

Quadruple Zygomatic Implant Support for Retreatment of Resorbed Iliac Crest Bone Graft Transplant

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The fabrication of a maxillary denture with adequate retention and stability for patients with an atrophic edentulous maxilla presents a significant challenge for the prosthodontist. There exists a direct relationship between prosthesis retention and patient satisfaction.^{1,2,3} Different techniques have been used successfully to restore the atrophic maxilla by creating more bone volume and better bone topography. The techniques used are:

- 1) iliac block grafting procedures;^{4,5}
- 2) maxillary sinus augmentation;⁶
- 3) Le Fort I osteotomies;⁷ and
- 4) placement of implants in the pterygomaxillary region^{8,9}. Despite all these techniques, many patients are unable or unwilling to undergo the rigors of these procedures. The zygomatic implant is an alternative method of treatment for the atrophic maxillae.^{10,11}

CASE REPORT

Patient history

The patient was a 63 year-old woman in good general health, with no known allergies or sensitivities to medications, who presented to Prosthodontics Intermedica, (Fort Washington, PA) for a second opinion seeking an improved reconstruction of her dentition. At the initial visit (Figs 1a-1c),

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Purpose: *The purpose of this report is to present a reliable surgical and prosthodontic protocol for the treatment of the atrophic maxilla by placing four zygomatic implants.*

Materials and Methods: *The surgical and prosthodontic procedures are described for the retreatment of a 63-year-old female patient who had previously undergone an iliac crest bone graft transplant, which had resorbed.*

Results: *It is possible to place double zygomatic implants bilaterally, in addition to conventional implants in the anterior maxilla. Bone grafting procedures can be avoided, resulting in a fixed implant-supported maxillary prosthesis.*

Conclusion: *A logical treatment solution is four zygomatic implants for the atrophic maxilla, especially because the previous iliac crest bone graft had resorbed.*

KEY WORDS: *atrophic maxilla, implant-supported prosthesis, endosseous dental implants, sinus-lift procedures*

she presented with three mandibular implants that were supporting an overdenture, and two maxillary implants that were supporting an overdenture. She was not satisfied with the lack of stability, retention and esthetics of her existing overdentures.

The patient's past dental history revealed that 11 years prior she had undergone an iliac crest bone graft procedure with the subsequent insertion of four IMZ implants (Interpore International, Irvine, CA) in each arch. Particulate hydroxyapatite had been placed in the mandible for vertical ridge augmentation. After the implant surgery the patient experienced pain, and some of the implants had become infected. During the first few months she had lost one maxillary implant, then one additional implant a few years later. In addition, the patient reported suffering a fractured mandible subsequent to these procedures. She was treated with internal fixation of the fracture.

Comprehensive clinical and radiographic evaluations were performed. Panoramic, lateral cephalometric and anterior-posterior cephalometric radiographs revealed significant

bone resorption for both the mandibular and maxillary arches (Fig 2a and Fig 2b).

A treatment plan was formulated to include Brånemark System dental implants (Nobel Biocare, Yorba Linda, CA, USA). For the maxillary arch: four Zygomatic implants, two implants of the standard type and two Prototype Mark IV (EBON) implants. This was intended to provide for cross-arch support and maximum biomechanical stability. Three implants would be placed for the mandibular arch. The existing implants were anticipated to be kept.

Treatment

To avoid the need for regenerating the atrophic maxilla, four zygomatic implants were proposed in the initial treatment plan. These new and specially designed implants penetrate the zygoma and provide posterior support



Fig. 1a Preoperative profile view prior to treatment, **Fig. 1b** Initial intraoral presentation of patient, **Fig. 1c** Initial intraoral presentation of resorbed maxilla.

for a fixed prosthesis. Although implants placed in maxillary-grafted bone have been shown to have a success rate of 90% or higher, 12 limited alternative treatment options were also discussed with the patient. These included iliac crest bone grafting in the maxillary arch with conventional implant placement or a complete removable prosthesis. The patient expressed the desire to be restored with a fixed prosthesis and also articulated the fact that she had a negative experience with her previous iliac crest graft. Additional bone grafting would have been difficult to accomplish due to scarring and the inherent avascularity in the anterior maxilla. The patient approved of the initial treatment plan. Diagnostic casts were articulated to replicate the oral and craniofacial structures three-dimensionally. Provisional dentures were fabricated to serve as the blueprint for the final prostheses as well as to clarify the amount of lip support and cheek support needed at the established vertical dimension. These would be worn during the osseointegration period. General anesthesia was administered by a board-certified anesthesiologist in the surgical suite of Prosthodontics Intermedica (Fort Washington, PA). Three carpules of 1:50,000 lignospan (Cooke-Waite, North Chicago, IL, USA) were administered as well. A board-certified prosthodontist performed the surgical procedure by initiating a crestal incision with dissection and flap elevation in the areas of teeth nos. 2-15. The tissue was reflected to reveal the bone in the maxillary arch. A window was made in the sinus floor for entrance into the zygoma. The sinus cavities were packed with packing strip gauze saturated with Lidocaine HCL 2% (Cooke-Waite, North Chicago, IL, USA) and Epinephrine 1:100,000. The existing implants were evaluated at this time; areas no.7 and area no.8. They were both mobile due to fibrous encapsulation, and were removed. The following Brånemark implants (Nobel Biocare) were placed in the maxilla:

- area no.1 (3.75-mm- x 15-mm),
- area no.3 (40-mm zygomatic)
- area no.4 (35-mm zygomatic),
- area no.7 (4.0-mm x 8.5-mm),
- area no.8 (4.0-mm x 8.5- mm;
- Mark IV Prototype),
- area no.9 (4.0-mm x 8.5-mm; Mark IV Prototype),
- area no.10 (4.0-mm- x 8. 5-mm;
- Mark IV Prototype),
- area no.13 (35-mm zygomatic),
- area no.14 (30-mm zygomatic),
- area no.16 (5.0-mm x 12-mm ; "spinner"

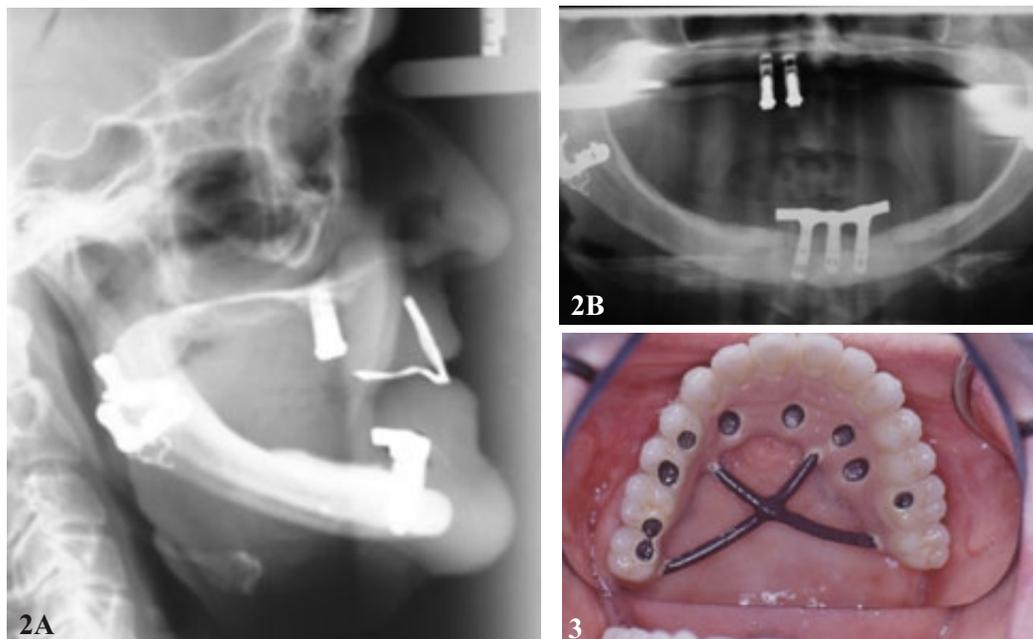


Fig. 2a Preoperative lateral cephalometric radiograph showing severe bone resorption for both the mandibular and maxillary arches, **2b** Preoperative panoramic radiograph showing severe bone resorption for both the mandibular and maxillary arches, **3** Try-in of final implant-supported prostheses

which is a term that describes the implant body as continuously rotating when the implant delivery device is removed and the cover screws applied. This "spinning" action in the bone occurred with no detectable lateral or apical movement and was a result of lack of initial stability caused by the minimal bone density at the osteotomy site.

In the mandible, the three previously placed IMZ implants were all stable. The following additional Brånemark implants (Nobel Biocare) were placed after drilling through the previously grafted hydroxyapatite ridge augmentation: area #22 (3.75-mm x 10-mm) area #24 (3.75-mm x 13-mm) and area #26 (3.75-mm x 15-mm).

All implants were placed using a torque controlled machine and then checked manually. The coverscrews were placed. Autogenous bone, which had been obtained from the mandible, was saved during the procedure and used to graft around all the implants and the voids created by the removal of the failed IMZ implants in the maxilla. After thorough irrigation, the mandibular implant sites were closed with resorbable vicryl sutures (Johnson and Johnson, Somerville, NJ, USA).

The removable complete dentures were adjusted and fitted using a soft relining material, (Visco Gel; Dentsply, Konstanz, Germany).

To minimize swelling and post surgical discomfort, the patient followed a standard regimen of Pen VK antibiotic (Par Pharmaceutical, Spring Valley, NY, USA), Decadron corticosteroid (Merck, West Point, PA) and Ibuprofen (Interpharm Inc., Hauppauge, NY) and Vicoprofen (Abbott Laboratories, Abbott Park, IL) pain medication. Cold compress therapy was recommended for the first 48 hours after implant placement surgery. Peridex (Zila Pharmaceuticals, Phoenix, AZ, USA) was also prescribed to be used as an antimicrobial mouthwash during initial osseointegration. Two weeks following the implant placement, the sutures were removed and a post-surgical radiographic examination was performed to provide a baseline. The provisional dentures were relined again using a soft lining material. Three months following the implant placement, the mandibular implants were uncovered following conventional mandibular second-stage surgery, and a traditional implant-supported fixed prosthesis was fabricated with a previously determined arch form and vertical dimension of occlusion.

Five months following the implant placement, the maxillary implants were uncovered. Angulated abutments were used with each zygoma implant to position the prosthetic retaining screw toward the occlusal table. At this time the all-acrylic conversion prosthesis

was constructed.¹³ The occlusion was adjusted and an interocclusal registration was made using Regisil (Dentsply, York, PA, USA). An alginate impression was made of the existing mandibular prosthesis. A final impression was made by using the maxillary conversion prosthesis as an impression template. Heavy body Reprisil (Dentsply, York, PA, USA) impression material was syringed beneath the all-acrylic mandibular implant prosthesis and a pick-up impression was made. A master cast was created by placing abutment analogs to the modified impression copings within the acrylic prosthesis. A final one-piece gold casting was designed and created on the master cast, tried-in and the final implant-supported prosthesis was finalized by the dental laboratory (Fig 3).

The final implant-supported prosthesis was delivered to the patient (Fig 4a and Fig 4b). The patient was extremely satisfied with the esthetics, comfort and function of the new prostheses (Fig 4c).

The occlusion was adjusted and radiographic evaluation was made of the final prosthesis (Fig 5a and Fig 5b). The patient has been followed-up clinically and radiographically for the past 2.5 years without any complications to treatment.

DISCUSSION

This patient initially presented with several complicating factors which were taken into consideration for the final treatment to have predictable results. These factors were: the resorption of the previously placed iliac crest bone grafting; the presence of hydroxyapatite particulate material in the mandible; a fractured mandible; and failed implants. A logical solution to treat the atrophic maxilla was the use of four zygomatic implants. By placing zygomatic implants, the patient had the advantage of wearing a maxillary removable complete denture during the healing period of the implants. Had another iliac crest onlay procedure been performed, wearing a removable complete denture would have been contraindicated due to the possibility of resorption of the graft. In addition to using the standard implants in



Fig. 4a Postoperative frontal view of the final implant-supported prostheses. **4b** Postoperative profile view of esthetics following completion of treatment. **4c** Postoperative frontal view of esthetics following completion of treatment.

the anterior region, using four zygomatic implants posteriorly provided for cross-arch stabilization of the final implant-supported prosthesis.

In the mandibular arch, the presence of the particulate hydroxyapatite prevented the patient from having another

removable prosthesis because of the soft tissue compression, the pain associated with the impingement of the nerve and the continual resorption of the ridge.

By using a fixed implant-supported prosthesis in the mandible, the posterior support was obtained by the implants; and,



Fig. 5a Postoperative lateral cephalometric radiograph with final implant-supported prostheses. **5b** Postoperative anterior-posterior cephalometric radiograph with final implant-supported prostheses.

at the same time, the ridge was preserved and the patient was comfortable.

CONCLUSION

A clinically successful treatment using four zygomatic implants, in a patient who had previously undergone iliac crest bone grafting procedures that had resorbed, has been described. The entire process was enhanced by the brevity of the treatment process that was performed by a team of prosthodontists in a prosthodontic surgical suite with predictable results and without any complications.

DISCLOSURE

The authors claim to have no financial interest in any company or any of the products mentioned in this article.

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