## CASE REPORT

# Lateral Sinus Augmentation: A Simpler, More Predictable Approach

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### ABSTRACT

Pneumatization of the maxillary sinuses may hamper implant placement in the posterior due to inadequate available crestal height. Sinus augmentation has been advocated to develop sufficient crestal bone height to support implant placement. This article will review a simpler more predictable approach utilizing a kit to access the lateral aspect of the sinus to allow sinus grafting without damage to the sinus membrane. **Keywords:** Lateral sinus augmentation, Sinus grafting, Sinus lift.

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#### INTRODUCTION

Normal pneumatization of the maxillary sinus frequently when combined with the loss of teeth provides inadequate volume of the bone, specifically related to height to house an implant. This process is further complicated with periodontally failing when posterior teeth are to be extracted. To achieve sufficient bone height to allow implant usage, augmentation of the maxillary sinus may be required. A crestal approach for sinus augmentation may be utilized when sufficient height is present to allow the stability of the implant but a greater height is indicated. Yet, clinical situations arise where minimal bone height is present and a greater height is required to support the planned implants wherein a lateral sinus approach is indicated.

Lateral wall sinus augmentation traditionally consisted of creation of a window in the lateral osseous wall below the zygoma with a round diamond or carbide in a surgical handpiece. The desired window is outlined with a round diamond/carbide and the surgeon keeps tracing it until the membrane is visualized. As an alternative to use of the bur for window preparation, piezo has been utilized, but this is a slower process. Some potential clinical challenges present with this approach as depth is surgeon dependent, with possible risk of membrane damage. Various kits have been developed that utilize larger carbide burs that are designed to minimize potential membrane damage when this delicate tissue is contacted with depth stops to increase procedure safety. Yet, these kits still require other instrumentation to complete the procedure and ready the elevated sinus for graft placement. A kit has been developed incorporating sinus safe lateral window burs both in carbide and diamond, with depth stops, a rotary instrument to laterally enlarge the window without tearing the sinus membrane and hand instruments to complete the elevation process.

## LATERAL SINUS INSTRUMENTATION

Rotary instruments are required when a lateral sinus augmentation is planned for access through the lateral osseous wall of the sinus. Additionally, hand instruments are required to elevate the sinus membrane from the boney floor and lateral/medial walls to create an area that will accommodate the graft augmentation to be placed. For convenience, a kit has been developed with all instrumentation required for the lateral approach for sinus augmentation (Fig. 1). <sup>1</sup>Private Practice, Miami, USA

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The thickness of the lateral bone varies both by patient and location on the lateral wall. During lateral wall access, the underlying membrane has the potential of tearing and depth rings for the kits rotary carbides and diamonds improving procedure safety while decreasing complication potential during lateral wall development. Lateral access (LA) stoppers are provided in increments of 0.5–3.0 mm, in half mm increments. This indicates that how much of the rotary instrument is exposed and how much depth penetration may occur before stopping further penetration (Fig. 2). The authors recommend that LA begins with a 0.5-mm LA stopper outlining the window desired, then increasing the depth by half mm increments until the membrane is visualized, decreasing membrane tearing potential.

The "Island" burs (Fig. 3, left) are rotary instruments utilized when it is desired to have an osseous window that can be replaced over the completed lateral window following completion of the sinus augmentation or rotated to become the new sinus floor. The Island burs are provided as a diamond-coated cylinder and as a serrated end cylinder in an 8.0-mm diameter. Depth penetration is controlled utilizing the LA stoppers, decreasing the potential of membrane tearing.

"Rotary" carbides and "Diamonds" (Fig. 3, middle) are utilized with the LA stoppers to create a lateral window in the sinus. The use of these is practitioner preference with some surgeons preferring the use of a diamond, while others like the feel of the carbide when accessing the sinus membrane. The diamond is provided in an 8.0-mm diameter with a rounded end (domed) or flat end. This rotary tool allows more precision when cutting the window as it "sands" the bone verses cutting found with the carbide. The carbide sinus

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Fig. 1: Lateral Wall Sinus kit (MedEquip Dental Supplies, Jupiter, FL)



Fig. 3: Rotary instruments used in the surgical handpiece to create the osseous lateral window for sinus elevation

burs are provided in a 6.0- and 8.0-mm diameter cutting bone more aggressively than the diamond and may be indicated when sinus wall is denser and thicker. When a thick lateral osseous wall is noted prior to initiating window creation, the carbide may be utilized to start window preparation and continued with the diamond when the wall thickness has been decreased sufficiently. This approach will help in shortening the time required to create the lateral window.

"Widener" burs have a smooth wider head with a narrower diamond covered shaft and are utilized following access into the sinus to widen the window based on the geometric shape of the sinus (Fig. 3, right). The smooth head is pressed into the sinus membrane elevating it to prevent membrane damage while enlarging the window with the diamond-coated shaft. The bur is rotated at a slow speed while contacting the edge of the window with the diamond covered shaft, moving the instrument to the anterior (right side sinus) or posterior (left side sinus) moving in the direction that the instrument is rotating.

Once the membrane has been exposed and initial elevation around the margin of the osseous window has occurred, further membrane elevation is performed with hand instruments along the floor and medial wall of the maxillary sinus. These are performed with four double-ended instruments labeled TOLA II 01–04 (Fig. 4). The TOLA II-01, 02, and 03 are curved end curettes that allow the practitioner to utilize the curved end to elevate the membrane as the tips edge separates and elevates the membrane at the boney



**Fig. 2:** LA stoppers in various depth heights ranging from 0.5 to 3 mm in half mm increments, shown on a rotary bur to demonstrate how much of the bur will be allowed to penetrate the bone of the lateral wall of the sinus



Fig. 4: Hand instruments utilized to elevate the sinus membrane exposed after access through the lateral osseous window of the sinus

surface working from the osseous window internally within the sinus. One end of the TOLA II-01 is similar to the widener with a rounded blunt end adding in initiation of separation of the membrane from the bone. The TOLA II-4 has a wide scoop at one end and is utilized to carry graft material to the elevated sinus and a condenser at the opposing end aids in compacting the graft into the areas needed.

# **CASE P**RESENTATION

A 51-year-old female presented interested in replacing the missing posterior teeth in the right maxillary quadrant. Radiographs determined that insufficient alveolar height was present at the missing first molar and second premolar. Crestal height was minimal that the greater height was needed that could be achieved with a crestal approach so a lateral approach sinus augmentation would be needed to create sufficient bone to house the planned implants. The patient agreed with the treatment plan presented and was scheduled for treatment.



Following local anesthesia administration, a crestal incision was made along with a mesial vertical releasing incision (Fig. 5). A full-thickness flap was elevated to expose the lateral osseous wall of the sinus (Fig. 6).

The carbide bur may be used but a greater care is needed as there is a higher potential to tear the membrane then with the diamonds. The diamond with an LA stopper was applied to the lateral wall of the bone with irrigation until the depth stopper contacted the osseous wall. The stopper was replaced with the 1 mm stopper and continued until the membrane could be visualized (Fig. 7). Following each lateral sinus drill, the site is examined for visualization of the underlying membrane. The process is repeated, increasing the depth stopper in half mm increments until the membrane could be visualized. The dome end of the TOLA II-01 hand instrument is then used to detach the membrane from the bone at the osseous windows' margins (Fig. 8). The spoon end of the TOLA II-01 instrument is next used to continue membrane separation at the windows' margins (Fig. 9). Should a larger window be desired, the rotary widener can be used on the handpiece to enlarge the osseous window.

TOLA II hand instruments are then utilized to detach and elevate the sinus membrane keeping the membrane intact and free of tearing. Membrane elevation needs to extend along the entire



Fig. 5: A crestal incision and mesial releasing incision is made with a scalpel

sinus floor, the mesial wall of the sinus, the medial wall, and distal to where the most distal implant would be placed and superior so that sufficient height would be attained. One of the mistakes that may occur during lateral sinus augmentation is failure to elevate sufficiently medially. This will result in inadequate graft placement on the medial of the implant and could lead to implant failure following restoration and loading.

Sinus membrane integrity is tested following membrane elevation by having the patient gently inhale and exhale through their nose. An intact membrane will demonstrate movement of the membrane in the sinus visible through the lateral window with each breath (Fig. 10). When the membrane is perforated (torn), movement of the membrane will not be observed. If the membrane is not intact, sealing of the damaged membrane will need to be performed prior to augmentation placement to prevent distribution of the graft material throughout the sinus during the healing phase. If the torn membrane cannot be sealed, the procedure will need to be aborted and the membrane allowed to heal before augmentation can continue.

Various augmentation materials have been advocated and the authors' preference is the use of allograft particles mixed with PRP to create "gummy bone." To create PRP, the blood is drawn from the patient at the start of the surgical appointment and centrifuged.



Fig. 6: A full thickness flap is elevated to expose the lateral wall of the maxillary sinus in preparation for lateral sinus augmentation



Fig. 7: The domed diamond with LA stopper on the surgical handpiece to initiate window preparation



Fig. 8: The sinus membrane is visualized through the bone



Fig. 9: The spoon end of the TOLA II-01 instrument detaches the membrane around the edges of the osseous window



**Fig. 11:** The PRP clots are placed in the tray for compression to create PRP membranes



**Fig. 13:** PRP liquid is mixed with cortical bone graft material to create gummy bone

The PRP clot is removed from the centrifuged tube (Fig. 11). PRP membranes are created, which will be placed in the sinus covering the elevated sinus membrane prior to graft placement to aid in

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Fig. 10: The PRP clot is removed from the centrifuged blood in the tube



**Fig. 12:** The sinus membrane has been elevated from the surrounding osseous structure of the maxillary sinus and the membrane remains intact



Fig. 14: Sterile gauze is used to remove any residual liquid from the mixture of PRP liquid and cortical bone graft

containing the graft during healing and over the lateral window before the flap closure (Fig. 12). Liquid is then drawn from the tube and added to the allograft particles in a sterile dish (Fig. 13). The PRP



and osseous graft particles are mixed and then a piece of sterile gauze is used to remove any residual liquid from the graft mixture (Fig. 14). The authors recommend placement of a PRP membrane into the sinus prior to graft placement to decrease the potential for graft displacement into the sinus during healing. Additionally, the stem cells within the PRP membrane aid in angiogenesis into the placed graft along with the PRP that will be mixed in with the osseous graft particles.

A disposable syringe that has had the end cut off is used to introduce the graft material into the elevated sinus. The syringe is then loaded with graft material and slowing expressed into the space created between the elevated sinus membrane and the surrounding bone of the maxillary sinus (Fig. 15). A condenser is used to compress the graft against the medial, mesial, and distal walls of the sinus to avoid potential voids within the graft or between the graft and walls of the sinus. Additional graft material is added with the syringe and compressed until the entire sinus area is filled to the level of the lateral window (Fig. 16).

The PRP clots that had been placed in the box for compression have formed membranes (Fig. 17). A PRP membrane is placed over the lateral window to limit soft tissue ingrowth into the sinus augmentation during graft organization and healing



**Fig. 15:** The gummy bone is introduced into the elevated sinus with a syringe that has had the end cut off



Fig. 17: The compressed PRP membranes are removed from the box

(Fig. 18). Additionally, this also provides patient stem cells to aid in the graft organization and maturation process. The flap is repositioned to achieve primary closure of the site and sutured (Fig. 19). The maxillary sinus augmentation surgical procedure



Fig. 16: The sinus is filled with gummy bone to the level of the exterior of the lateral wall of the sinus



Fig. 18: A PRP membrane is placed to cover the lateral sinus window and the graft placed



**Fig. 19:** The flap is repositioned over the PRP membrane and underlying graft to achieve primary closure and secured with sutures

is complete and healing will process with implant placement after several months.

# CONCLUSION

When insufficient available alveolar height is present in the posterior maxilla, sinus augmentation may be indicated when implants are planned. This may present when in situations where the teeth have been missing for periods of time and resorption has occurred or teeth are being extracted as a part of treatment. The lateral window approach to sinus augmentation to create sufficient height for implant placement has been avoided by practitioners with less experience at complex osseous surgery. The simplified approach outlined with the kit makes use of lateral sinus augmentation less complex with greater safety and should be considered when implants are planned in the posterior maxilla and insufficient alveolar height is needed and a crestal approach cannot be utilized.

