Clinical pearls for surgical implant dentistry: Part 3

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Clinical Pearls for Surgical Implant Dentistry: Part 3

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This is Part 2 of a 4-part article series. Part 2 of Dr. Greenstein's article was published in the August 2010 issue of Dentistry Today *and can be found in our archived articles at our Web site, dentistrytoday.com. This, and all future articles that are presented in multiple parts, will now be available to our readers for review in their entirety at dentistrytoday.com. This is being done to help those readers who may have missed a portion of any multiple-part article, and will also facilitate the ability to review a complete article in its entirety for others.*

In part 1 and part 2 of this 4-part series of articles, clinical pearls related to diagnostic procedures and clinical pearls related to implant insertion were discussed, respectively. In this, the third part of this series, adjunctive implant procedures will be addressed.

REMOVAL OF A TOOTH

There are several methods for tooth removal that can help avoid damage to the buccal plate of bone. This is particularly important in the aesthetic zone. Patients present with either of 2 extraction scenarios: a tooth with an intact crown or one that is broken subgingivally. If the tooth is intact, a periotome can be used at a 20° angle (to avoid slippage) to facilitate extraction of the tooth. Work around the whole tooth and release periodontal fibers to the osseous crest. Place the instrument into the periodontal ligament (PDL) and work it apically. It is possible to reach two thirds of the root length. Do not use a forceps until there is significant tooth mobility. However, this procedure can be time-consuming and is not always effective.

There are other methods that can be used to manage intact and broken teeth. If the crown is intact, cut it off at the osseous crest. Drill into the pulp chamber with a high-speed, long, thin, pointed diamond (10 mm long) (No. 859 diamond [Brasseler USA]) and section the tooth mesiodistally. Then, remove the sections. This avoids destroying any bone.

Another technique is to take a long, thin diamond and go around the tooth on the mesial, distal, and the palatal (if the bone is thick). To preserve bone, it is preferable when creating a trough around the tooth to cut slightly into the tooth rather than the adjacent bone. This will provide room for a periotome or a small-diameter elevator.

Surgical blades can facilitate tooth removal. A rib carbon blade, which is stronger than regular blades (Bard Parker Rib Back, carbon No. 15), can be forced down 2 mm into the PDL. Drive it down between the tooth and the bone with pressure, then use a periotome. Another efficient method to remove a tooth employs a regular No. 15 blade with a mallet (Figures 1a to 1c). However, this technique must be done carefully, and a finger rest needs to be employed. Place the blade into the PDL and gently mallet it down several millimeters. Do this several times on the mesial, distal, and palatal aspect of a tooth. After there is some mobility, an elevator can be used to deliver the tooth. Multirooted teeth such as molars should be sectioned prior to removal to avoid damaging bone that can occur when luxating a tooth buccolingually. After an extraction, the site should be carefully debrided to remove granulomatous tissue.

REMOVAL OF AN IMPLANT

A trephine can be used to remove an implant; however, this destroys a lot of bone. Alternately, if feasible, it is beneficial to penetrate 360° around the implant with a thin diamond bur to the full length of the implant. If the lingual or buccal plate of bone is thin, it is still prudent to trough around the whole implant. Otherwise, when the implant is elevated, there is risk of fracturing an area of bone that maintained osseointegration.

SEQUENCING THERAPY: GUIDED BONE REGENERATION

In general, it is advisable to complete augmentation procedures in the aesthetic zone *prior* to implantation to ensure that the desired results are obtained. After an osseous defect is debrided for guided bone regeneration (GBR) or a ridge is prepared for augmentation, it is prudent to release the flaps prior to placing a bone graft to ensure that primary coverage can be attained without disturbing the bone graft. Keep in mind that vertical ridge augmentations should be done to the height of the anticipated papilla, not to the facial height-of-bone desired on the mid buccal. Periosteal fenestration, without penetrating deeply into the tissue at the base of the flap, facilitates tissue advancement (Figure 2).[1]

Scoring the periosteum every 3 to 5 mm apical to the mucogingival junction may contribute to additional flap release. To attain adequate flap advancement for a large augmentation, the scalpel blade should be used parallel to the outer surface of the flap to dissect muscle fibers. Hold the flap under tension with a tissue forceps and score the periosteum laterally (insert the scalpel several millimeters into the tissue) across the whole flap. (Be careful not to perforate through the outer surface of the tissue.) Then, a curved hemostat can be inserted into the muscular layer and spread from the closed to the open position to stretch and separate muscle fibers. The amount of

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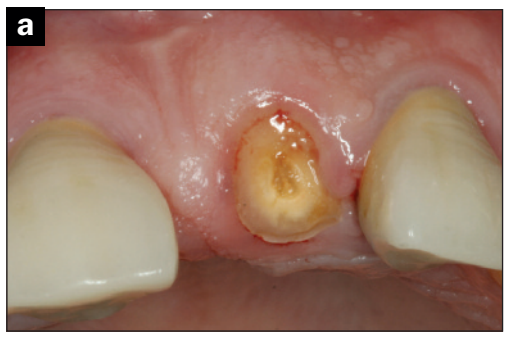
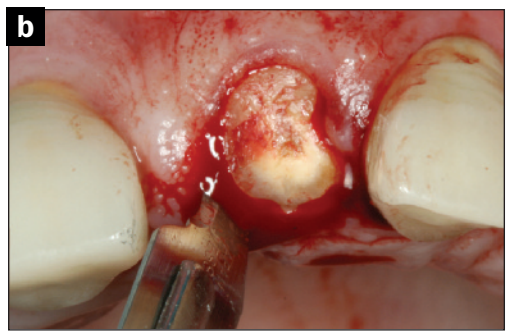
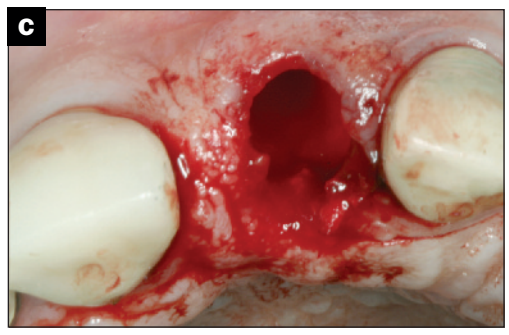






Figures 1a to 1c. Extraction of a tooth using mallet and scalpel. Use a finger rest.

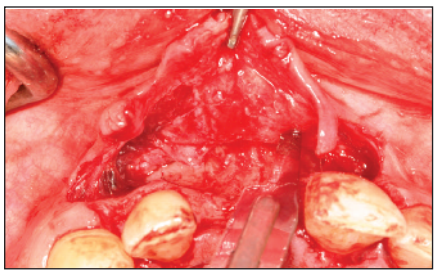
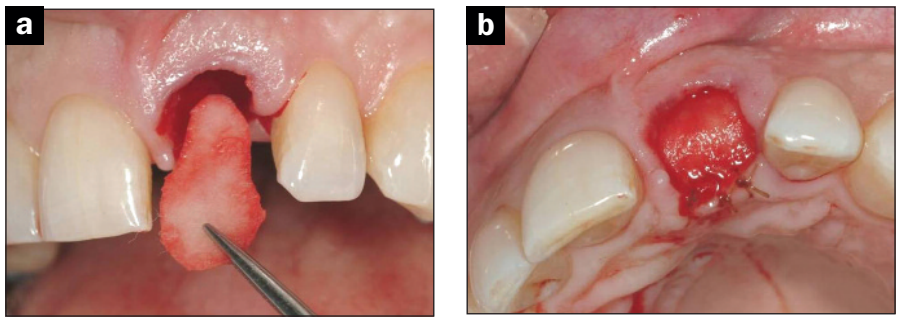


Figure 2. Score the periosteum (1.0 mm deep) at the base of the flap, while the flap is held under tension. Greater release can be attained with multiple, or deeper incisions.



Figures 3a and 3b. Barrier (in shape of an ice cream cone) being inserted into the socket (a). Then, it is sutured into place on the palate (b).

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release should be checked, and the buccal flap should be able to be pulled 3 to 5 mm beyond the original incision line. Note that this procedure may result in additional pain, edema, and ecchymosis for the patient. Furthermore, vital structures (eg, mental nerve) may be located in the subjacent tissues and must be considered when dissecting to attain flap advancement.

Next, a template is used to develop the optimal membrane shape. It should cover approximately 3 mm of bone beyond the grafted area. The anticipated size of the barrier should take into account that bone, barrier(s), and tenting screws (if used) require that the barrier be considerably larger than the area of the bone being measured for augmentation. As a general rule, when defining the extent of the barrier on the buccal or lingual surfaces, try to end it on prominent aspects of the adjacent bone; this can aid in tenting the barrier. After the barrier is trimmed, it is a good idea to tack one side (buccal or lingual) into place before delivering graft material. (Barrier resorption times can be found in the Table). Six months should be allowed for calcification of the graft material. Subsequent to bone placement, the barrier should be tacked down (secured) under the flap on the opposite side. A suture material that provides prolonged suture resorption time (eg, Vicryl sutures) should be selected. Note that with GBR procedures, it is important to understand the biology of these therapies. From this will stem the philosophy of trying to accomplish one small miracle at a time. In general, horizontal bone augmentation is easier to accomplish than vertical augmentation. Some authors have suggested that around 3 mm of vertical bone augmentation (range of one to 5 mm) is predictably attainable.[2]

SOFT-TISSUE AUGMENTATION AT IMPLANT PLACEMENT WITHOUT GRAFTING

The situation may arise when there is a discrepancy in the gingival height on a tooth and the adjacent implant site. If the ridge is more apical than the gingiva on the contiguous tooth, this can be corrected at the time of surgery. Place a tall healing abutment on the inserted implant and advance the flap, thereby submerging the healing abutment and gaining several millimeters of gingival vertical height.[3] Similarly, when a papillary area is deficient, it is possible to attain soft-tissue enhancement by submerging a healing abutment during implant surgery. Subsequently, the soft tissue can be molded to have better papillary form.[3]

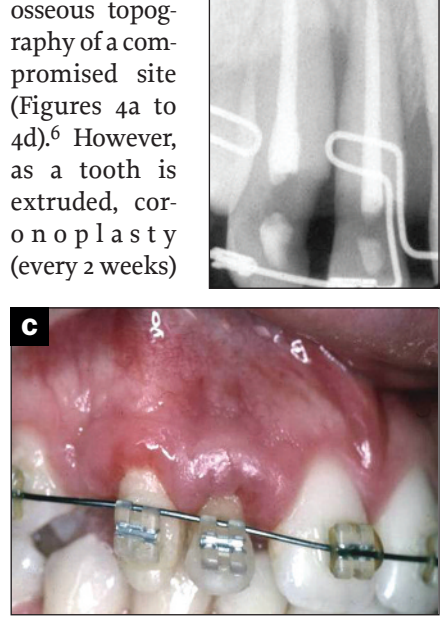
SOCKET PRESERVATION: DEFECTIVE BUCCAL PLATE OF BONE

If the buccal plate of bone is defective after an extraction at a future implant site, a bone graft is needed to restore the defect. However, bone placed into the alveolus without a barrier (GBR) is not effective since epithelium and connective tissue invades the graft and bone will not form. Accordingly, a resorbable barrier in the shape of an upside-down ice cream cone can be inserted within the alveolus to provide a buccal retaining wall for the graft without raising a full thickness flap (Figures 3a and 3b).[4] The narrow part of the barrier (representing the "cone" part) is placed several millimeters past the buccal dehiscence into the socket and extended laterally, mesially, and distally, 3 mm onto the bone. The rounded part of the barrier (representing the "ice cream") is tucked under the palatal flap, and then the barrier material should be sutured into place on the palate (eg, BioMend Extend can be sutured, whereas Bio-Gide and Ossix cannot be sutured). The buccal aspect of the barrier does not need to be sutured into place since it will be secured by the packed small particle bone graft.

The major advantage of the described procedure is avoidance of raising a flap that could result in additional resorption of the buccal plate and recession. However, if it is necessary to elevate a flap for visualization or barrier placement, then it should be done without incising the papillae to minimize additional bone resorption or recession.[5] Papilla sparing incisions should be made leaving 1 mm width of the papilla intact to the adjacent teeth.

Orthodontic Extrusion of Teeth

Recession and bony defects adjacent to hopeless teeth can be corrected prior to implant placement. Orthodontic extrusion for approximately 8 to 12 weeks followed by 4 to 6 weeks of stabilization can align disharmonious gingival margins and improve the osseous topography of a compromised site (Figures 4a to 4d).[6] However, as a tooth is extruded, coronoplasty (every 2 weeks) may be needed to accommodate the lengthened tooth. After orthodontic movement, the bone should be allowed to mature for 3 to 6 months before it is used for implants because it is not fully calcified, and the apical area needs to fill in with bone.[7] When extrusion is performed, the mucogingival junction will usually maintain its position if it is initially apical to the crest of bone. Accordingly, the zone of keratinized tissue will be increased as the tooth is extruded.[8] In addition, as the tooth is extruded, the sulcular epithelium becomes everted and appears reddish (called Athertons's patch). It takes 28 days for it to become keratinized.[9] Preceding extraction of the extruded tooth the gingival margin should be one to 2 mm coronal to the gingival margin of the planned implant restoration to accommodate post-extraction recession.



Figures 4a to 4d. Extrusion of teeth Nos. 6 and 7 was done to the level the ridge, prior to extractions and implant placement.

SINUS LIFT

If the panoramic or periapical film suggests that the inferior wall of the sinus (alveolar ridge) has a fenestration, the bone should be sounded with a probe to verify this possibility

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Table. Resorption Time for Collagen Barriers*

Commercial Name	Time for Resorption in Months
Biomend resorbs	2 months
Biomend extend	4.5 months
BioGide	3 to 4 months
Ossix	6 months
Resolut	4 to 6 months
Neomen	6 to 9 months

* Information from manufacturers of products.

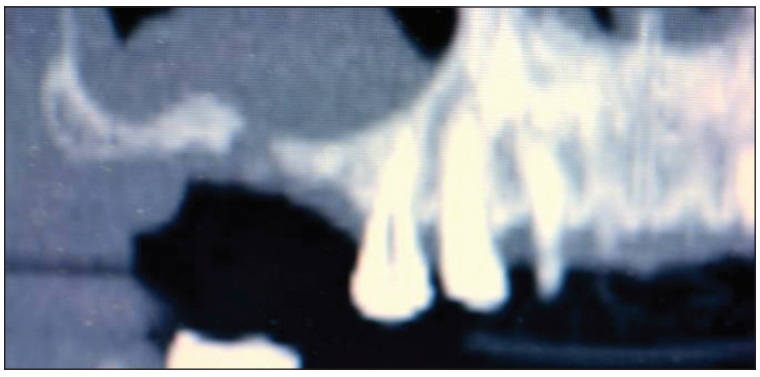

Figure 5. Bone fenestration in inferior wall of the sinus, with inflammation of the Schneiderian membrane.

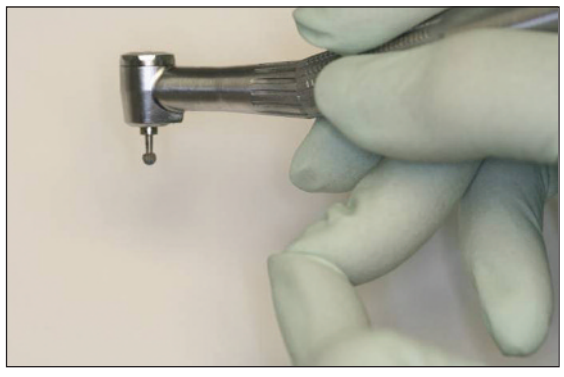

Figure 6. Finger rest for the hand holding the handpiece when developing the lateral window, if there are no teeth available to be used for support.

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prior to flap elevation (Figure 5). A computed tomography (CT) scan can provide accurate and invaluable information. If this situation is confirmed, then a split-thickness flap should be developed at this location to avoid perforating the Schneiderian membrane. Subsequently, when the membrane is elevated, the tissue over the bone perforation will need to be pushed into the sinus. This is because the sinus membrane cannot be separated from the soft tissue that was lodged in the osseous fenestration. If there is chronic inflammation resulting in hyperplasia and the membrane is very thick, consider obtaining an ENT consult before proceeding with implant placement (Figure 5). Keep in mind that the ostium is more than 20 mm (mean = 28 mm) apical to the floor of the sinus, above the first molar.[10] This fact can be used to avoid overfilling the sinus or displacing a thick membrane too far apically, which can result in occluding the ostium and inducing sinusitis.

It is critically important to use a finger rest for the hand that holds the handpiece when developing a lateral window for a sinus lift. If there are no teeth to provide a finger rest on the maxilla, extend the ring finger from the hand that holds the elevator and put out the ring finger from the hand that holds the handpiece; these 2 fingers should touch at their tips (Figure 6). This will provide a stable finger rest for the hand holding the handpiece and help avoid perforating the membrane during window preparation. It is a good idea when developing the window to use a diamond instead of a carbide bur, because it reduces the chance of membrane perforation.

When preparing the lateral window, the initial outline is deepened in bone until a bluish-purplish color (which reflects the Schneiderian membrane) is seen. The bone, within the outline, is gently pressed to determine if the window is released from the adjacent bone before elevating the membrane. This procedure can be expedited by doing the following: after the outline is created and deepened, and without fully exposing the membrane, it is possible to take a mallet and mirror handle and gently tap the handle infracturing the lateral window (Figure 7). This technique is fast and effective. However, it is important to remove any sharp edges of bone around the osteotomy to avoid tearing the membrane when it is elevated. Currently, the ability to create the lateral window and release the membrane without inducing tears has been facilitated by using the ultrasonic Piezo instrument **(AUTHOR: Manufacturer/model? Thanks! DCA)** (Figure 8).[11] The Prichard curette (Hu-Friedy) is an effective tool for finishing the membrane release. The face of the curette is directed toward the bone, and as it is moved along the bone, it creates a scraping sound. The curved back of this instrument allows the membrane to be elevated while the sharp part of the curette hugs the bone. If it is difficult to visualize the mesial aspect of the lateral window from the operator's side during membrane elevation, switch seats with the assistant to improve visual access. In general, to improve access on the anterior aspect, create the mesial vertical osteotomy as close as possible to the anterior wall of the sinus. This reduces the bony overlip **[AUTHORS: overlap?]**, thereby enhancing visualization and facilitating easier membrane release.

If a tear in the membrane occurs during the sinus lift procedure, and it is a small defect (1 to 6 mm), patch the opening with BioMend (Integra) or another type of collagen barrier. (Remember to hydrate the barrier to soften it.) Take a piece large enough to overlay the tear by several millimeters. Fold it in half, insert it into the sinus, and when the barrier springs open, it creates an effective patch (Figure 9). When a tear in the Schneiderian membrane occurs along the periphery of the window, and it is difficult to re-engage the membrane, before the tear elongates, extend the osteotomy several millimeters in bone, away from the original site (Figure 10). Remove the bone over the membrane to attain better visibility and accessibility, and re-engage the membrane where it is not torn.

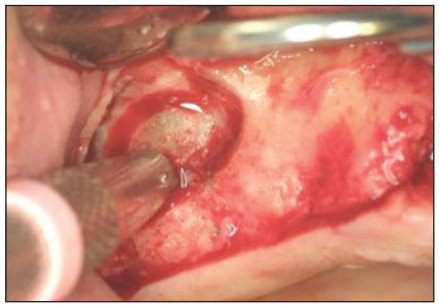

Figure 7. After the outline of the lateral window has been scored in the bone, the lateral plate of bone can be tapped in with a mallet and an instrument.

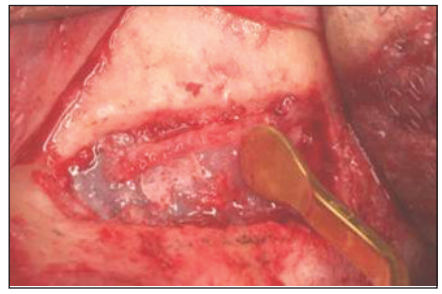

Figure 8. Piezo Ultrasonic Device, used for creating the osteotomy.

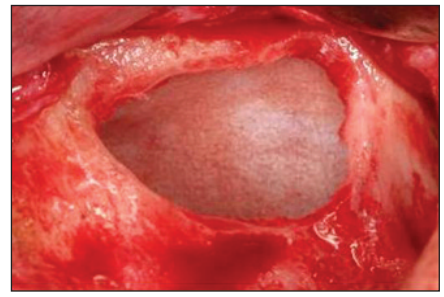

Figure 9. Repair of a perforated Schneiderian membrane with a collagen barrier.

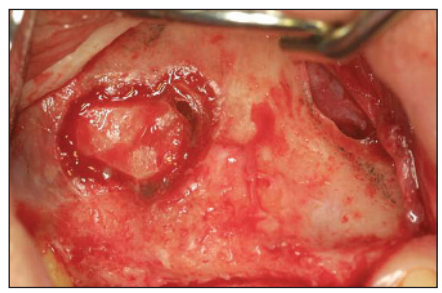

Figure 10. Extension of the border of the osteotomy to facilitate re-engaging the perforated membrane.

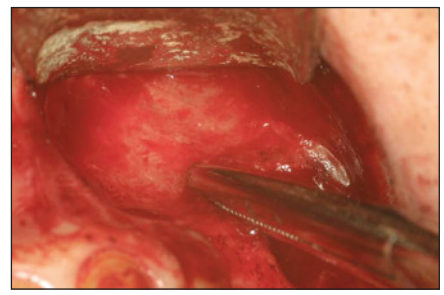

Figure 11. Clamping bone to crush an intraosseous artery encountered during lateral window preparation.

Excessive bleeding can occur due to several reasons when developing a lateral window. It is possible to sever a blood vessel that runs anteroposteriorly along the membrane (anastomosis of branches of the posterior superior alveolar and infraorbital artery), or to cut an intraosseous artery in the lateral wall of the sinus.[12,13] Twenty percent of the time, intraosseous arteries are less than 16 mm from the crest of the ridge and may need to be dealt with during lateral window preparation.[14] Bleeding from the membrane can be managed by placing gauze that is saturated with anesthetic solution (containing 1/50,000 epinephrine) directly onto the membrane. Hemorrhage from the bone requires direct pressure with an instrument or it can be touched with a cautery unit (eg, Bovie). If the osteotomy is developed, displace the membrane and clamp the bone with a mosquito hemostat, thereby crushing the bone and occluding the bleeding blood vessel (Figure 11). Sometimes it is necessary to continue preparing the window, despite the bleeding, until the membrane is displaced and the bone can be clamped. Have the assistant place the suction tip adjacent to the bleeding site to maintain good visibility. If an intraosseous artery is detected on a CT scan prior to commencing the lateral osteotomy, and it is possible to avoid it, create the lateral window below the artery, elevating the membrane internally in a superior direction.

Septa may be found in 31% of the maxillary sinuses, and they usually do not compartmentalize the antrum.[15]

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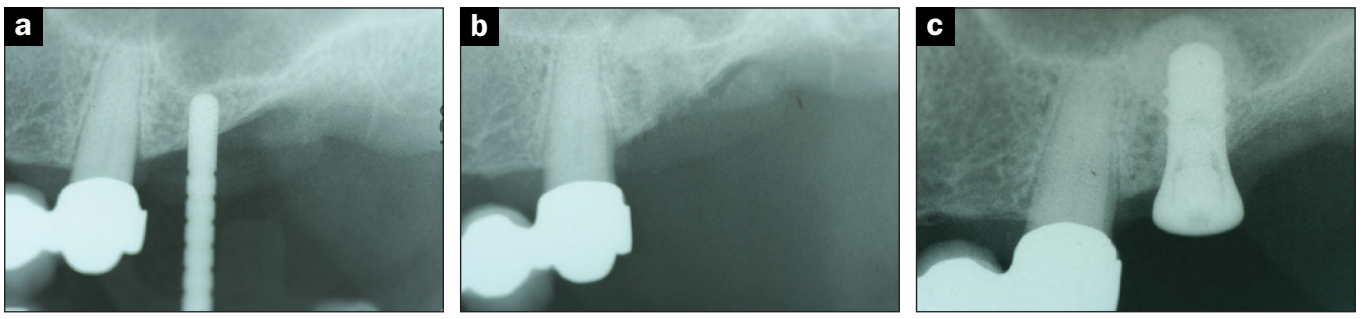

Figures 12a to 12c. Osteotome technique: Drill one mm short of the subantral floor **(a)**, bone delivered via the osteotomy **(b)**, and the implant is inserted **(c)**.

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If present, they frequently are partial septa and enlarge as they proceed medially. When septa are present, it is advantageous to completely remove the lateral bony wall to attain better access for membrane elevation. Over partial septa, membrane release should be done laterally to medially on each side of the septa. Releasing the membrane anteriorly to posteriorly directly over the spine of the septa should be avoided, since the membrane is prone to tearing. If there are large septa or compartmentalization of the sinus, another option is to create more than one lateral window as part of the antral opening to facilitate membrane elevation.

With regard to instruments used during a sinus elevation procedure, it is advisable to keep them separate from instruments that come in contact with saliva during flap elevation to reduce potential intra-sinus contamination. Mix and deliver bone into the sinus with instruments that have not been used in the mouth at any time. (This latter remark, with respect to not contaminating bone graft materials, is pertinent when mixing all implant materials.)

After the sinus lift is completed, a barrier should be placed over the lateral window. It should extend 3 mm beyond the window, and it can be tacked in place. Another easy method of stabilizing the barrier is to place a suture within the buccal flap at its apical extent (enter it from the lingual side and come out from the lingual side without emerging through the buccal aspect of the flap), and then go across the barrier and suture to the palatal aspect of the incision line. This will hold the barrier in position while the buccal flap is sutured to the palatal tissue. Alternately, if the barrier tends to stay in place, the flap can be pulled directly over the barrier and sutured. Applying pressure to the flap after it is sutured reduces the size of the fibrin clot. Apply pressure for 5 minutes; bleeding time varies from 2 to 9 minutes. It also helps to avoid "dead spaces." Barriers should not lie under an incision line; they may impede soft tissue healing due to decreased vascularity and can result in an incision line dehiscence.

SINUS ELEVATION USING OSTEOTOMES

There are several procedures that can aid in performing a sinus elevation. Drill 1.0 mm short of the subantral floor with the narrowest, smallest, twist drill (verify with a radiograph). Then, proceed from the smallest to the largest twist drill that would normally be used before implant placement. To preclude the osteotome from entering the sinus, set the depth stop on the osteotome so that it will engage the osseous crest when the osteotome tip is 1.0 mm shy of the subantral floor. At this juncture, add bone to the osteotomy, then infracture the cortical bone with the osteotome (tap it with a mallet) (Figures 12a to 12c). Dip the osteotome in saline before using it each time, as it facilitates a smoother entry into the osteotomy site. If there is a perforation of the Schneiderian membrane, replace the flap, and after 8 to 12 weeks, the membrane will be healed so that the area can be re-entered. The second option is to initiate a lateral window procedure, repair the membrane as previously described, and place the implant. Therefore, it is advisable to have consent for both procedures.

When the subantral floor is on a slant as opposed to being flat, drill the osteotomy 1.0 mm short of the most inferior aspect. Increase the twist drill size to what would normally be used prior to implant placement. Now take a small osteotome, angle it to the section of bone that was thicker, and try to break through with a narrow osteotome. Then, increase the osteotome size to accommodate the planned implant. It should be noted that sloped areas of the sinus floor, as well as septa, are risk factors for perforating the membrane upon reflection.

Another variation of the sinus elevation technique (site enhancement) can be employed when there is not enough bone to stabilize an implant. Use the osteotome to infracture the subantral floor, adding several millimeters of bone and a barrier; and do *not* place the implant. Some clinicians have used trephines to create larger access portals into the sinus.[16] After the bone heals for 6 months, return to the site and place an implant, *if* enough bone is present to encase the implant. Otherwise, a sinus elevation procedure can be done again. Additional bone is added (if needed), and the implant is placed.

In an upcoming issue of *Dentistry Today*, the fourth and final part of "Clinical Pearls: for Surgical Implant Dentistry" will be presented. It will address various issues related to handling postoperative problems and review clinically relevant numbers that are important to know.

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Disclosure: Dr. Cavallaro reports no conflicts of interest.

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