Sinus Slot Technique for Simplification and Improved Orientation of Zygomaticus Dental Implants: A Technical Note

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The zygomaticus dental implant, designed by Nobel Biocare for the Brånemark System, is indicated primarily for the severely resorbed maxilla. Though the zygomaticus implant has had a remarkable success rate in a very difficult patient population, there are some shortcomings to the protocol for placement. The sinus slot technique described herein provides a simplified approach to zygomaticus implant placement, as compared to the currently recommended protocol. (Int J Oral Maxillofac Implants 2000;15:889–893)

Key words: *dental implants, endosseous dental implantation, maxillary sinus, zygoma*

The zygomaticus dental implant, designed by Nobel Biocare for the Brånemark System (Nobel Biocare, Göteborg, Sweden), was developed for use primarily for the severely resorbed maxilla. The overall success rate for the zygomaticus implant is 97%, as reported by Brånemark in an unpublished study, which included a total of 164 implants placed in 81 patients over a 10-year-time span.[1] This success certainly supercedes any previously published bone grafting/implant technique for managing the same patient population with severely resorbed maxillae.[2] Though the zygomaticus implant has a remarkable success rate in a very difficult patient population, there are some shortcomings to the protocol for its placement. The recommended LeFort I vestibular incision creates a long alveolar flap that may be more difficult to manage than a crestal incision and places the flap closure over the antrostomy. Implant placement requires extensive dissection of the zygoma, extending from the maxillary vestibule to possibly the lateral infraorbital rim and around the zygomatic buttress area. This dissection can be time-consuming, resulting in considerable postoperative edema, ecchymosis, and patient discomfort. The extensive dissection also makes pain control quite challenging during surgery, necessitating the performance of the procedure under deep intravenous sedation or, preferably, general anesthesia.

The current recommendation for zygomaticus implant placement includes a sinus window to help visualize the angulation and eventual positioning. In an already resorbed maxilla, a sinus window can further compromise the precarious bone support of the remaining dental alveolus. Finally, and perhaps most compromising, is the final position of the zygomaticus implant. As currently described, it is recommended that the zygomaticus implant emerge palatal to the residual maxillary alveolar ridge. This mandates that the final prosthesis be fabricated with a significant cantilever from the palatally positioned implants to the functional occlusal surface. The magnitude of palatal placement of the implants can adversely affect the configuration of the prosthesis.

The sinus slot technique described herein provides a solution to the shortcomings in the current Brånemark protocol for placement of zygomaticus implants.

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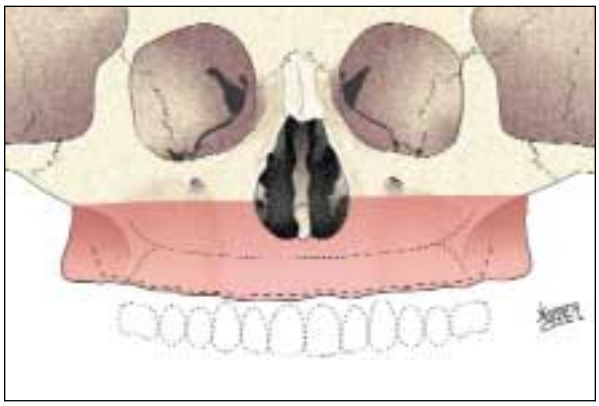

Fig 1a In contrast to the recommended Le Fort I incision, a crestal incision is performed, extending from one maxillary tuberosity to the contralateral tuberosity. A 1-cm vertical releasing incision is made at the posterior extent of the incision bilaterally.

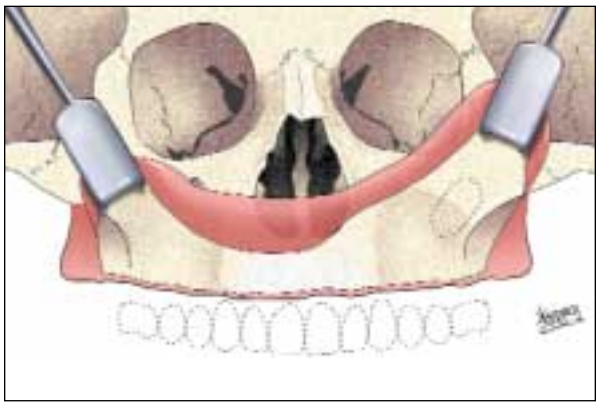

Fig 1b A comparison between the dissection needed for the sinus slot versus the recommended antrostomy is illustrated. (*Left*) The dissection extends around the base of the piriform rim up to the inferior aspect of the infraorbital nerves and around the inferior half of the body of the zygoma for the sinus slot, whereas (*right*) the dissection is carried more superiorly to the superior border of the zygomatic arch for the antrostomy. The dotted lines demarcate the positions of the sinus slot and antrostomy.

SINUS SLOT TECHNIQUE

Patient Selection

The primary indication for the zygomaticus dental implant is in the severely atrophied maxilla. However, the authors have used these implants in a wide variety of patients with varying amounts of maxillary ridge. Contraindications are very important and worth noting. Most commonly, limited interarch distance, whatever the cause, precludes this technique by limiting the proper angulation of the long drill bits. Limited access may occur in patients with temporomandibular disorders, opposing natural teeth or fixed prostheses, and/or trauma patients who have soft tissue scarring. Finally, patients with acute and/or productive sinusitis are best managed by first eliminating the sinus disease prior to zygomaticus implant placement.

Patient Preparation

The patient is prepared for surgery by brushing the teeth and oral cavity with 10% povidone iodine and rinsing with 0.12% chlorhexidine gluconate. Intravenous sedation with midazolam and fentanyl follows, and the face is prepared with 10% povidone iodine surgical scrub. Approximately 10 mL of 2% lidocaine with 1:100,000 epinephrine is distributed as follows: greater palatine foramen, infraorbital foramen, zygomatico-temporal, and zygomaticofacial areas. Additionally, for longer-lasting local anesthesia, 5 mL of 1.5% etidocaine with 1:200,000 epinephrine is distributed in a similar fashion as the lidocaine. The authors use the facial block technique detailed by Zide and Swift.[3] Local anesthesia injections are repeated on the contralateral side.

Operative Technique

A crestal incision is made extending from one maxillary tuberosity to the contralateral tuberosity. A 1-cm vertical releasing incision is made bilaterally at the posterior extent of the incision (Fig 1a). With a periosteal elevator, a traditional LeFort I exposure is accomplished, extending around the base of the piriform rim, up to the inferior aspect of the infraorbital nerves, and around the inferior one half of the body of the zygoma bilaterally (Fig 1b). This dissection is considerably less than the recommended exposure to the level of the lateral infraorbital rim and superior aspect of the zygomatic arch. The palatal mucosa is reflected only to expose the crest of the ridge.

A 703 crosscut fissure bur is then used to make a hole through the bone and into the sinus cavity at the superior extent of the contour of the zygomatic buttress. The zygomaticus implant depth gauge, which has a small "hook" at the end, is placed in the bur hole and positioned to simulate the angle of approach of the implant twist drill (Figs 2a and 2b). A second bur hole is then made on this line 5 mm above the crest of the ridge. A slot is then made that connects the 2 bur holes. The superior aspect of the slot extends to the base of the zygoma, where solid zygomatic bone is encountered. The inferior extent of the slot approximates the floor of the maxillary

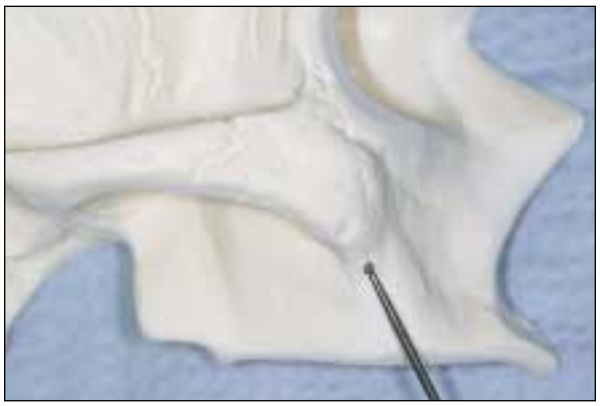

Fig 2a The end of the zygomaticus implant depth gauge is inserted into a bur hole at the superior aspect of the height of contour of the zygomatic buttress. The angle of approach of the implant twist drill can then be simulated with the depth gauge.

Fig 2b The angle of the implant twist drill approach over the height of contour of the zygomatic buttress is marked by a dotted line, with bur holes at both the superior and inferior aspects.

Figs 3a and 3b Sinus slot technique (*left*) on a dry skull and (*right*) in an actual patient.

sinus. This slot is made directly through the buttress wall without concern of compromise to the sinus membrane (Figs 3a and 3b). In extremely atrophic maxillary ridges, the authors recommend leaving approximately 5 mm of intact lateral maxillary wall at the inferior aspect of the slot. The slot results in a smaller antrostomy that will serve to orient the twist drills for implant placement. With a round bur, a small purchase point is marked at the ideal location on the crest of the maxillary ridge, which lines up with the sinus slot. This places the implant abutment in the first molar region.

The 2.9-mm zygomaticus twist drill is used to initiate the first preparation. The tip of the drill is placed in the purchase point, directly over the crest of the ridge, and the drill is directed such that it extends directly through the sinus slot that was previously fabricated. The tip of the drill is guided through the center of the slot and is easily seen under direct visualization. The drill is advanced superiorly toward the junction of the lateral orbital rim and zygomatic arch. In the same fashion, the 3.5-mm pilot drill and 3.5-mm twist drill are also used, being directed through the center of the sinus slot. To date, the authors have not needed to use the 4-mm pilot drill to widen the inferior aspect of the dental alveolus; the maxillary bone is generally compliant enough that the final 4-mm pilot drill preparation step is not required.

Implant Placement

The depth of the preparation is reconfirmed with the zygomaticus implant depth gauge, and the appropriate length implant is chosen. As the implant is being placed, it can be seen directly, cutting threads on either side of the sinus slot, and eventually the implant can be seen entering the body of the zygoma (Figs 4a and 4b). To ensure proper angulation of the implant platform, a hexagonal machine screwdriver (DIA 186, Brånemark

Figs 4a and 4b Operative sight preparation is completed with the implant placed using the sinus slot technique. (*Left*) Model (lateral view); (*right*) actual patient.

Fig 5 A hexagonal machine screwdriver (DIA 186) is used to precisely orient the platform of the zygomaticus implant when completing the last turns of the implant. An anterior screwdriver marks the position of the anterior implant, to which the zygomaticus implant is made parallel.

System, Nobel Biocare) is placed in the implant mount screw and allowed to rotate in the proper position as the implant is turned with the hand wrench (Fig 5).

DISCUSSION

The sinus slot technique described has many advantages over the zygomaticus implant protocol detailed by the manufacturer. By eliminating the extensive dissection that is recommended, patient discomfort can be more effectively controlled by appropriately placed local anesthetic and routine intravenous sedation. Minimizing dissection also facilitates recovery time by reducing postoperative edema and ecchymosis.

By eliminating the need for a sinus window from the protocol and substituting a sinus slot as described, the surgery can proceed more quickly, and therefore the patient's recovery is expedited. Additionally, preserving the maximum amount of bone over a severely atrophied maxilla has structural advantages. The sinus slot technique increases the amount of bone-implant contact area, as seen by comparing the sinus view of 2 models (Figs 6a and 6b). Figure 6a illustrates the sinus view of the slot technique, and Fig 6b shows a sinus view using the traditional Brånemark protocol. Less than half the amount of implant is exposed with the sinus slot method than with the traditional published protocol, and therefore a greater bone-to-implant interface exists with the sinus slot technique than with the standard protocol. Finally, the slot orients the zygomaticus implant more vertically along the coronal plane and positions the implant in the most ideal prosthetic position possible. When models employing the 2 techniques are compared, it is apparent that the sinus slot technique allows for a more posteriolaterally positioned implant (Figs 7a and 7b). This places the implant platform directly over the crest of the ridge in the first molar region, as opposed to the traditional technique, which finishes with an implant platform along the palatal aspect of the first or second premolar region.

SUMMARY AND CONCLUSION

The sinus slot technique is a significant improvement over the previously published protocol for placement of zygomaticus implants. It provides the following advantages:

Figs 6a and 6b Operative sight preparation is completed with implant placed (*left*) using the sinus slot technique and (*right*) using the Brånemark protocol (*view from sinus*).

Figs 7a and 7b (*Left*) Lateral position of the zygomaticus implant platform placed using the sinus slot technique. It is situated over the crest of the ridge. (*Right*) Final position of the zygomaticus implant platform, placed using the recommended Brånemark protocol. The implant is oriented quite palatally from the maxillary ridge crest.

1. Intraoperative pain control and patient recovery is facilitated with reduced degloving of the zygomas.
2. The crestal incision provides excellent exposure of the alveolar ridge and zygomatic buttress.
3. The sinus slot facilitates reproducible implant position and angulation.
4. The final position of the implant platform is more ideally located over the crest of the ridge in the area of the first molar.
5. Greater potential exists for bone-to-implant interface because of the more lateral position of the zygomaticus implant.
6. The need for a sinus window and sinus lining elevation is eliminated, thereby expediting surgery.
7. No residual sinus wall defect remains after surgery.
8. Zygomaticus implant placement over the crest of the maxillary ridge allows traditional prosthetic reconstruction. This is in contrast to the prosthetic challenge of palatal coverage of palatally positioned implants, which may interfere with speech and hygiene.

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