Sinus Tenting for Posterior Maxillary Implant Placement

Timothy F. Kosinski, DDS

INTRODUCTION

Perceived limitations often exist when considering placement of dental implants in the posterior maxillary area. The maxillary sinus lies under the cheeks, below the eyes, and above the teeth on either side of the nose. These sinuses drain into the nose through ostia on the side of the sinus wall. These holes empty into recesses or meatuses in the nasal cavity. These meatuses are covered by turbinates, which are bony shelves surrounded by erectile soft tissue.[1] Most often, the maxillary bone in the posterior part of the arch is relatively soft, or Type IV in nature. This bone is very trabecular or porous with thin cortical plates.[2] The nature of the bone allows the skull to be lighter to be kept on the shoulders. Implant placement in this softer bone can be compromised, as initial stability of the implant is reduced as is surface integration of bone to the body of the implant. In conjunction with this situation is the fact that occlusal forces placed on teeth in the posterior of the jaw are the greatest. In summary, the bone is the weakest, yet the chewing forces are the greatest.

Nature has provided large posterior teeth. Maxillary molars consist of 3-rooted teeth, which are naturally made to withstand the occlusal forces placed on them. These roots hold up the maxillary sinus area. When teeth are extracted or lost, the support mechanism for the bone holding the sinus higher up in the mouth is also lost. We can think of the anatomy like a pole holding up a tent. When the tent pole is removed, the tent collapses. This is true to when teeth are lost—the bone holding up the maxillary sinus is also reduced, thus the sinus collapses by gravity, and the sinus appears to be bigger.

When considering implant placement to replace missing maxillary posterior teeth, the lack of bone in the area can make the procedure difficult or impossible without some more invasive surgical procedures, such as Caldwell luc sinus elevation or tenting of the maxillary sinus membrane.[3] The lateral window sinus augmentation procedure is very useful in gaining bone height but can be difficult for a less experienced dentist. It is ideal to place a wider, longer implant in the edentulous maxillary area to take on occlusal stresses; however, if there is not much bone height available, what else can be done? My personal opinion is that at least a 10.0-mm long dental implant should be placed in the edentulous posterior maxilla. The final crown fabricated over this implant needs to also have a narrower occlusal table to reduce lateral stresses placed on the implant.

Figure 1. Periapical radiograph illustrates lack of vertical height of bone under the maxillary sinus.

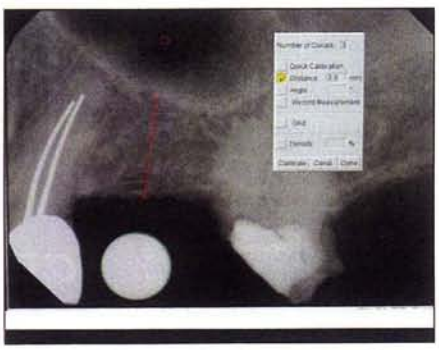


Figure 2. A 5.0-mm ball bearing was placed in wax to definitively determine precise amount of bone available; measured at 7.5 mm.

Figure 3. Use of an 8.0-mm round surgical bur and high-speed handpiece with water spray to mark the location of the implant placement, drilled through the gingiva into the cortical bone.

Figure 4. A pilot drill was used at 1,000 rpm, stopping at 1.0 to 2.0 mm below the floor of the sinus.

The maxillary sinus Schneiderian membrane can be elevated or stretched about 3.0 mm without complication. This membrane is bilaminar in design with ciliated columnar epithelial cells on the internal side and periosteum on the osseous side. Tearing of this membrane may result in sinus trauma and could affect the osseointegration of the implant. Therefore, in situations where there may be 7.0 mm (or so) of vertical height of bone, a 10-mm long implant could be considered; and, the width would be determined by the buccal-palatal dimension of available bone. Our implant is ideally placed subgingivally to achieve proper emergence profile and easy maintenance.

Placing a small-diameter or short implant in the posterior maxilla may compromise long-term stability or function and is not recommended. The use of a sinus lift procedure (created by OCO Biomedical) allows for tenting of the sinus floor to allow for placement of a properly large implant, reducing the morbidity associated with more invasive lateral window procedures.[4] An issue associated with tenting of the sinus Schneiderian membrane is proper visualization of the inferior cortical bone of the floor of the sinus and the potential for perforating the membrane with the sharp implant drills. The sinus elevation procedure described here is best used when the quality and quantity of bone in the posterior maxilla is compromised by a large sinus, which occurs when the site has been edentulous for a long time; when excessive trauma resulted during the extraction, or when

Figure 5. Periapical radiograph showing the pilot drill in place.

Perceived limitations often exist when considering placement of dental implants in the posterior maxillary area.

Figure 6. A tissue punch with center guide was used to drill through the gingiva to bone through the periosteum.

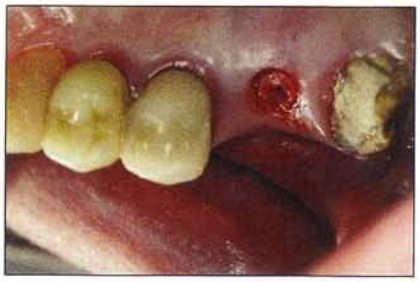
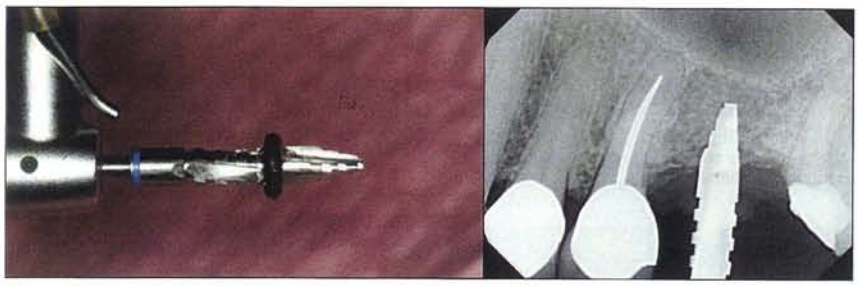


Figure 7. The punched tissue was easily removed in this flapless procedure.



Figures 8 and 9. The final osteotomy former opened the pilot hole to allow entry of the flat tip final drill.

grafting of socket sites is not done in preparation for implants at the time of extraction; and the socket is allowed to resorb naturally. It is ideal to not only elevate the sinus but also condense the surrounding bone, adding to initial stability of the implant. Techniques using digital radiography have helped in allowing us to visualize position of each drill used. The elevation of the inferior cortical bone and Schneiderian membrane can be accomplished simply and predictably.

Improvements in Implant Design and Techniques

Recent technique and design improvements in dental implantology have made our job easier and more predictable, to be sure. Long-term prognosis has improved with our modern implants, allowing greater initial stability, greater integration of bone to the surface of the implants, and better prosthetic results.

OCO Biomedical has several implant designs. Here I will discuss the ERI 2-piece system that has a body with mini-cortico thread patterns at the coronal portion of the implant, helping it lock into the cortical bone. It also has a bull nose "auger" design at the apex that condenses the bone around the tip and threads of the implant. Dual stabilization is allowed, ideal where more trabecular bone is present (such as in the posterior maxilla).

The surgical technique using the OCO Biomedical ERI implant in the edentulous posterior maxilla consists of utilizing the company's sinus lift procedure kit. The edentulous area illustrated by our case presentation is in need of sinus elevation procedures. There is vertical height of bone, but not enough to accept the 10.0 mm that, in my opinion, is minimal to restore this area of the mouth. Obviously, health conditions must be evaluated.

Figures 10 and 11. The flat tip final drill entered to the depth established by the pilot drill, 1.0 to 2.0 mm short of the sinus floor.

Figure 12. The side-cutting drill (OCO Biomedical) was taken to the bottom of the osteotomy, making a cut to the side, circumferentially around the osteotomy.

Figure 13. A piece of resorbable barrier material membrane about 4 times the size of the osteotomy was cut and then tucked up into the osteotomy site with a concave tipped osteotome.

CASE REPORT

Diagnosis and Treatment Planning

Our patient was a septogenarian in good health with a desire to replace a tooth in the maxillary first molar area. Prior to any surgical intervention, a proper diagnosis needed to be made.

A periapical radiograph illustrated a lack of vertical height of bone under the maxillary sinus (Figure 1). Using our measuring tools with the DEXIS digital radiograph, we took a 5.0-mm ball bearing and placed it in orthodontic wax. The radiograph determined the precise amount of vertical bone available—measured at 7.5 mm in this case (Figure 2). The Schneiderian membrane in the area could be predictably elevated 3.0 mm, maintaining the cortical floor. If the membrane would be elevated using the technique described below, a proper length implant could be placed.

Clinical Protocol

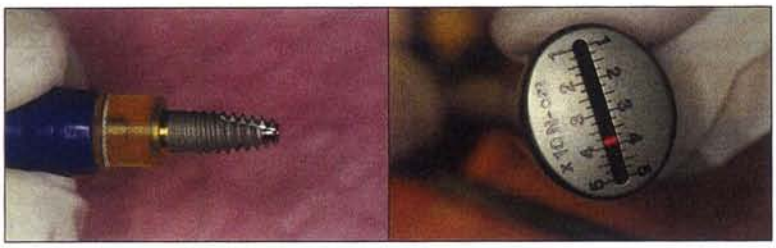
Using an 8.0-mm round surgical bur and a high-speed handpiece with sterile water spray, the location of the implant placement was marked (Figure 3). The bur penetrated through the gingiva into the cortical bone. Using the conventional bur kit (OCO Biomedical) for the ERI implant system, a 2.0-mm pilot drill was used at 1,000 rpm, stopping at 1.0 to 2.0 mm below the floor of the sinus (Figure 4). A periapical radiograph (Figure 5) with the pilot drill in place illustrated proper position. (Obviously, several radiographs could be taken in incremental drill positioning to ensure ideal placement.)

Next, Figure 6 illustrates the use of a tissue punch that was used to remove the attached gingiva from the crest. This punch penetrated through the gingiva to bone through the periosteum. This step was important to eliminate the possibility of putting gingival tissue into the final osteotomy site, which could have affected osseointegration. Figure 7 shows the nice, clean removal of the tissue from the surgical site. The final osteotomy former opens the pilot hole to allow for entry of the flat tip final drill (Figures 8 and 9). Again, we are short 1.0 to 2.0 mm from the floor of the sinus, as determined by digital radiographs. Figures 10 and 11 illustrate the flat tip final drill that entered to the depth established by the pilot drill (still 1.0 to 2.0 mm short of the sinus floor). Next, an innovative side-cutting drill (OCO Biomedical) was used (Figure 12); it was taken to the bottom of the osteotomy while making a cut to the side circumferentially around the osteotomy. With the first couple of revolutions, it chattered a bit but then it smoothed out. This side-cutting drill actually undermined the bone at the floor of the sinus.

Figure 13 illustrates the use of a collagen bioresorbable membrane (Heli-TAPE [Integra Miltex]). This membr was cut about 4 times the size of osteotomy, then tucked up into osteotomy site with a concave tip osteotome. This membrane served transitional barrier when we cre the new sinus floor. Mineralized c co-cancellous blend allograft mat was mixed with the patient blood vested from the surgical site and ta

Figure 14. Mineralized cortico-cancellous blend graft material was mixed with the patient's blood and taken to the osteotomy site.

Figures 15 and 16. With the properly sized concave tipped ostetome, the barrier and graft material were pushed up and the floor of the sinus was lifted. The osteotome was then removed and more grafting material added, pushing it up with a mallet to the desired depth



Figures 17 and 18. The OCO Biomedical ERI dental implant was threaded into the osteotomy site. The rachet/torque wrench was used to seat the implant completely (to 40 Ncm of torque), allowing for nice initial implant stability.

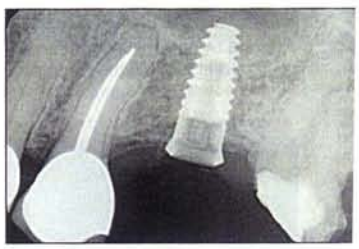


Figure 19. The implant was now in place i the chamber containing the grafted bone within the sinus.

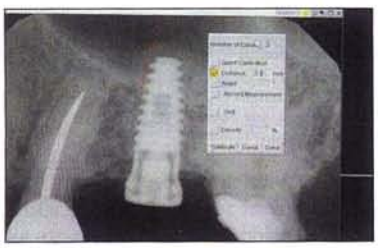


Figure 20. This image shows that 3.8 mm of sinus elevation was demonstrated.

Figure 21. After approximately 5 months of integration, the implant level impression was made and a custom abutment fabricated and seated.

Figure 22. The final restoration, a full gol crown (per patient's request) was cement into place.

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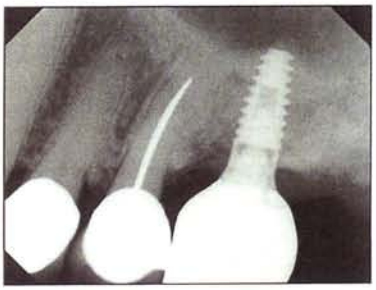

Figure 23. The final periapical radiograph illustrates proper healing of the implant after elevating the sinus membrane nearly 4.0 mm.

to the osteotomy site (Figure 14). Figures 15 and 16 illustrate the use of properly sized, concave tipped osteotomes that were used to push the barrier and graft material up into the socket. The osteotome was premeasured to allow for positioning of a 10.0-mm implant; tissue thickness was considered when setting the final length that we intended to use. In this case, we had set the screw to 12.0 mm so that we would create a 10.0-mm osteotomy site in bone as measured to the tissue crest. The osteotome was tapped, elevating the barrier and graft material upward. Because the bone 1.0 to 2.0 mm below the sinus floor had been undermined with the side-cutting drill, the bone and Schneiderian membrane were easily and predictably elevated without any tearing. Figures 17 and 18 illustrate the ERI implants as they were being threaded into the osteotomy site. The rachet/torque wrench was used to seat the implants completely. A final torque of 40 Ncm was achieved, allowing for great initial stability of the implant. Figure 19 shows the implant in place in the chamber containing the grafted bone within the sinus. Clearly, 3.8 mm of sinus elevation was achieved when measured again during the final radiograph (Figure 20). After approximately 5 months of integration, the implant-level impression was made and a custom abutment fabricated and seated (Figure 21). The patient requested a full gold crown that was fabricated by our dental laboratory team, returned to the office, and then cemented onto the prepared custom abutment (Figure 22).

Figure 23 illustrates the proper healing of the implant after elevating the sinus membrane nearly 4.0 mm. Our patient was delighted with the final result.

CLOSING COMMENTS

The clinical procedure, as outlined here, was done using a flapless technique. It was relatively painless, bloodless, and no sutures were required. Initial implant stability was achieved, and integration progressed without complication.

It is clear that although we had legitimate concerns about placing implants in the patient's maxillary sinus area, techniques now exist that allow the practitioner to have control in determining the final position.✦

References

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Dr. Kosinski is an adjunct clinical professor at the University of Detroit Mercy School of Dentistry, serves on the editorial review board of *REALITY*, and became the editor of the Michigan AGD, of which he is currently president. He received his DDS from the University of Detroit Mercy Dental School and his Mastership in Biochemistry from Wayne State University School of Medicine. He is a Diplomate of the American Board of Oral Implantology/Implant Dentistry, the International Congress of Oral Implantologists, and the American Society of Osseointegration. He is a Fellow of the American Academy of Implant Dentistry and received his Mastership in the AGD. He has received many honors, including Fellowship in the American and International Colleges of Dentists and the Academy of Dentistry International. He is a member of OKU and the Pierre Fauchard Academy. He was the University of Detroit Mercy School of Dentistry Alumni Association's "Alumnus of the Year," and in 2009 received the AGD's Lifelong Learning and Service Recognition Award. He has published more than 90 articles on the surgical and prosthetic phases of implant dentistry and was a contributor to the textbooks *Principles and Practices of Implant Dentistry* and 2010's *Dental Implantation and Technology*. He was featured on Nobel Biocare's *Nobelvision* and lectures extensively. He can be reached at (248) 646-865, drkosin@aol.com, or the Web site smilecreator.net.

Disclosure: Dr. Kosinski reports no disclosures.