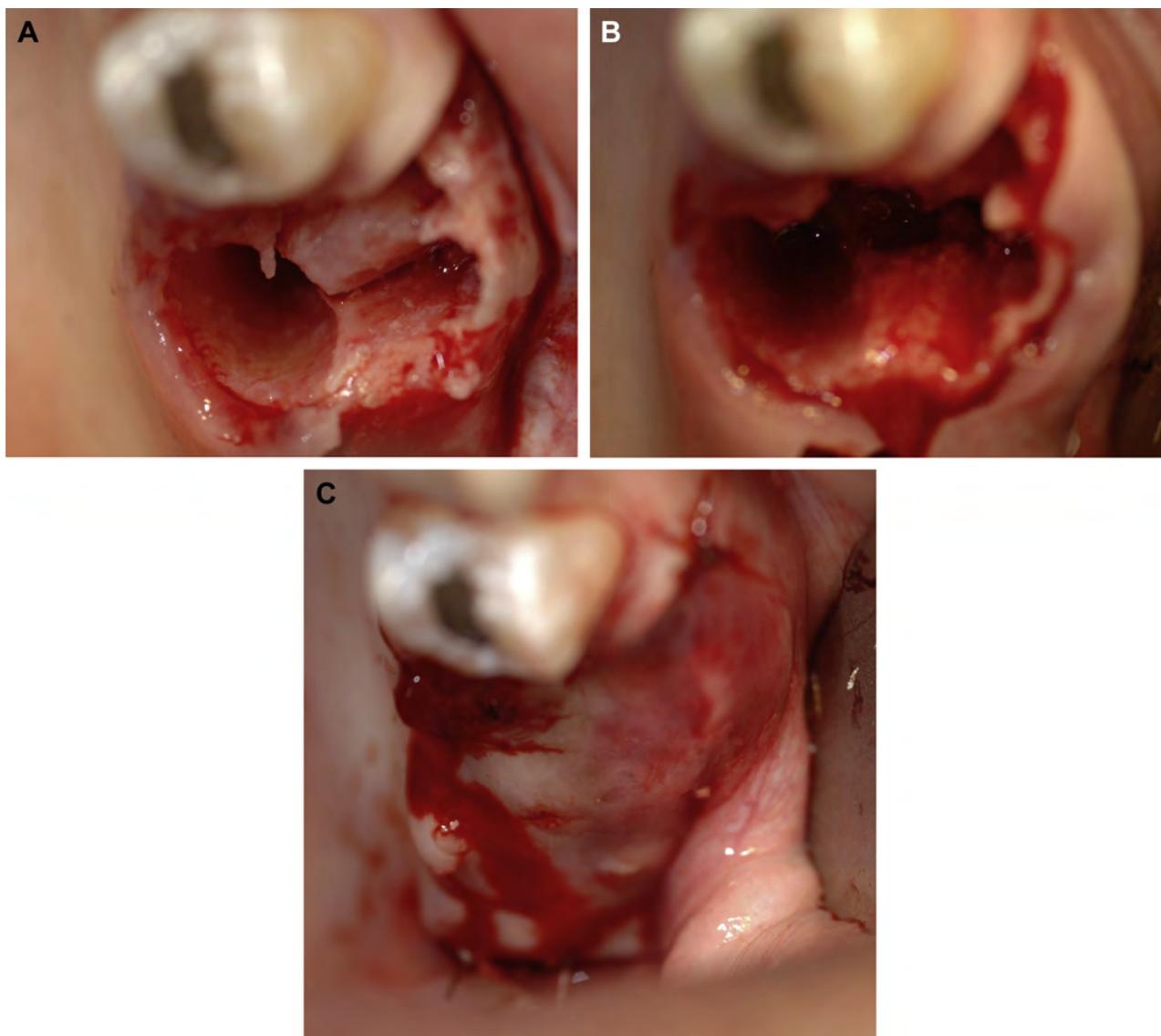


FIGURE 3. A, The maxillary first molar was carefully removed and the osteotomies were made, creating a mobile segment of bone between the root sockets. B, The mobilized bone was gently tapped superiorly to create 8 mm of vertical socket depth. C, After the graft was placed, the flap was released and closed with 4-0 resorbable sutures.

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incisions that are made include a vertical release so a full-thickness flap can be elevated. The periosteum is incised and the flap is released so it can be closed without tension, covering the graft.

Patient Selection Criteria

A cone-beam computed tomographic scan is taken at the preoperative consultation visit and the thickness of the bone in the molar furcation is measured (Fig 1). If less than 7 mm of bone height is present, elevation of the socket will be performed. If greater than 7 mm of bone is present, then the socket can be conventionally grafted and elevated further at the time of implant placement.

The sinus is inspected on the cone-beam computed tomographic scan. It is common to have sinus membrane thickening in a patient with maxillary molar problems.² For this case series, if the sinus membrane thickness was limited to less than 6 mm, then sinus elevation was performed. If greater than 6 mm, then a staged approach was used to avoid sinus infection.

Patients who smoked cigarettes were staged with tooth removal and grafting the sockets, but without sinus elevation. If there was purulent exudate present, then the procedure was staged. Patients with a history of radiation to the mouth, autoimmune therapy, steroid use, uncontrolled diabetes, or other systemic disease that would adversely affect bone healing

Table 1. VERTICAL HEIGHT MEASUREMENTS BEFORE AND AFTER INTRUSION PROCEDURE FOR 10 PATIENTS

	Bone Height Before Extraction (mm)	Bone Height Immediately After Extraction (mm)	Bone Height 3 mo After Procedure (mm)
Mean	4.4	9.3	8.7
Standard deviation	1.3	2.1	2.4

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were staged with straightforward socket grafting without sinus elevation at the time of tooth removal.

Surgical Procedure

Local infiltration is used for anesthesia. A sulcular incision is made with vertical release incisions while avoiding the papilla on the adjacent teeth. A flap is elevated only on the facial aspect to expose the junction of the tooth to labial bone. A periosteal release is performed to allow for passive flap rotation to cover the mesial and distal buccal root sockets.

The tooth is removed with the aid of a piezosurgery unit with a periosteal tip to preserve the bone. If necessary, the tooth is sectioned with a small fissure bur to avoid loss of the labial cortical bone. After the tooth roots have been removed, granulation tissue is carefully removed while taking care to avoid damage to the sinus membrane if it is visible through the root sockets (Figs 2, 3).

The piezosurgery (Piezosurgery Inc, Columbus, OH) unit is used to create precise osteotomies. The serrated tip is used to gently cut through the bone between the 2 buccal root sockets and then connect the cuts to the palatal root socket. Care is taken to cut through the bone, but not through the membrane. Loss of resistance is used to limit the depth of the cuts. The bone segment bordered by the root sockets should be mobile at this point of the procedure. A round osteotome with a flat tip is used to very gently superiorly raise the bone segment 4 to 5 mm, resulting in a socket deeper than 7 mm. The vertical bone height can be raised further when the implant is placed through a simple implant site preparation sinus elevation.³

After the segment of bone is mobilized and gently elevated, the graft is placed. No effort is made to elevate the membrane further to avoid membrane perforations. Because the root sockets are simultaneously grafted, the result will be a flat but thickened alveolus with adequate dimension for implant placement. The graft material chosen is at the clinicians' preference. The author has used allograft alone, xenograft alone, or allograft mixed with recombinant bone morphogenetic protein (Medtronic, Minneapolis, MN). This small case series does not allow for evidence-based discrimination between graft materials.

The gingival flap is closed with minimal tension. If the ridge has a prominent vertical facial morphology, a piece of collagen is placed over the palatal root socket, which has been grafted with an osteoconductive material, with the edge of the flap limited to cover only the buccal root sockets. The patient is given sinus precautions instructions and antibiotics and advised to spray the nose with a decongestant aerosol to maintain the opening of the os for drainage.

Upon healing the patient usually can have implants placed into these sites with intra-alveolar sinus elevation for another 3 to 4 mm of bone height development or might have sufficient height for routine implant placement.

Retrospective Evaluation

Ten consecutive patients treated with this method had vertical height measurements made using cone-beam computed tomographic cross-sectional images. The furcations of the molars were identified and vertical bone height was measured. Measurements were made immediately after intrusion of the bone at the time of tooth removal and 3 months after the procedure to verify bone height before implant placement. Implant lengths also were recorded. Five patients had 9-mm-long implants, 1 patient had a 10-mm-long implant, and 4 patients had 11-mm-long implants placed and restored. All patients required small secondary sinus floor elevation through the implant preparation site.³ No implants were lost. No patients required lateral window approaches for sinus augmentation. Implant placement follow-up ranged from 6 months to 2 years. No long-term cone-beam computed tomographic scans were taken to avoid excessive radiation to the patient (Table 1).

Discussion

When patients require a maxillary molar extraction, the replacement of this tooth with a dental implant is often desired. The patients' desire is to accomplish this task with minimal chair time, minimal pain, and minimal loss of time from work. They also want to avoid complications. Perforation of the maxillary sinus membrane can occur secondary to the tethering

of the membrane to the sinus floor in the locations of previous root tips, septi, thin membranes, or iatrogenic reasons. By elevating the bone in the furcation region at the time of tooth removal, an appropriate amount of vertical bone height can be established to allow a simple and low-morbid second intrusion procedure to place implants of sufficient length. This eliminates the need for many lateral window approaches.

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