MAXILLARY ALVEOLAR ATROPHY

Zygomatic Implants for the Management of Severe Alveolar Atrophy in the Partial or Completely Edentulous Maxilla

Paul S. Petrungaro, DDS, MS; Gregori M. Kurtzman, DDS; Santiago Gonzales, DDS; and Carlos Villegas, DDS

Abstract: Treatment of severely resorbed partially or completely edentulous maxillae can include the utilization of the zygomatic process for immediate implant fixation and stabilization with immediate function. This approach may alleviate the need for significant grafting to enable implant placement in the posterior maxilla and allow implants to be placed into denser, more stable bone. Zygomatic implants, which have been used clinically for the past 20 years in the treatment of the severely resorbed maxilla, allow implant placement to support fixed prosthetics. Their usage can potentially shorten treatment time and reduce costs, as the need to wait for osseous graft maturation is eliminated. Guided surgical approaches are being utilized to maximize placement of the prosthetic platform of these implants.

Osseous resorption and enlargement of the maxillary sinus can complicate treatment of edentulous areas of the posterior maxilla. Treating such cases with traditional dental implants can be challenging, and treatment time, morbidity, and costs may significantly increase for the patient. Treatment planning options for the management of these types of severely resorbed partially or completely edentulous maxillae have been expanded to include the use of the zygomatic process for immediate implant fixation and stabilization with immediate function. This approach averts the need for significant grafting to enable implant placement in the posterior maxilla and allows implants to be placed into denser, more stable bone.

Zygomatic implants have been used for the past two decades to treat patients with severely resorbed maxillae. They allow implant placement to support fixed prosthetics. Brånemark introduced the first zygomatic implants in 1988, and they became available to the profession 10 years later after their viability was proven in clinical use.[1] Initially, the protocol involved placing two zygomatic implants with additional root-form implants placed in the anterior maxilla, which were splinted together to support a screw-retained fixed prosthesis. Frequently, this may have resulted in the zygomatic implants being placed palatal to the alveolar ridge, leading to complications related to speech, hygiene, and comfort. Implant placement was done essentially freehand during surgery, which led to many of the common complications with this type of implant. Updated protocols and changes to the zygomatic implants themselves and their parts have largely resolved these types of complications.

Guided surgical approaches are being utilized to maximize placement of the prosthetic platform of these implants. The implant team (including surgeon, prosthetic dentist, and laboratory technician) uses a 3-dimensional (3D) computed tomography (CT) scan, ie, cone-beam CT (CBCT), to determine the available bone mass present in the severely resorbed maxilla, which will help dictate whether successful rehabilitation can be achieved through multiple grafting procedures, a conventional All-on-4® (Nobel Biocare, nobelbiocare.com) or similar procedure may be performed, or zygomatic implants will be required to restore the patient's arch. Each of these procedures has benefits and drawbacks associated with it, as discussed below.

Grafting Procedures

Enlargement of the maxillary sinus related to tooth loss and periodontal disease frequently requires sinus augmentation, ie, elevation of the maxillary sinus and placement of osseous grafting, to allow implant placement in molar sites (Figure 1).[2] Over the past 20 years multiple bone grafting procedures used in the reconstruction

of partially or completely edentulous maxillae have been described and well-documented in the dental literature.[3-6] Understanding the prosthetic requirements needed to provide dentition to these patients, as well as the limitations involved, is paramount to the overall success of the grafting procedures performed. Sinus elevation and grafting, horizontal/vertical ridge augmentation, onlay grafting, LeFort osteotomy/sandwich grafting are just several of the options available for reconstruction of the severely resorbed maxilla.

Though all of these options have been shown to have a variety of success rates long term[7,8] they usually require multiple surgeries, and the patient is unable to wear a prosthesis for at least the initial healing phase. Additionally, these techniques lengthen the treatment time before the final prosthetics can be initiated; cases of complex or multiple grafting procedures may stretch to a year or more.[9] Frequently, in such cases involving severe resorption, implants cannot be placed at the time of initial grafting, potentially increasing treatment time further.

Angled Dental Implant Placement/ Immediate Function

The severely resorbed maxilla and associated enlarged sinus can also be managed through the use of angled dental implant placement to avoid interfering with the medial aspect of the maxillary sinus, the lateral pyriform nasal plate, and the nasal floor (Figure 2).[2] The All-on-4 treatment concept originally described by Maló allows for a non-grafting, immediate function option for patients who are partially or completely edentulous or in "terminal dentitions"; an immediate, fixed, maxillary palate-less prosthesis can be realized in a single procedure.[10]

However, if the available residual bone does not allow for the implants to be placed with sufficient insertion torque, anterior-posterior (A-P) spread (ie, A-P distance between implants), or presence of bone in the anterior at the lateral nasal wall, the procedure is not possible for immediate implant fixation and loading, and long-term success may be compromised.[11] In these situations a delayed approach may be taken, allowing implants to integrate prior to loading. Jensen et al described the use of the vomer/nasal crest in such atrophic cases as another option to engage dense cortical bone and achieve immediate implant stabilization.[12] However, this does not address the handling of the posterior implants that are required.

Zygomatic Implants

In cases where the residual maxillary bone is insufficient, especially in the paranasal region or lateral pyriform rim and when the sinus pneumatization is anterior to the canine region, and multiple grafting procedures are contraindicated, the use of zygomatic implants may be an option (Figure 3).[2] This may allow for immediate stabilization of the dental implants and immediate function of a stable fixed prosthesis. Brånemark initially described using the zygomatic process to allow longer implants (30-mm to 55-mm length) to be placed and achieve a higher insertion torque.[1] Multiple authors have published on the use of zygomatic implants for the immediate stabilization and loading of a full-arch fixed prosthesis in the severely resorbed maxilla.[13-16]

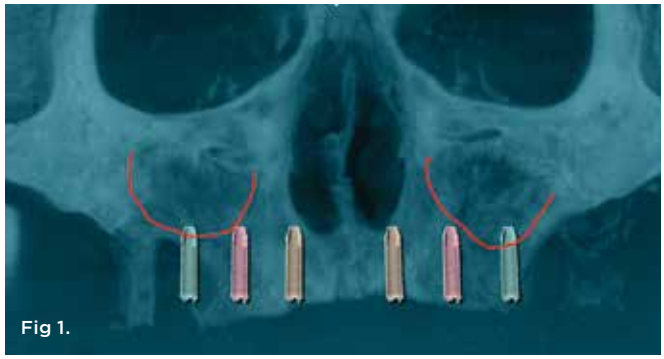
Fig 1.

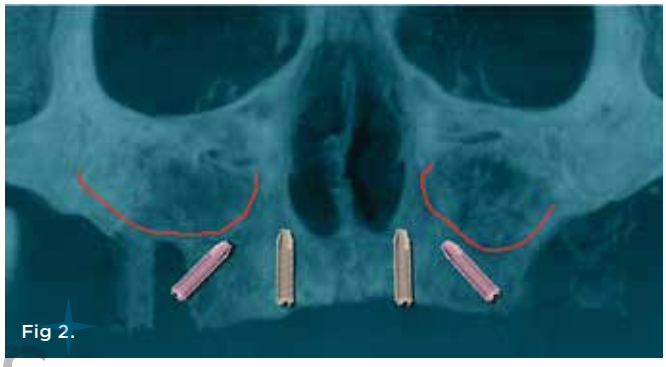
Fig 2.

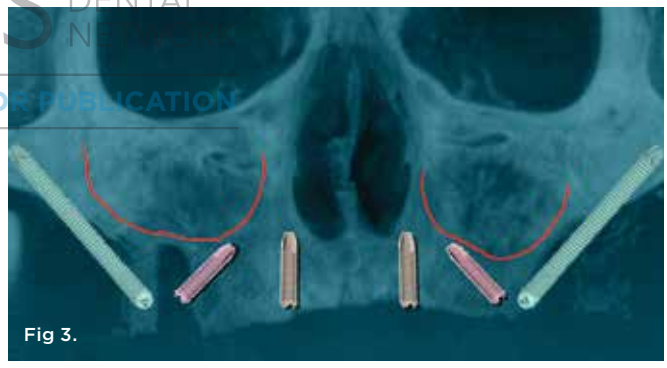
Fig 3.

Fig 1. Enlargement of the maxillary sinus frequently requires augmentation of the sinus to permit implant placement in the posterior when implants are placed in an axial direction (parallel to other implants in the arch). **Fig 2.** Use of angled (tilted) implants allows bypassing of the enlarged maxillary sinus, but this constrains how far distal the prosthetic platform of the implant may be situated. This can prosthetically limit reconstruction of the maxillary arch. **Fig 3.** Use of zygomatic implants allows the maxillary sinus to be bypassed while the prosthetic platform may be positioned more distally, allowing a full complement of teeth to be placed to restore the full arch.

To engage the zygomatic bone, zygomatic implants require substantially longer lengths than traditional implants and are available in lengths ranging from 30 mm to 60 mm. Widths typically are in the 3.5-mm to 4.5-mm diameter range. These implants are available in various designs to accommodate different types of bone that may be present, as per the Aparicio classification.[17] For example, one manufacturer (Southern Implants, southernimplants.com) offers designs that feature an apical diameter of 3.5 mm and other models that are 4.3 mm in apical diameter (Figure 4). Because the implant will be placed at an angle that skirts or has a trajectory through the

maxillary sinus so it can engage the zygoma with its apical end, the implant has an angled correction at its platform. Nobel Biocare, for example, provides zygomatic implants with a 45-degree correction, while Southern Implants manufactures them with a 55-degree correction. This angled correction is illustrated in Figure 5. This allows the prosthetic axis to more effectively approach a vertical inclination, but multi-abutments are added to further enable the platform to be brought into the appropriate position.

Anatomically, patients vary with regard to the position of the lateral wall of the sinus and the zygoma in relation to the ridge crest. Classifications of zygomatic implants according to Aparicio present as five different types based on where the zygomatic implant will lie in relation to the lateral wall of the sinus (Figure 6).[17] In each classification the implant is fixated at the crest inferiorly and at the zygoma superiorly, but will traverse through part of the maxillary sinus. A portion of the body of the implant where it traverses through the sinus will not be encased in bone, and in some clinical situations part of the implant will not be in bone as it lies on the exterior of the lateral wall of the sinus. Anatomical variations aside, these implants are very long (30 mm to 60 mm) so that stability can be achieved at the apical portion, in the dense bone of the zygoma.

Variations of incorporating zygomatic implants into the severely resorbed maxilla may be part of a conventional type of All-on-4 treatment procedure when sufficient bone exists in the paranasal region for the placement of anterior implant fixtures (Figure 7 through Figure 10). When the paranasal region will not accommodate implant placement, this approach can be expanded to the quad zygoma procedure where two zygomatic implants are inserted in each upper quadrant bilaterally (Figure 11 through Figure 16).[18,19]

> **In each classification the implant is fixated at the crest inferiorly and at the zygoma superiorly, but will traverse through part of the maxillary sinus.**

Zygomatic implants are not limited to use in fully edentulous cases. Options exist for partially edentulous patients exhibiting multiple posterior tooth loss with both horizontal and vertical bone loss volume in the ridge crest. The implants may be used in the partially edentulous maxilla when insufficient volume of bone is present as an alternative to osseous grafting of the sinus or crest to enable implant placement in the posterior (Figure 17 through Figure 19). The incorporation of sinus grafting will lengthen treatment time, as the graft will need to mature prior to implant loading if the implant is able to be placed at the time of sinus augmentation. Should the implant not be able to be placed when sinus augmentation is

Fig 4.

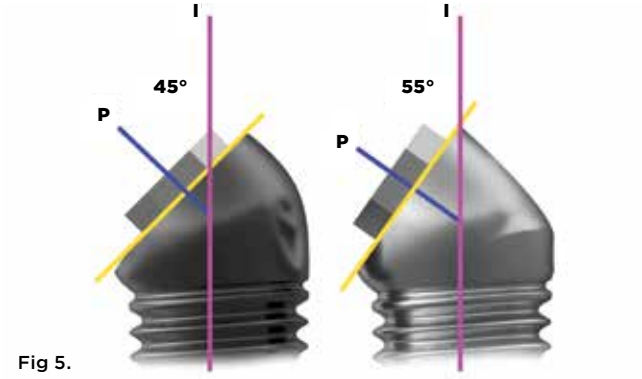

Fig 5.

Fig 6.

Fig 4. Examples of zygomatic implants available in lengths up to 60 mm and in different styles based on the Aparicio classification present in the patient. Apical diameters could range from 3.5 mm, as shown in the two middle implants, to 4.3 mm, as shown in the two outer implants. **Fig 5.** Zygomatic implants have a correction at the platform (yellow line) that may place the prosthetic axis (P) at an angle of 45 (left) or 55 (right) degrees from the implant axis (I) to allow restoration of the implant, which is placed at a significant angle compared to an axial implant position. **Fig 6.** Classification (Aparicio) of zygomatic implants based on orientation to the lateral wall of the maxillary sinus.

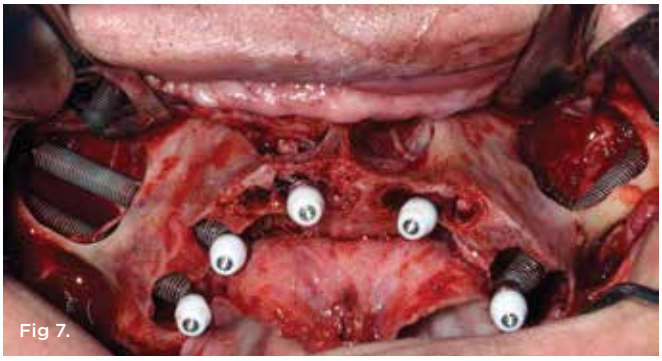

Fig 7. A combination of zygomatic implants (two right side of maxilla, one left side) in the posterior bilaterally (ZAGA 0 classification) and traditional implants in the anterior may be used to accommodate a full-arch prosthesis after healing. **Fig 8.** Zygomatic implants may be used in combination with traditional implants when adequate bone is present in other areas of the maxilla. This CBCT shows the case in Fig 7 after 6 months of healing ready for the restorative phase of treatment to be initiated. **Fig 9.** Emergence of the prosthetic platform of the case shown in Fig 7 falls at the midline of the crest (ZAGA 0 classification), allowing screw-access emergence in the prosthesis to be in the occlusal surface. **Fig 10.** Maxillary All-on-5 fixed prosthesis for the case shown in Fig 9, on three zygomatic and two traditional implants with posterior screw access on the occlusal surface.

performed, treatment time is further increased and restoration may not be possible for up to 1-year post initial surgery.

Discussion

Bone resorption combined with increased maxillary sinus enlargement and poor bone quality often makes it impossible to execute conventional implant placement in the posterior maxilla without extensive osseous grafting. Various bone augmentation techniques have been described for increasing the volume of bone to accommodate conventional implants. These techniques include sinus augmentation via lateral and crestal approaches and onlay grafting. Efforts have pursued alternatives to grafting procedures in the atrophic maxilla, both to decrease treatment time and lower the costs associated with bone grafting. Zygomatic implants have been in clinical use for 20 years and are utilized for treatment of patients with severely resorbed fully or partially edentulous maxillary arches.

Use of zygomatic implants, however, is not without risks; therefore, surgical experience is needed when placing them.[20] Of the complications reported in the literature, sinusitis is the most common.[21] Because a portion of the implant will traverse through the maxillary sinus, depending on which classification the patient falls into (Figure 6), sinus issues may potentially be expected. The incidence of sinusitis reported after zygomatic implant placement is as high as 26.6%.[22-24] Sinusitis may develop several years after implant placement. The literature indicates that placement of zygomatic implants does not seem to be associated with severe sinusitis complications.[25] D'Agostino reported that in a considerable number of patients with zygomatic implants asymptomatic radiologic alterations of the paranasal sinuses were observed.[26] Asymptomatic chronic sinusitis with osteitis and a gradual collapse of the maxillary sinus cavity can be anticipated but does not appear to affect the high success rates being reported for these implants.[27]

Other potential complications that have been reported include oroantral fistula formation, temporary deficit of sensory nerves, vestibular cortical fenestration, postoperative periorbital/subconjunctival hematoma or edema, and moderate nasal bleeding for 1 to 3 days.[28] Patients with pronounced

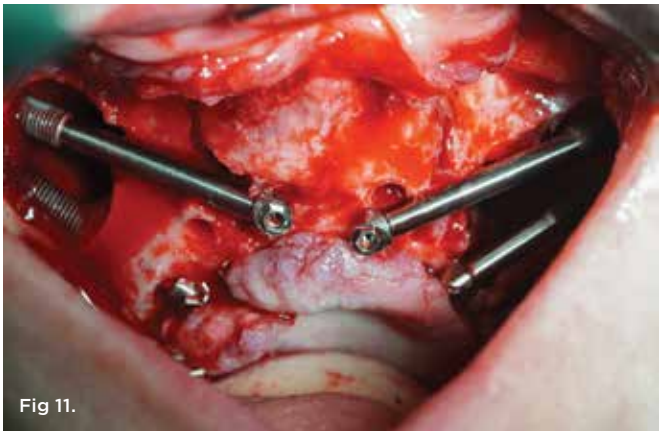
Fig 11.

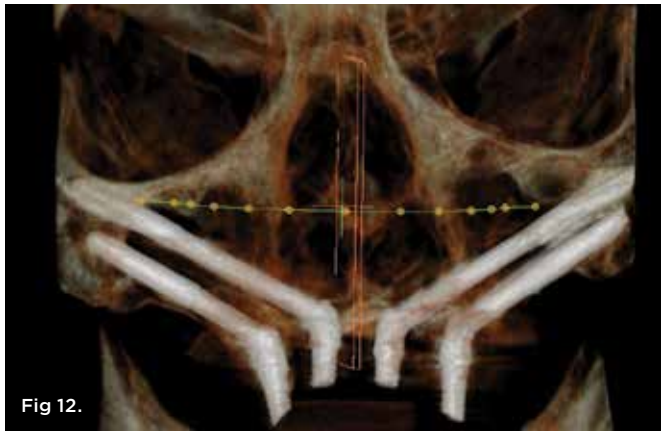
Fig 12.

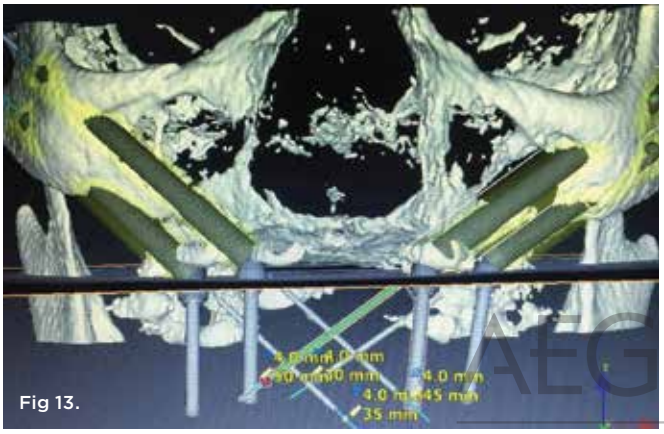
Fig 13.

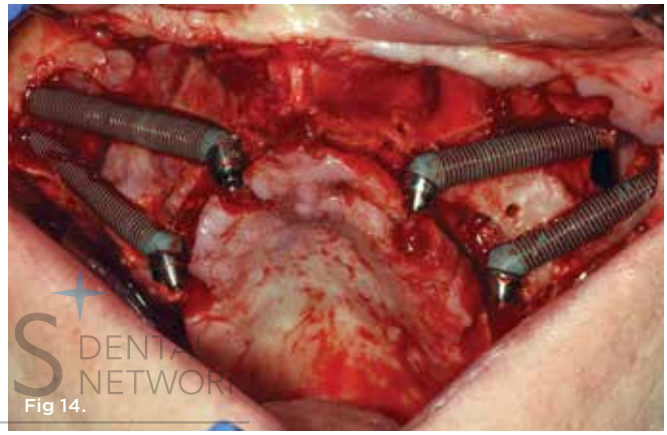
Fig 14.

Fig 11. Quad case using zygomatic implants. Three implants ZAGA 4 (top right side of maxilla and both on left side) and one implant ZAGA 0 (bottom right side of maxilla) were used to restore a severely atrophic maxilla. **Fig 12.** CBCT of the case shown in Fig 11 demonstrating the position of the four zygomatic implants. **Fig 13.** Another example shows a ZAGA 4 classification demonstrating severe bone loss of the entire maxilla, severely limiting implant treatment with traditional implants, which would require extensive osseous grafting. Four zygomatic implants have been placed with stabilization in the zygoma allowing restoration with a full-arch fixed prosthesis. **Fig 14.** Clinical image of the ZAGA 4 case shown in Fig 13 with four zygomatic implants placed and stabilized in the dense zygomatic bone prior to site closure. Note the angled platforms with multi-abutments on the zygomatic implants to allow placement of the prosthetic axis in a restorable position irrespective of the severe angulation in which the implants are positioned to engage the zygoma.

buccal concavities of the lateral aspect of the maxillary sinus may be more prone to such complications especially when a non-guided surgical approach is used. The limited intraoperative visibility along with the anatomical complexity of the structures and intricacies of the zygoma make this surgical procedure clinically demanding. Increased availability of CBCT, virtual implant planning, and CAD/CAM surgical guide fabrication may potentially greatly decrease complications and make placement less stressful.

Despite these potential complications, multiple authors have reported success rates with zygomatic implants. After observation of 92 zygomatic implant rehabilitations over 5 years performed on patients with completely edentulous, severely atrophic maxillae supported by immediately loaded zygomatic implants alone or in combination with conventional implants, Maló et al reported long-term outcome was satisfactory with cumulative success rates of 97% and 98.8% as related to patient and implant, respectively.[29] Another study supported Maló's findings wherein the authors observed at 10 years a zygomatic implant success rate of 100% in 34 patients identified with a total of 220 implants placed.[30] In yet another study, 49 patients received bilateral zygomatic implants and nine patients received unilateral zygomatic implants, with 107 zygomatic implants reported. All patients observed had supplemental anterior implants with a follow-up of 5 to 13 years and a mean follow-up time of 8.4 years per zygomatic implant. No losses of zygomatic implants were reported, and no major surgical or restorative complications were observed.[31] In 2014, a systematic review of studies of zygomatic implant survival published from 2000 to 2012 culminated in 25 full-text articles considered clinically relevant.[32] These studies reported the insertion of a total of 1541 zygomatic implants, of which 33 failed. These failures generally occurred during the first year and related to clinical complications, such as recurrent acute and chronic sinusitis. The survival rate after a 36-month follow-up was 97.86%.

The American College of Prosthodontists' position on these implants states, "the use of the zygomatic implant in various clinical scenarios with multiple configurations enables the dental team to

Fig 15. The ZAGA 4 case shown in Fig 14 after 6 months healing with multi-abutments emerging through the soft tissue and providing adequate arch spread to restore this severely resorbed maxilla with a full-arch fixed prosthesis. **Fig 16.** Try-in of the full-arch screw-retained fixed prosthesis on the four zygomatic implants in the ZAGA 4 case shown in Fig 15. Screw-access emergence in this case and others like it will be on the lingual aspect of the prosthesis.

restore quality of life and gives patients an expedited and predictable option."[33]

Conclusion

The use of zygomatic implants, either in combination with or without conventional implants in the anterior, may be considered in the atrophic fully or partially edentulous maxilla as an alternative treatment option to osseous grafting, which may be required to provide bone for conventional implant placement. Success and survival rates of zygomatic implants have been reported to be equal to conventional implants. Use of zygomatic implants may shorten the treatment time that would normally be required for osseous graft maturation and subsequently delay implant placement until such maturation occurs. Additionally, treatment costs may be lowered due to the elimination of complex grafting procedures. As the use of CBCT, virtual planning, and surgical guides progresses, it is anticipated that these implants may be more readily utilized and potential complications that had been associated with prior placement techniques will be reduced.

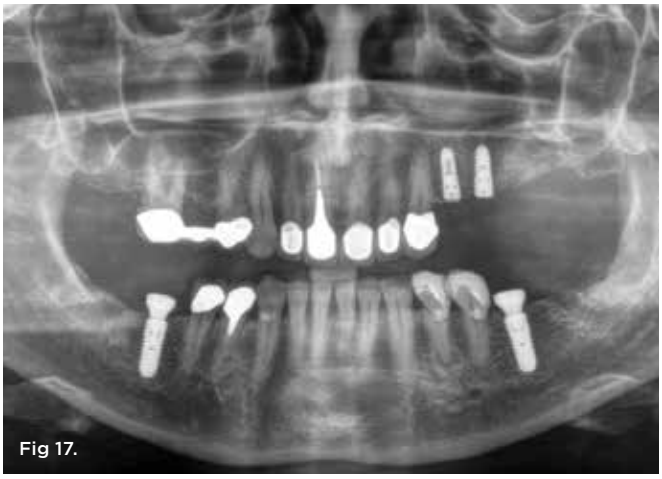
Fig 17.


Fig 18.

Fig 17. Sinus enlargement in the left posterior maxilla limited implant placement distal to the existing implants at the premolar sites, and osseous grafting would be required for implant placement. **Fig 18 and Fig 19.** A zygomatic implant was instead placed into the posterior left, allowing the maxillary sinus to be avoided and the need to augment that region for standard implant placement to be averted. This enables a shortened treatment time prior to implant loading and reduces costs as grafting of the sinus is unnecessary.

ABOUT THE AUTHORS

Paul S. Petrungaro, DDS, MS
Private Practice, Periodontics and Implantology, Chicago, Illinois

Gregori M. Kurtzman, DDS
Private Practice, Silver Spring, Maryland; Master, Academy of General Dentistry; Diplomate, International Congress of Oral Implantologists

Santiago Gonzales, DDS
Clinical Professor, Autónoma University School of Dentistry, Manizales, Colombia; Private Practice, Oral Surgery, Manizales, Colombia

Carlos Villegas, DDS
Private Practice, Oral Surgery, Medellin, Colombia

REFERENCES

1. Brånemark PI. Surgery and fixture installation. Zygomaticus Fixture Clinical Procedures (ed 1). Gothenburg, Sweden: Nobel Biocare AB; 1998:1.
2. Bedrossian E, Sullivan RM, Fortin Y, et al. Fixed-prosthetic implant restoration of the edentulous maxilla: a systematic pretreatment evaluation method. *J Oral Maxillofac Surg*. 2008;66(1):112-122.
3. Wessberg GA, Jacobs MK, Wolford LM, Walker RV. Preprosthetic management of severe alveolar ridge atrophy. *J Am Dent Assoc*. 1982;104 (4):464-472.
4. Misch CE. Maxillary sinus augmentation for endosteal implants: organized alternative treatment plans. *Int J Oral Implantol*. 1987;4(2):49-58.
5. Lamberti VS. Subantral graft: clinical application of the biological principles osseoinduction in the treatment of posterior maxillary atrophy. *Int J Dent Symp*. 1994;2(1):56-59.
6. Chanavaz M, Donazzan M, Ferri J, et al. Sinus augmentation. Statistical evaluation of 15 years of surgical experience (Manuel Chanavaz, 1979-1994). *Rev Stomatol Chir Maxillofac*. 1995;96(4):267-273.
7. Urban IA, Monje A, Lozada JL, Wang HL. Long-term evaluation of peri-implant bone level after reconstruction of severely atrophic edentulous maxilla via vertical and horizontal guided bone regeneration in combination with sinus augmentation: a case series with 1 to 15 years of loading. *Clin Implant Dent Relat Res*. 2017;19(1):46-55.
8. Moreno Vazquez JC, Gonzalez de Rivera AS, Gil HS, Mifsut RS. Complication rate in 200 consecutive sinus lift procedures: guidelines for prevention and treatment. *J Oral Maxillofac Surg*. 2014;72(5):892-901.
9. Petrungaro PS. Reconstruction of severely resorbed atrophic maxillae and management with transitional implants. *Implant Dent*. 2000;9(3):271-277.
10. Maló P, Rangert B, Nobre M. All-on-4 immediate-function concept with Brånemark System implants for completely edentulous maxillae: a 1-year retrospective clinical study. *Clin Implant Dent Relat Res*. 2005;7 suppl 1:S88-S94.
11. Wallace SS, Froum SJ. Effect of maxillary sinus augmentation on the survival of endosseous dental implants. A systematic review. *Ann Periodontol*. 2003;8(1):328-343.
12. Jensen OT, Cottam JR, Ringeman JL, et al. Angled dental implant placement into the vomer/nasal crest of atrophic maxillae for All-on-Four immediate function: a 2-year clinical study of 100 consecutive patients. *Int J Oral Maxillofac Implants*. 2014;29(1):e30-e35.
13. Maló P, Nobre Mde A, Lopes I. A new approach to rehabilitate the severely atrophic maxilla using extramaxillary anchored implants in immediate function: a pilot study. *J Prosthet Dent*. 2008;100(5):354-366.
14. Bedrossian E, Stumpel LJ 3rd. Immediate stabilization at stage II of zygomatic implants: rationale and technique. *J Prosthet Dent*. 2001;86 (1):10-14.
15. Davo R, Malevez C, Rojas J, et al. Clinical outcome of 42 patients treated with 81 immediately loaded zygomatic implants: a 12- to 42-month retrospective study. *Eur J Oral Implantol*. 2008;9 suppl 1(2):141-150.
16. Aparicio C, Ouazzani W, Hatano N. The use of zygomatic implants for prosthetic rehabilitation of the severely resorbed maxilla. *Periodontol 2000*. 2008;47:162-171.
17. Aparicio C. A proposed classification for zygomatic implant patient based on the zygoma anatomy guided approach (ZAGA): a cross-sectional survey. *Eur J Oral Implantol*. 2011;4(3):269-275.
18. Aboul-Hosn Centenero S, Lázaro A, Giralt-Hernando M, Hernández-Alfaro F. Zygoma quad compared with 2 zygomatic implants: a systematic review and meta-analysis. *Implant Dent*. 2018 doi: 10.1097/ID.0000000000000726. [Epub ahead of print]
19. Malevez C. Zygomatic anchorage concept in full edentulism. *Rev Stomatol Chir Maxillofac*. 2012;113(4):299-306.
20. Chrcanovic BR, Abreu MH. Survival and complications of zygomatic implants: a systematic review. *Oral Maxillofac Surg*. 2013;17(2):81-93.
21. Esposito M, Worthington HV. Interventions for replacing missing teeth: dental implants in zygomatic bone for the rehabilitation of the severely deficient edentulous maxilla. *Cochrane Database Syst Rev*. 2013;(9):CD004151.

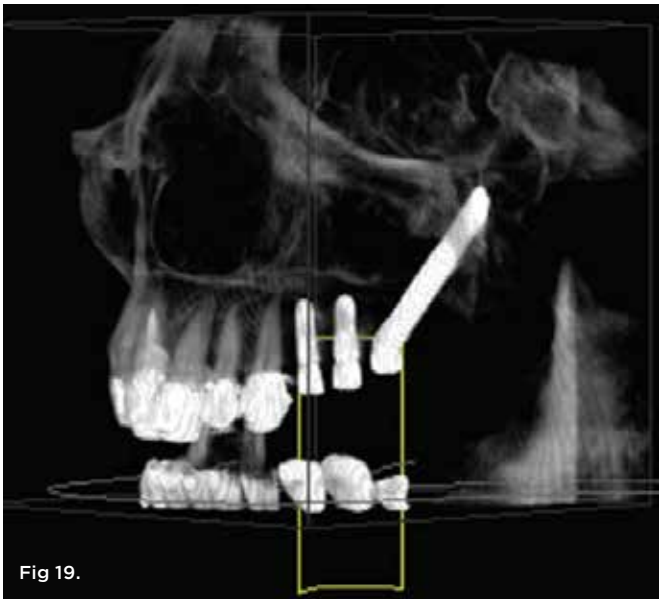

Fig 19.

22. Molinero-Mourelle P, Baca-Gonzalez L, Gao B, et al. Surgical complications in zygomatic implants: a systematic review. *Med Oral Patol Oral Cir Bucal*. 2016;21(6):e751-e757.
23. Araújo RT, Sverzut AT, Trivellato AE, Sverzut CE. Retrospective analysis of 129 consecutive zygomatic implants used to rehabilitate severely resorbed maxillae in a two-stage protocol. *Int J Oral Maxillofac Implants*. 2017;32(2):377-384.
24. Fernández H, Gómez-Delgado A, Trujillo-Saldarriaga S, et al. Zygomatic implants for the management of the severely atrophied maxilla: a retrospective analysis of 244 implants. *J Oral Maxillofac Surg*. 2014;72(5):887-891.
25. Tzerbos F, Bountaniotis F, Theologie-Lygidakis N, et al. Complications of zygomatic implants: our clinical experience with 4 cases. *Acta Stomatol Croat*. 2016;50(3):251-257.
26. D'Agostino A, Trevisiol L, Favero V, et al. Are zygomatic implants associated with maxillary sinusitis? *J Oral Maxillofac Surg*. 2016;74(8):1562-1573.
27. Bothur S, Kullendorff B, Olsson-Sandin G. Asymptomatic chronic rhinosinusitis and osteitis in patients treated with multiple zygomatic implants: a long-term radiographic follow-up. *Int J Oral Maxillofac Implants*. 2015;30(1):161-168.
28. Chrcanovic BR, Abreu MH. Survival and complications of zygomatic implants: a systematic review. *Oral Maxillofac Surg*. 2013;17(2):81-93.
29. Maló P, Nobre Mde A, Lopes A, et al. Five-year outcome of a retrospective cohort study on the rehabilitation of completely edentulous atrophic maxillae with immediately loaded zygomatic implants placed extra-maxillary. *Eur J Oral Implantol*. 2014;7(3):267-281.
30. Alzoubi F, Bedrossian E, Wong A, et al. Outcomes assessment of treating completely edentulous patients with a fixed implant-supported profile prosthesis utilizing a graftless approach. Part 1: clinically related outcomes. *Int J Oral Maxillofac Implants*. 2017;32(4):897-903.
31. Fortin Y. Placement of zygomatic implants into the malar prominence of the maxillary bone for apical fixation: a clinical report of 5 to 13 years. *Int J Oral Maxillofac Implants*. 2017;32(3):633-641.
32. Goiato MC, Pellizzer EP, Moreno A, et al. Implants in the zygomatic bone for maxillary prosthetic rehabilitation: a systematic review. *Int J Oral Maxillofac Surg*. 2014;43(6):748-757.
33. Tuminelli FJ, Balshi TJ. *Zygomatic Implants*. Chicago, IL: American College of Prosthodontists; 2016. Position Statement. https://www.prosthodontics.org/assets/1/7/Zygomatic_Implants.pdf. Accessed August 23, 2018.