Zygomatic implants have been considered an alternative treatment for prosthetic rehabilitation of patients with an atrophied maxilla without bone augmentation. These fixtures were introduced by Branemark in 1988, ranging in length from 30 mm to 52.5 mm and designed to be anchored in zygomatic bone. These implants have also been widely used for rehabilitation of maxillary defects as a result of tumor resections, congenital defects, trauma, and cases of severe atrophy of the maxilla. Indeed, the applicability of zygomatic implants represents a simplification of the conventional treatment of atrophic maxillae, which is based on bone augmentation procedures associated with dental implant placement. Therefore, these implants involve a less invasive surgical technique, reduction of costs, and treatment duration, compared to conventional rehabilitation of atrophic maxillae.

Several studies have been reported high success rates related to the use of zygomatic implants, ranging from 94% to 100%, comparable to conventional dental implants. These findings strongly suggest that zygomatic implants may provide a predictable alternative for the rehabilitation of a severely resorbed maxilla. In these cases, use of 2 zygomatic fixtures placed in each zygomatic bone has been described with favorable results, characterizing a quadruple zygomatic support. Moreover, use of 3 zygomatic implants in each side of the maxilla for support of a dental prosthesis has been previously described. However, the applicability of multiple zygomatic fixtures remains poorly reported. The aim of this case letter is to describe a modified technique using multiple zygomatic implants in combination with conventional implants for rehabilitation of the extremely atrophic maxilla.

CASE REPORT

A 78-year-old male patient was referred to the Latin American Institute of Dental Research and Education complaining of an unstable maxillary complete denture (Figure 1). The medical record includes a history of chronic sinusitis. However, the patient also related the absence of symptoms for a long time and no evidence of opacification of the maxillary sinus were detected in computerized tomography evaluation (Figure 2). Clinical, radiographical and tomographical examinations revealed absence of all teeth in the maxilla and the presence of an osseointegrated nonfunctional implant in the region corresponding to tooth #1. This implant was not removed in order to avoid communications or bone resorption in this region. Moreover, it was detected that there was extensive bone resorption with bilateral pneumatization of the maxillary sinuses aggravated by the previous use of a subperiosteal implant (Figure 2). In the mandible, the following teeth were missing: #18, #19, #20, #21, #22, #23, #24, #25, #26, and #30. Teeth #31, #29, #28, and #27 had severe periodontal disease with mobility. There was also the presence of 3 osseointegrated implants in regions corresponding to teeth #26, #22, and #20, which supported a metal-ceramic fixed prosthesis replacing teeth #26, #25, #24, #23, #22, #21, #20, and #19. In the region corresponding to tooth #31, there was a fractured metal pin.

A treatment plan was based upon the placement of 3 zygomatic implants in the right maxilla and 1 zygomatic and 2 conventional implants in the left maxilla. Prosthetic planning was performed prior to initiation of the surgical procedures.
Initially, teeth #31, #29, #28, and #27 were extracted and the prosthesis was removed. Two implants with Morse taper interface (Alvim CM, Neodent, Curitiba, Brazil) were placed in the regions corresponding to teeth #27 and #28, and implant-supported fixed prosthesis was installed.

In the next phase, surgical procedures were performed in the maxilla under general anesthesia. Initially, a mucoperiosteal incision was performed above the maxillary mucogingival line, from the region corresponding to teeth positions #3 to #7 and the region of teeth positions #14 to #10. Thus, 3 zygomatic implants with Morse taper interface were installed on the right side (Figure 3), 1 zygomatic implant with a Morse cone platform on the left side and 2 cylindrical implants interface (Titamax CM, Neodent, Curitiba, Brazil) in the region of teeth positions #12 and #13 (Figure 4). An installation torque greater than 40 N.cm was obtained in the placement of all implants, allowing the use of immediate load protocol. Mini-pilar and transepithelial

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**Figure 1.** Initial clinical aspect.

**Figure 2.** Initial cone beam computed tomography. (a) and (b) refers to transversal reconstruction and (c) panoramic reconstruction. Observe the severe maxillary atrophy, bilateral pneumatization, and the absence of opacification of the maxillary sinuses.
abutments (Neodent. Curitiba, PR, Brazil) were installed on the conventional and zygomatic implants, respectively (Figure 5). Postoperatively, the use of antibiotic (amoxicillin, 500 mg), anti-inflammatory (ibuprofen, 600 mg) and analgesic (paracetamol, 750 mg) drugs were prescribed.

Transfer impressions were taken using a multifunctional maxilla guide and fluid condensation silicone. After 48 hours, an implant-supported fixed prosthesis was installed (Figures 6 and 7), following the protocol of immediate loading using the passive luting technique. Postoperative follow-up was performed at 9 (Figure 8), 17 (Figure 9), 28 (Figure 10), 36 (Figure 11), and 55 months (Figure 12), including clinical and radiographical examinations.

In this case report, we described the rehabilitation of an extremely atrophic maxilla throughout the placement of multiple zygomatic implants, and several factors influenced in the decision for using this technique. Initially, it was not possible to place conventional implants in the right premaxilla due by the absence of adequate bone availability even in region of the canines and lateral incisors. Despite the severe maxillary atrophy, the patient presented with adequate bone availability in the zygomatic bone required for placement of multiple zygomatic implants. Additionally, this technique has been previously described.

**DISCUSSION**

![Figure 3-7. Placement of 3 zygomatic implants in the right maxilla using immediate loading. Figure 4. Placement of 1 zygomatic implant and 2 conventional implants in the left maxilla using immediate loading. Figure 5. Placement of abutments and protective caps. Observe the formation of a polygon. Figure 6. Immediate postoperative panoramic radiograph of the maxilla. Figure 7. Installation of complete maxillary metal-resin prosthesis over implants in the maxilla.](http://meridian.allenpress.com/joi/article-pdf/41/1/97/2035544/aaid-joi-d-12-00212.pdf)

![Figure 3. Placement of 3 zygomatic implants in the right maxilla using immediate loading. Figure 4. Placement of 1 zygomatic implant and 2 conventional implants in the left maxilla using immediate loading. Figure 5. Placement of abutments and protective caps. Observe the formation of a polygon. Figure 6. Immediate postoperative panoramic radiograph of the maxilla. Figure 7. Installation of complete maxillary metal-resin prosthesis over implants in the maxilla.](http://meridian.allenpress.com/joi/article-pdf/41/1/97/2035544/aaid-joi-d-12-00212.pdf)

![Figure 8-12. Figure 8. Radiographical follow-up at 9 months postsurgery. Figure 9. Radiographical follow-up at 17 months postsurgery. Figure 10. Clinical follow-up at 28 months postsurgery. Figure 11. Radiographical follow-up at 36 months postsurgery. Figure 12. Radiographical follow-up at 55 months postsurgery.](http://meridian.allenpress.com/joi/article-pdf/41/1/97/2035544/aaid-joi-d-12-00212.pdf)
Accordingly, several studies demonstrated predictable results after the placement of 2 zygomatic implants associated with anterior maxillary implants.\textsuperscript{2,19,22} Favorable clinical findings were also observed with the use of 4 zygomatic fixtures, where 2 implants were placed in the each zygomatic bone.\textsuperscript{1,11–16} Therefore, the success of multiple zygomatic implants reported in this case is in accordance with the high success rates previously described.\textsuperscript{2,3,7,8}

Torque values greater than 40 N.cm were obtained during implant placement, allowing the application of immediate loading technique.\textsuperscript{21} Some studies have also reported good outcomes with immediate loading of zygomatic implants in atrophic maxillae. The zygomatic bone density permits the use of immediate prosthetic loading.\textsuperscript{12,14,22} Indeed, the success of this rehabilitation technique is related to the biomechanical concepts. Tilted implants may create horizontal forces when subjected to load therefore, being the most critical aspect of zygomatic implants.\textsuperscript{23}

Some disadvantages have been related to zygomatic implant treatment such as difficult surgical accessibility as well as the potential risk of orbital injury, mainly in cases with an extremely atrophic maxilla. Other complications have been described, including infections in the maxillary sinus, hyperplasia of soft tissues, paresthesias, and fistula formation.\textsuperscript{7,9} In this case report, there were no complications associated to the placement of multiple zygomatic fixtures as well as the use of immediate loading protocol. Moreover, the patient reported complete satisfaction associated with an improvement in the quality of life considering that it allows an effective rehabilitation of atrophic maxillae with anterior conventional implants: a retrospective study of 81 immediately loaded zygomatic implants: a 12- to 42-month retrospective study.\textsuperscript{11}


