



Zygomatic Implant Options for the Atrophic Maxilla: Case Report

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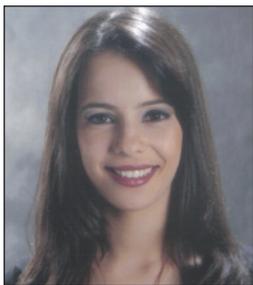
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Zygomatic Implant Options for the Atrophic Maxilla: Case Report

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Learning Objectives: After reading this article, the individual will learn: (1) the outcome of rehabilitation of the atrophic maxilla using zygomatic implants, and (2) intrasinus and extrasinus surgical techniques for placing zygomatic implants in the atrophic maxilla.

About the Authors



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The use of zygomatic bone for implant placement can be a predictable alternative to certain other treatment techniques when rehabilitating the atrophic maxilla. Despite the high success rates of zygomatic implants, there is no consensus in the literature about the ideal surgical technique for their

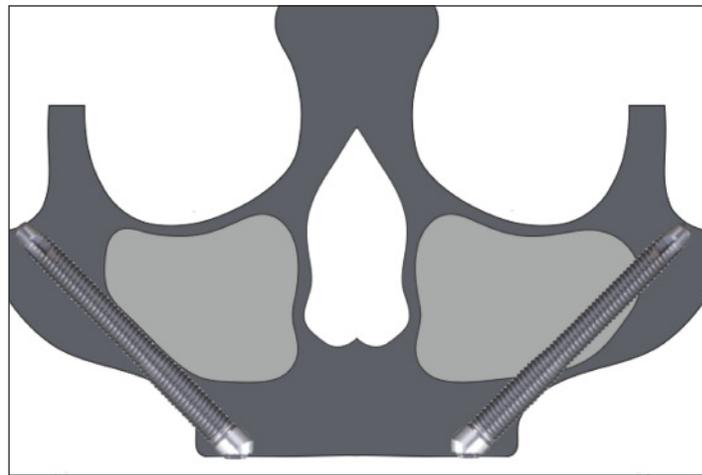


Figure 1. Schematic figure showing the anchorage of implants in zygomatic bone by means of intrasinus or extrasinus techniques (left and right sides, respectively).

placement. Therefore, the objective of this case report is to describe the outcomes of the rehabilitation of an atrophic maxilla with a fixed prosthesis supported by 4 conventional implants at the anterior region and 2 zygomatic implants at the posterior region, which were placed with distinct surgical techniques: intrasinus or extrasinus. After 60 months of follow-up, both zygomatic implants were considered a success and the patient presented a high level of overall satisfaction with the treatment. Thus, the outcomes of this case report confirm that zygomatic implants can be a predictable alternative to rehabilitate an atrophic maxilla. In addition, as no difference was observed between intra- or extrasinus techniques regarding implant and prosthetic status, the extrasinus technique should be preferable since it is simpler and less invasive than the classic intrasinus technique.

BACKGROUND

The rehabilitation of partially or completely edentulous patients with implants has become a common practice in dentistry, with reliable long-term results.¹ However, the posterior maxilla frequently presents a challenge for implant placement due to pronounced alveolar ridge resorption and maxillary sinus pneumatization. To overcome these problems, different solutions have been proposed throughout the years, such as the use of short implants,^{2,3} tilted implants placed in the anterior maxilla,⁴ or maxillary sinus floor elevation associated with bone grafts.⁵ Among these techniques, sinus lift procedures have gained popularity in the last several decades with success rates of 60% to 90%.^{6,7} Nevertheless, this procedure often requires invasive surgeries and delayed implant placement, and has been associated with certain morbidities including sinusitis and contamination or exposure of the graft.⁵⁻⁷

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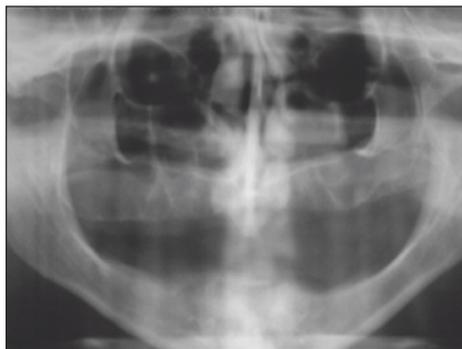


Figure 2. Preoperative panoramic radiograph.

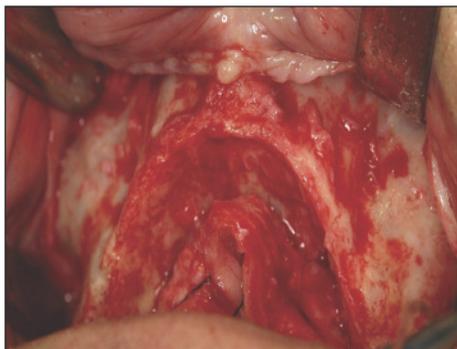


Figure 3. Total surgical exposure of the maxilla for placement of implants.



Figure 4. Placement of zygomatic and conventional implants in the atrophic maxilla.

In the 1990s, Brånemark et al⁸ introduced an alternative solution to these bone-grafting techniques, the zygomatic implant. This new implant aimed to obtain a steady anchorage in the zygoma bone for the rehabilitation of the posterior maxilla with severe bone resorption. Bone anchorage of the zygoma is considered sufficient due to triple cortical strength even if trabecular bone density is unfavorable. Furthermore, this technique simplifies the treatment of the atrophic maxilla, as it allows the reduction of treatment time and pain by using less invasive surgeries, with success rates comparable to those of conventional implants (Figure 1).⁹⁻¹¹

Additionally, the placement of implants in zygomatic bone can be performed by means of 3 different surgical techniques. The most conventional is the classic sinus window technique, which exposes the fronto-lateral face of the zygomatic bone to create a 10 x 5 mm window in the maxillary sinus in order to visualize the implant trajectory into the zygomatic process.⁸ A variant of this classic technique was proposed by Stella and Warner,¹² in which the implant is positioned in the zygomatic process through the sinus via a narrow slot following the contour of the malar bone. In addition to these techniques that placed the implant in zygomatic bone via the maxillary sinus, a new technique placing extrasinus zygomatic implants by fixing them to the lateral sinus wall and zygomatic bone has been described.¹¹

Although zygomatic implants have a high success rate, there is no consensus about the ideal surgical technique.¹³ Therefore, this case report aims to describe the outcomes of the rehabilitation of an atrophic maxilla with a fixed prosthesis supported by 2 zygomatic implants placed with different surgical techniques: the classic sinus window and the extrasinus techniques. On the left side of the mouth, a zygomatic implant

was placed in the malar zygoma using the conventional intrasinus technique described by Brånemark et al,⁸ and in the right malar zygoma, the zygomatic implant was placed using the extrasinus technique described by Aparicio et al.¹¹

CASE REPORT

A 50-year-old male, nonsmoking, had been fully edentulous in the maxillary arch for 10 years. The presence of sinus pneumatization and maxillary atrophy was observed in the initial radiographic image (Figure 2). The patient's chief complaint was that he was unhappy with the retention and fit of his conventional maxillary denture. Following clinical and radiographic evaluations, a treatment plan was proposed for an implant-supported fixed prosthesis. After initial evaluation, records were obtained to produce a new complete denture in accordance with functional and aesthetics requirements. Once approved by the patient and dentist, this prosthesis was duplicated in clear acrylic resin to obtain a "multifunctional guide," which was used for surgical orientation during implant placement.

Surgical Phase

The patient was surgically treated under general and local anesthesia (lidocaine hydrochloride 2% with epinephrine 1:100,000). Crestal and posterior vestibular incisions were made and the mucoperiosteal flaps were raised to expose the alveolar crest, the lateral wall of the maxillary sinus, and the inferior rim of the zygomatic arch (Figure 3). In the left side, a 4.0 x 5.0 mm zygomatic implant (Master Zigo [Conexão Sistema de Implantes]) was placed in the malar zygoma using the intrasinus technique described by Brånemark et al,⁸ while in the right malar zygoma, a similar fixture was placed by the extrasinus technique described by Aparicio et al.¹¹ The zygomatic implants' positions

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and the surgical techniques, intra- or extracranial, were determined during the surgical procedure according to the anatomy of the zygoma and surrounding structures, in order to improve the implant placement and to obtain a better prosthetic result. In addition, 4 additional conventional implants (2 implants of 3.75 x 11.5 mm, one implant of 3.75 x 13 mm, and one implant of 4.0 x 13 mm—Master Porous [Conexão Sistema de Implantes]) were placed in the anterior region (Figure 4). After the surgical phase, the patient's prosthesis was relieved and adapted directly on the implants with tissue conditioner (COE-SOFT [GC America]). All the implants remained submerged for 6 months, when the second surgery was performed.

Prosthetic Phase

In the second surgery, the implants were exposed and the conventional complete denture was transformed into a fixed provisional prosthesis screwed directly onto the implants (Figure 5). For financial reasons, the treatment was interrupted for a period of 3 years after implant placement. Upon resuming treatment, the fixed provisional prosthesis showed signs of wear and pigmentation, resulting in aesthetic and functional changes. After removing this prosthesis, the abutments were selected based on depth and inclination of implants, as well as the size of interocclusal space. As a result, 4 straight conical abutments (Micro Unit [Conexão Sistema de Implantes]) were installed on conventional implants, and two 17° angled conical abutments (Micro Unit) were installed on the zygomatic implants, minimizing the palatal bulge that is associated with these implants. Finally, the provisional prosthesis screwed on the implants was transformed to a provisional prosthesis screwed on the abutments.

At the next clinical session, the provisional prosthesis was removed and the transfers were screwed onto the abutments and connected with metal bars and acrylic resin (Duralay [Polidental]). A periapical radiograph was made to evaluate the transfers' adaptation on abutments before performing an impression with condensation silicones (Zetaplus System [Zhermack]) in an open tray. Afterwards, the maxillomandibular relationship was determined according to Willis¹⁴ and aesthetic methods,¹⁵ the models were assembled in the semi-adjustable articulator and the prosthetic bar was made. The adaptation of this bar on the abutments was confirmed, and acrylic teeth were fixed to the metal-

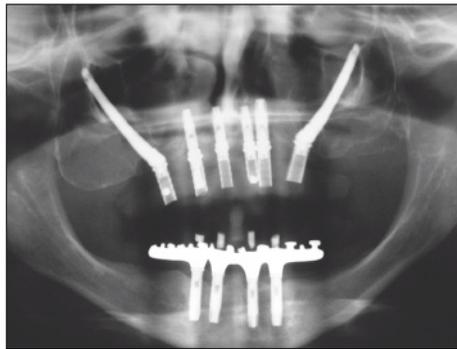


Figure 5. Postoperative panoramic radiograph after second surgery.



Figure 6. Occlusal view of the installed prosthesis after occlusal adjustment.

lic framework. The teeth arrangement was analyzed clinically according to aesthetic and functional requirements before processing the prosthesis. Finally, the fixed implant-supported prosthesis was installed in the patient's mouth, and occlusal adjustments were performed as recommended by Kim et al¹⁶ (Figure 6). After occlusal loading, the patient reported significant improvement in oral function and aesthetics (Figure 7).

DISCUSSION

The edentulous posterior maxilla presents a wide variety of clinical situations, ranging from mild atrophy and sinus pneumatization to extreme 3-D atrophy. Hence, the initial clinical situation of the posterior maxilla to be rehabilitated with implant-supported prostheses should be evaluated carefully, since the patterns of bone resorption in this region greatly influence the choice of treatment (ie, short implants, tilted implants, zygoma implants, or sinus-grafting procedures). In addition to the atrophy type, the postoperative morbidity, patient's expectations and compliance, number of surgical procedures, rehabilitation time, costs, and aesthetic and functional outcome should be considered.¹⁷

Tridimensional maxilla atrophies have been associated with unfavorable vertical, horizontal, and transverse interarch relationships. In these situations, sinus-grafting procedures are unable to adequately correct the initial clinical situation. The conventional surgical protocol suggested for this critical situation is a Le Fort I osteotomy with downward and forward repositioning of the maxilla, in association with interpositional iliac bone grafts.^{17,18} Despite the high success rates, this technique often requires invasive surgeries and long treatment time with delayed implant placement.¹⁸ Therefore, less invasive surgical techniques are necessary to avoid reconstructive procedures

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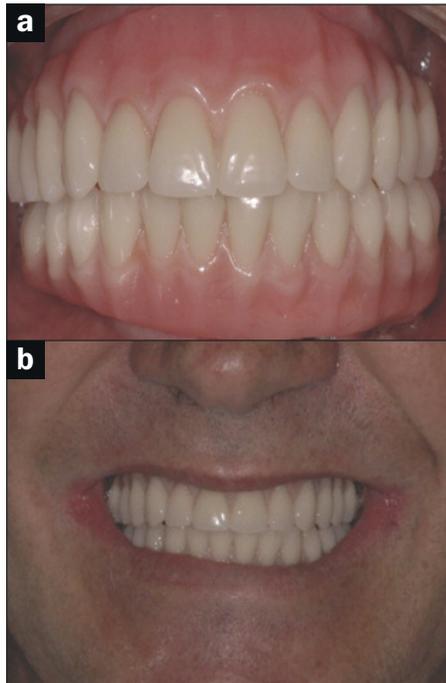
and optimize the rehabilitation of the atrophic maxilla.

In this context, the case report showed that zygomatic implants can be used with success for the rehabilitation of the atrophic maxilla. This treatment reduces the rehabilitation time and eliminates the donor site morbidity, which is associated with bone harvesting. Furthermore, other studies showed that the success rate is greater for implants placed in mature residual bone than for those placed in areas of bone grafts.¹⁹ The reason for the high success rate of zygomatic implants could be attributed to the thicker cortical layer of the zygoma bone, which offers a solid and extended anchorage for implants.²⁰

However, zygomatic implants, when considered in an isolated manner, have been associated with an unfavorable biomechanical situation as they are much longer (35 to 52.5 mm) than conventional implants and must be angulated approximately 45° to engage the zygomatic process.^{4,9} For this reason, the zygomatic implants used in this case report were splinted with 4 standard implants placed in the anterior maxilla in order to minimize the biomechanical risk. Survival rates ranging from 98% to 100% have been reported in the literature when these tilted implants are connected with 2 to 4 anterior standard implants.^{8,12,21}

Nevertheless, the success rates of zygomatic implants can be greatly influenced by the type of surgical technique used.¹³ In the extrasinus technique, the lateralized placement of the zygomatic implant provides a greater penetration of the implant in the zygomatic bone, increasing the implant-bone contact. In addition, this technique is simpler than the classic sinus window technique⁸ and is less invasive, reduces surgical time, and provides a shorter cantilever.²² However, in this case report, the zygomatic implants installed with intra- or extrasinus surgical techniques showed similar and favorable results upon analyzing the length of the cantilever, implant position, and post-op pain, and were considered a success after 5 years of follow-up.

Furthermore, the patient in this case report did not present any complications in spite of sinus membrane perforation at the left side where the implant was installed using the classic sinus window technique.⁸ Some authors have reported prob-



Figures 7a and 7b. (a) Intraoral and (b) extraoral pictures of the maxillary implant-supported fixed prosthesis.

lems with maxillary sinusitis when the sinus membrane is perforated, with a frequency of zero percent to 37.5%.^{8,23} In addition, the presence of a foreign body may also contribute to maxillary sinusitis. In order to reduce this problem, the extrasinus implant placement technique could be indicated, since it avoids the introduction of a foreign object into the sinus. However, when the patient has an overcontoured external maxillary sinus wall, the maxillary sinus membrane is inevitably perforated, as it is in the pathway of the drill direction.²⁴

CONCLUSION

The outcomes of this limited case report confirm that zygomatic implants can be a predictable alternative to rehabilitate an atrophic maxilla. In addition, as no difference was observed in this particular case between intra- or extrasinus techniques regarding implant and prosthetic status, the extrasinus technique should be preferable since it is simpler and less

invasive than the classic intrasinus technique. ♦

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POST EXAMINATION QUESTIONS

1. The posterior maxilla frequently presents the following challenge(s) for implant placement:

- Pronounced alveolar ridge resorption.
- Maxillary sinus perforation.
- None of the above.
- Both a and b.

2. Bone anchorage of the zygoma is considered sufficient due to triple cortical strength even if trabecular bone density is unfavorable.

- True.
- False.

3. The placement of implants in zygomatic bone can be performed by means of ___ different surgical technique(s):

- 1.
- 2.
- 3.
- 4.

4. Tridimensional maxilla atrophies have been associated with unfavorable vertical, horizontal, and transverse interarch relationships. In these situations, sinus-grafting procedures are unable to adequately correct the initial clinical situation.

- The first statement is true, the second is false.
- The first statement is false, the second is true.
- Both statements are true.
- Both statements are false.

5. The following is/are true of the Le Fort I osteotomy with downward and forward repositioning of the maxilla:

- High success rate.
- Often requires invasive surgeries.
- Often requires long treatment time.
- All of the above.

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6. Some authors have reported problems with maxillary sinusitis when the sinus membrane is perforated, with a frequency of zero percent to 37.5%. The presence of a foreign body may also contribute to maxillary sinusitis.

- a. The first statement is true, the second is false.
- b. The first statement is false, the second is true.
- c. Both statements are true.
- d. Both statements are false.

7. Studies show that the success rate for zygomatic implants is greater for implants placed in mature residual bone than for those placed in areas of bone grafts.

- a. True.
- b. False.

8. Zygomatic implants must be angulated approximately _____ to engage the zygomatic process.

- a. 30°.
- b. 35°.
- c. 40°.
- d. 45°.

9. In isolation zygomatic implants have been associated with an unfavorable biomechanical situation. This risk is minimized when zygomatic implants are connected with 2 to 4 standard anterior implants.

- a. The first statement is true, the second is false.
- b. The first statement is false, the second is true.
- c. Both statements are true.
- d. Both statements are false.

10. In the extrasinus surgical technique for placing zygomatic implants, the following is/are true:

- a. Simpler than the classic sinus window technique.
- b. Reduces surgical time.
- c. Provides a shorter cantilever.
- d. All of the above.



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