Rehabilitation of Atrophic Maxilla With Immediate Loading of Extrasinus Zygomatic Implant

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Abstract: The aim of this case series was to evaluate the long-term success rate of immediate occlusal loading of extrasinus zygomatic dental implants after a 3-year follow-up. The sample consisted of 31 patients (mean age of 64 years) with atrophic maxillae rehabilitated with 1 to 4 extrasinus zygomatic implants, placed unilaterally or bilaterally. All the patients received complete implant-supported dental prostheses with immediate loading by associating zygomatic implants with conventional implants. None of the procedures were associated with bone grafts. During the 3-year period of follow-up in the present study, all the patients attended clinical sessions and underwent radiographic exams every 6 months. In total 55 zygomatic and 69 conventional implants were placed, where 1 zygomatic and 2 conventional implants were lost, representing success rates of 98.18% and 97.20%, respectively. None of the studied patients had signs of sinusitis or changes in the maxillary sinuses. All the patients showed occlusal contact on natural antagonist teeth or implant-supported dental prostheses. Therefore, it was concluded that the use of exteriorized zygomatic implants with immediate loading represented a feasible option with high success rates for the treatment of atrophic maxilla.

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Rehabilitation of atrophic maxillae poses a challenge to the implant dentist. The treatment by means of horizontal bone grafts have been described in the literature, with high success rates[1–4] however, apart from producing greater morbidity, they also demand a longer waiting time for bone repair. Moreover, they make it unfeasible to insert implants with immediate loading in the first surgical stage.[2] Whereas the options for rehabilitation based on anchorage of implants in remaining bone such as the lateral wall of the nasal fossa, canine, pterygoid, and zygomatic pillars, have shown equally high success rates, and are a therapeutic option.[5]

Anchorage in the canine pillar is the most used and has been established in the literature through the "All-on-4" concept.[6] Nevertheless, in some cases, bone remodeling in the posterior region of the maxilla has been shown to be so severe that it promotes extensions into the anterior maxillary sinus, making it impossible to anchor implants in the region of the canine pillar, as recommended in the original angled implant technique.[7] When faced with these situations, the alternative for rehabilitation include transsinus implants,[8,9] pterygoid implants and zygomatic implants.[10]

The original technique implemented for zygomatic fixations recommended the insertion of implants through the interior of maxillary sinus from the remaining alveolar ridge, so that an apical anchorage of the zygomatic bone could be achieved.[11] However, despite being an innovative technique and with considerable success rates, some disadvantages have been observed, such as the need for preservation and elevation of the sinus membrane. A consequence of the extremely palatalized approach is the position of the implant platform, which in most cases will cause discomfort for the patient. Another factor to be considered in this option is the biomechanics of the whole set of the prosthetic reconstruction that may be overloaded due to the creation of a vestibular cantilever. Also, as the implant is located within the maxillary sinus from the remaining edge, it is more susceptible to sinusitis and buccal sinus communications.[12,13]

The technique to improve and avoid complications resulting from the initial technique was proposed by Stella and Warner in 2000.[14] They proposed a technique for installing zygomatic implants, which the antrostomy and lifting of the sinus membrane were not necessary, they recommend a lateral slot outside of wall of the maxillary sinus, avoiding or minimizing the contact of the implant with the sinus's membrane. Through this technique, the implant platform was improved, moving the emergence of its platform nearer to the residual crest, in an ideal three-dimensional position for implant-supported prosthesis.[14]

Some changes proposed for the technique were reported by Migliorança et al in 2012[15] and by Aparício et al 2010,[16] allowing the implant to be placed in the maxillary sinus in an exteriorized approach, optimizing the prosthetic position, coinciding with the bony ridge, thereby minimizing the risk of contaminating the maxillary sinus via the peri-implant sulcus, and consequently, the possibility of sinusitis occurrence. In this technique, a slot is not necessarily made in the side wall of the sinus, the implant will be supported, from the inside, or partially on the rim, which will determine the position of the implant in the ideal prosthetic position and/or the anatomy of the patient. The implant will always be inserted outside the maxillary sinus.

The aim of this study was to report a series of cases, in which 31 patients received zygomatic implants by means of the exteriorized technique, under immediate loading, with a mean follow-up period of 3 years.

CLINICAL REPORT

Sample Selection

The selected patients were informed about all the treatment possibilities available, besides the option of zygomatic fixation, the benefits and hypothetical risks. All patients agreed to participate and authorized the procedure by signing an informed consent form. The study was conducted between January and December 2016, with 31 patients.

The inclusion criteria considered acceptable for inclusion in the sample were completely or partially edentulous patients (Fig. 1A) with indication for extraction due to advanced periodontal disease, fracture, or esthetic indication (Fig. 1B); who had a bone height of 1 to 4 mm in the region posterior to the canine pillar, making it unfeasible to place short or conventional implants. The exclusion criterion considered patients unacceptable for the sample, those in whom it would be possible to insert conventional inclined implants or trans-sinus long implants. Further exclusion criteria adopted were patients undergoing oncological treatment, those using bisphosphonates, pregnant women, and patients who refused to participate in the study. Patients with systemic conditions such as diabetes, cardiopathies, hypertension, smokers, and those with parafunctional habits were not excluded.

Sample Preparation

After laboratory exams, taking digital photographs and obtaining the initial plaster models, these models were mounted in semi-adjustable articulators. After the reverse planning, a multifunctional guide was prepared, which served as a surgical guide and occlusal register (Fig. 1C).

The surgical procedure was performed according to the same protocol in all patients and was always performed by the same professional (AMC). When performed in a hospital environment, the patients received 2 g Cephalexin by intravenous injection before the procedure. All procedures were performed under general anesthesia. For patients undergoing outpatient surgeries, 10 mg Diazepan was used to control anxiety. As the protocol for antibiotic prophylaxis, 2 g Amoxicillin was used 1 hour before the procedure and 4 mg dexamethasone 2 hours before surgery, to control edema. In the case of patients allergic to amoxicillin, 300 mg Clindamycin was prescribed. The postoperative medication was the same for all patients: 875 mg amoxicillin associated with potassium clavulanate every 12 hours for 7 days; in case allergy to amoxicillin, 300 mg Clindamycin every 8 hours for 7 days. For pain control, 100 mg nimesulide every 12 hours, for 3 days and 1 g sodium dipyrone every 4 hours were prescribed. Mouth rinsing with 0.12% chlorhexidine twice a day for 15 days was prescribed for biofilm control until the suture was removed.

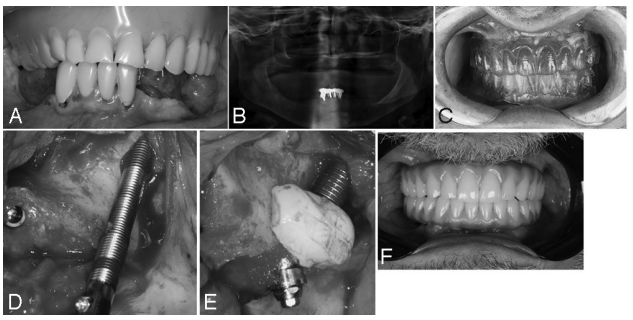

FIGURE 1. (A) Clinical aspect partially edentulous patients enrolled in this study. (B) Panoramic radiographic of edentulous patients. (C) Surgical guide and occlusal register. (D) Zygomatic implants placed extrasinus. (E) Connective tissue grafting was performed in the vestibular region of the zygomatic implant, with the intention of preventing gingival recession and/or inflammation. (F) Definitive prosthesis.

Surgical/Prosthetic Procedure

An incision was made on the alveolar crest along the full extension of the maxillary ridge, and to relaxing incisions were made posterior to the zygomatic process of the maxilla. A mucoperiosteal flap was raised, exposing all the anatomic structures necessary for implant placements. First, the conventional axial anterior implants were placed in the region of the lateral incisors, with an internal connection of the morse type (S.I.N National Implant System, Sao Paulo, Brazil). Afterwards the zygomatic implants were placed, always by means of the exteriorized technique, in which the implant was supported on the ridge in a position external to the maxillary sinus. The initial perforation was made with a 2.0 spherical bur and transfixed the zygoma bicortically. After making this perforation, it was probed for the purpose of determining the implant length, which was calculated considering a gap of 2 mm, to prevent the implant from protruding through the gum. After this the milling sequence was proceeded with as recommended by the manufacturer. The implants were initially inserted extrasinus (Fig. 1D) by using a motor until locking of 45 Ncm was achieved. Insertion was concluded with a key and a manual surgical torque meter was used to check a final torque of 60 Ncm. After this bone regeneration was performed in the vestibular portion of the implant, with the purpose of preventing possible future oral-sinus communication, using the same biomaterial that is used for maxillary sinus filling (Bio-Oss Geistlich Pharma AG, Wolhusen, Switzerland). Placement of the implants allowed emergence of the platform in the first molar region, with the insertion of the prosthetic screw as parallel as possible, to the axial implant. In some patients, connective tissue grafting was performed in the vestibular region of the zygomatic implant, with the intention of preventing gingival recession and/or inflammation (Fig. 1E). In sequence, the abutments were installed, after the mucoperiosteal flap was repositioned and fixed with quilting type and simple sutures using monofilament nylon thread 5.0. The sutures were removed as from the fourteenth day after the surgical procedure.

A provisional dental prosthesis was fabricated of heat polymerizing acrylic resin, without metal infrastructure, and this was inserted within 48 hours after the surgical procedure. This prosthesis remained in function throughout the 3-month period of implant osseointegration.

After osseointegration, fabrication of the definitive prostheses began, in some cases with a metal infrastructure and pressed resin, and in other cases, metal-ceramic prostheses (Fig. 1F).

Patients returned for evaluation every 6 months, after insertion of the definitive prostheses. At this time, the prostheses were removed for cleaning and polishing. After removal of the prostheses, probing was performed with the purpose of evaluating the peri-implant tissue health, level of gingival bleeding, clinical attachment level, and presence or absence of signs of suppuration and peri-implantitis. In all cases panoramic images were captured during the return consultations.

The sample consisted of 31 patients, 17 males and 14 females, with a mean of 62.12+/−10.02 years of age and mean follow-up period of 3 years. In total 69 conventional and 55 zygomatic implants were inserted, which were divided into rehabilitations with 1 to 4 zygomatic implants, placed unilaterally or bilaterally, as shown in Supplementary Digital Content, Table 1, http://links.lww.com/SCS/D609.

Five patients were operated on in the hospital environment, under general anesthesia and the remaining 26 patients underwent

surgeries performed in the outpatient clinic environment, with local anesthesia. In all the implants, both conventional and zygomatic, primary stability was achieved, allowing insertion of the provisional prostheses on the second day after surgery.

During the follow-up period in the present study, all the 31 patients had peri-implant tissues in a healthy peri-implant condition. In addition, we emphasize that none of the patients had signs and symptoms of sinusitis. In this period, 1 zygomatic and 2 conventional implants failed after 2 years in function, showing success rates of 98.18% and 97.20%, respectively.

DISCUSSION

The present case series study showed results that made it feasible to insert zygomatic implants by means of the exteriorized technique used as an alternative therapy for maxillary atrophy as shown in Supplementary Digital Content, Table 1, http://links.lww.com/SCS/D609. This technique was a modification of the original technique because it did not demand maxillary antrostomy sinus surgery, because the implant was placed outside the maxillary sinus. Initially, the placement of zygomatic implants using the approach via the maxillary sinus was recommended and had high success rates, reaching a percentage of approximately 97%.[17] However, the palatal emergence of the implant could cause the patient discomfort due to the design of the dental prosthesis, difficulty with cleaning, and occlusal overload arising from the vestibular cantilever.[15] The technique of placing exteriorized zygomatic implants used in the present study allowed a more favorable prosthetic position, coinciding with the bony ridge. This fact may have contributed to the high success rate of 98.8%, because of making it easier to clean when compared with the conventional technique. The success rate found in this study is in agreement with those described by Aparício et al 2010,[16] Maló et al 2013[9] and 2015,[6] and Coppedê et al 2017.[18] Aparício et al 2020[19] described a revisited zygoma criteria of success code (ORIS [offset, rhinosinusitis, infection, and stability]), considering the criteria of success used in implants placed in pristine alveolar and zygomatic bone. The ORIS is the acronym of offset, rhinosinusitis, infections, and stability. According to these criteria, in the present case series, it is possible classify just 1 patient in success condition II, which represents an alteration of routine without clinical impact, because the failed implant and a new implant was performed with a satisfactory result. All the other patients could be classified in the success condition I, which represents the optimal stage.

In the original technique, an important fact to consider was the possibility of contamination via the maxillary sinus.[18] In the exteriorized technique used in the present study, a possible intercurrence would be represented by gingival tissue recession and peri-implant tissue inflammation. In this case series, 2 patients had this condition. This phenomenon, as in the case of natural teeth, occurs more frequently in patients with a thin gingival biotype. Gingival recession results from migration of the junctional epithelium, in is more pronounced in implants due to the attachment of this epithelium to the implant being more fragile when compared with the attachment to dental tissues.[20] The attached gingiva that is covered with keratinized epithelium plays an important role in protecting the peri-implant gingival tissues, and in these cases of recession, the loss of attached gingiva is a common fact. This invariably causes sensitivity and consequent biofilm accumulation, contributing to the appearance of localized inflammation, findings like those of Coppedê et al 2017.[18] However, in the patients of the case series who were operated on more recent dates, this complication was minimized by means of connective tissue grafting in the vestibular region of the zygomatic implants, with the purpose of making the gingival biotype thicker; this therapy was also reported by Aparício et al 2020.[21] This condition was in agreement with the findings in the study of Peñarrocha-Diago et al 2020,[22] in which they reported a case series with bone regeneration and connective tissue grafting being performed in the vestibular region of the implant. They obtained satisfactory results with maintenance of peri-implant tissue stability and absence of sinusitis, corroborating the findings of the present study.

Lack of a control group is the main limitation of all case series studies. Nevertheless, the preliminary study showed results favorable to the use of extrasinus zygomatic implants in the rehabilitation of atrophic maxillae. This may be useful in future study projects, including controlled randomized clinical studies.

CONCLUSIONS

By means of this case series it would appear to be admissible to say that the rehabilitation of atrophic maxillae with zygomatic implants using the exteriorized technique, and immediate occlusal loading could be an effective alternative treatment that showed not only a high survival rate of the implants but a high success rate as well.

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