JOURNAL OF BIOLOGICAL REGULATORS & HOMEOSTATIC AGENTS Vol. 33, no. 5, 1651-1656 (2019)

LETTER TO THE EDITOR

SATISFACTION GRADE ASSESSMENT OF PATIENTS TREATED WITH ZYGOMATIC IMPLANTS WITH SELF-TAPPING APEX AND MACHINED BODY

A. SCARANO[1], R. CONTE[2], G. MURMURA[1] and F. LORUSSO[3]

[1]Department of Medical, Oral and Biotechnological Sciences and CeSi-MeT, University of Chieti-Pescara, Chieti, Italy; [2]Private Practice, Padova, Italy; [3]Department of Medical, Oral and Biotechnological Sciences, University of Chieti-Pescara, Chieti, Italy

Received June 7, 2019 – Accepted August 2, 2019

To the Editor,

The treatment of maxillary severe atrophies related to the traumatic loss of the dental elements, incorrect prosthetic loads or oncologic resection needs reconstructive surgery procedures, preparatory to implant-prosthetic support (1). Many different regeneration techniques to increase hard and soft tissue reconstruction with autologous bone have been proposed, such as the use of bone intraoral and/or extraoral grafts, sometimes associated with Type I Le Fort osteotomies (2).

In this context, the use of auxiliary surgical techniques, such as the use of zygomatic implants, may represent a treatment option in cases of severe partial or complete atrophy of the maxillary. Brånemark et al. has described a positioning technique that involved the insertion of implants through the sinus intra route and guided insertion through the execution of a lateral trapdoor bone, without lifting the Schneider membrane, experiencing a high predictability of the procedure (3). The original technique has been modified to provide for the preservation and lifting of the sinus membrane, contextual to the procedure.

Stella and Warner have proposed a variant of the zygomatic implant placement technique (sinus slot technique), which does not require detachment of the Schneider membrane (4). In this regard, a further technical variant with extrasinus approach has been proposed, the implant route of which is completely external to the cavity of the maxillary sinus. In the literature, different geometries and implant designs have been proposed in order to facilitate an optimal positioning of the fixture and a long-term maintenance of osseointegration of the placed implants (5-7).

The aim of this work was to clinically evaluate the survival rate and patient satisfaction before and after prosthetic rehabilitation of zygomatic implants with machined body and self-tapping apex.

MATERIALS AND METHODS

A total of twelve patients affected by extreme atrophy of the maxilla, who needed prosthetic implant-borne maxillary rehabilitation, were treated from May 2016 to January 2019 in the Department of Medical Sciences, Oral and Biotechnology, University of Chieti-Pescara. Healthy patients with non-contributory past medical history, 7 women and 5 men, all non-smokers, mean age 51 years, (range 49–61 years) were included in this study.

The inclusion criteria were extreme atrophy jaw with unstable implants accompanied by wounds, sores and associated functional and aesthetic discomfort. In the

Key words: zygomatic implants; maxillary atrophy; fixed prosthesis

Corresponding Author:
Prof. Antonio Scarano,
Department of Medical, Oral
and Biotechnological Sciences and CeSI-Me,
University "G. D'Annunzio" of Chieti-Pescara,
Via dei Vestini, 31, 66100 Chieti (CH), Italy
Tel.: +39 0871 3554084
e-mail: ascarano@unich.it

0393-974X (2019)

DISCLOSURE: ALL AUTHORS REPORT NO CONFLICTS OF INTEREST RELEVANT TO THIS ARTICLE.

period of study (including a 1-year follow-up), twenty-four zygomatic implants (Isomed, Padova, Italy) and 24 standard implants (Isomed, Padova, Italy) were inserted in the premaxilla area. The implants used in this study are characterized by a self-tapping apex of 13 mm with surface treatment, while the remaining part by a machined surface (Fig. 1A). The implant has an internal hexagonal connection that allows screwing a Multi-Unit Abutment (MUA) to allow prosthetic anchoring.

The subjects underwent screening according to the following inclusion criteria: absence of lesions in the oral cavity and insufficient residual bone volume to receive standard implants. In addition, patients who agreed to participate in a postoperative program were included.

The exclusion criteria were: i) smoking more than 20 cigarettes a day, or excessive consumption of alcohol (about 1 litre a day of wine); ii) local radiation therapy of the oral cavity, anti-cancer chemotherapy; iii) blood disorders, liver or kidney disease, immunodepressed patients; iv) patients receiving corticosteroids; v) pregnancy; vi) autoimmune and inflammatory diseases of the oral cavity.

After examination by three-dimensional X-ray (CBCT) and oral impressions, investigations proceeded with a 3D printing of the atrophic jaws (Fig. 1B) in order to simulate the surgery and confirm the previously planned implant length using 3D planning software (Isomed, Padova, Italy). All patients received two zigomatic implants and two standard implants. The zygomatic implants used in this study had a diameter of 4.1 mm and a length of 40 mm.

Data collection

Before the surgical treatment, radiographic examinations were performed such as radiographs, orthopantomographies (OPT) and tomographic scans (CBCT). In the period of follow-up, OPT and radiographical data were collected and processed by a dedicated software (ITK-SNAP, Penn Image Computing and Science Laboratory, University of Pennsylvania, USA). The rate of successful implantation was evaluated according to the following criteria:

(i) absence of persistent pain or dysesthesia;

(ii) absence of peri-implant infection with suppuration;

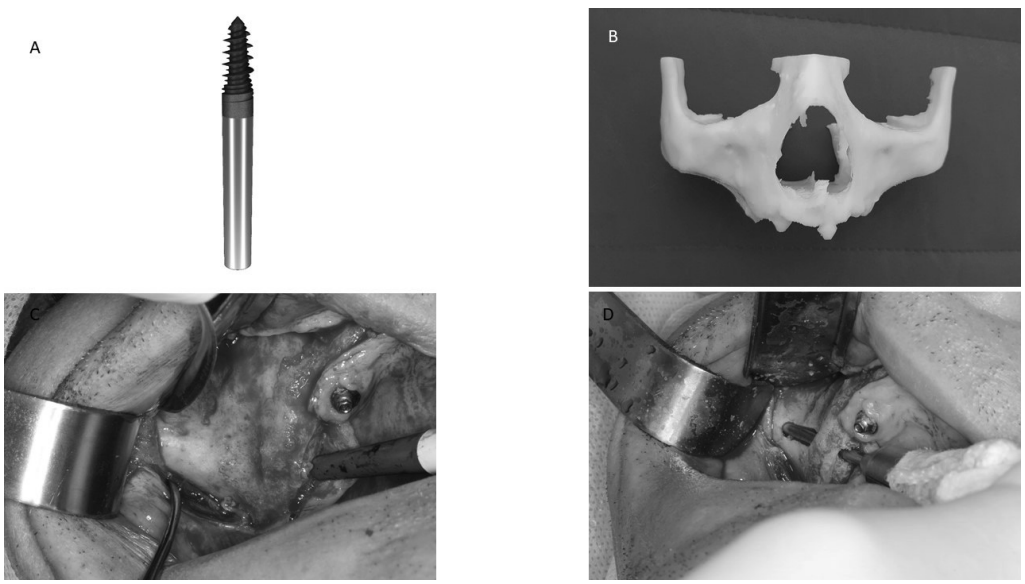

Fig. 1. ***A)*** *Zygomatic implants with machined body and self-tapping apex used in the present study.* ***B)*** *3D printing of the atrophic jaws in order to simulate the surgery and confirm the previously planned implant length using 3D planning software.* ***C)*** *After crestal incision a modified mucoperiosteal triangular flap was performed. The zygomatic region was exposed and remained clearly visible with through retractor for the whole duration of the intervention.* ***D)*** *The second bur perforates the cortical bone of the maxillary sinus and enters in the zygomatic bone for about 14 mm, impacting forwards at about 1 cm from the orbital cavity.*

(iii) absence of mobility;

(iv) absence of persistent peri-implant bone resorption visible in orthopantomography.

In this study zygomatic implants were used which had a spiral self-tapping apex and a machined body.

Surgical technique and prosthetics

All patients were treated following the same surgical protocol, with an antimicrobial prophylaxis of 500 mg amoxicillin twice daily for 5 days starting from one hour before the intervention. The shape and volumes of the maxillary were studied using Cone Beam Computed Tomography (CBCT). Impressions were vertical dimension (VDO), centric relation (CR) and skeletal relationship of the jaw. A stereolithography model was realized by the DICOM files and a 3D printer, which is a particularly indicated for this type of surgery as it faithfully reproduces the bony anatomy of each case, allowing to assess the exact size and position of the implants. Local anesthesia was induced by infiltration of articaine/epinephrine Articaine Pierrel (Pierrel, Milano, Italy) and the postsurgical analgesic treatment was carried out with 600 mg of ibuprofen twice a day for 3 days.

After crestal incision, a modified triangular mucoperiosteal flap, recently described and used in the large sinus lift, was raised (Fig. 1C), proceeding with the exposure of the zygomatic region, leaving it clearly visible (through retractor) for the whole duration of the intervention (Fig. 1D) (7).

An initial osteotomy was performed with a 5 mm round bur in the highest part of the bone ridge. A furrow in the crestal direction was performed with a second diamond bur with machining tip. The third bur perforated the cortical bone of the maxillary sinus and entered the zygomatic bone for about 14 mm, impacting forwards at about 1 cm from the orbital cavity. The distance between the point of crestal bone and the apical point was measured with a probe, based on the tomography measurement. The suitable length of the implant was confirmed and it was screwed into the implant bed. The relationship between the alveolar crest and zygomatic area influences the implant position, and the final preparation was performed with a calibrated bur to the predetermined length (Fig. 2A). The implant was inserted with an axis extending from the second premolar or canine

Fig. 2. ***A)*** *The final preparation was carried out with a calibrated bur of a predetermined length.* ***B)*** *The maxillary sinus after a small detachment of the Schneider's membrane.* ***C)*** *Zygomatic implant placement.* ***D)*** *Placement of two conventional and two zygomatic implants.*

from the highest point of the cheekbone, exactly in the corner formed by the frontal and temporal process. The point of entry was palatally in the premolar area. During the placement, the implant leans against the wall of the maxillary sinus after a small detachment of the Schneider's membrane (Fig. 2B). The implants used present a geometric shape characterized by self-tapping threads that allow an easy positioning and, above all, a high primary stability (Fig. 2C) This shape allows the implant to slide along the osteotomy and to be engaged in the zygomatic hole in a simple and predictable way (fig. 2D). The flaps were sutured with non-absorbable thread 4.0 (Assut Europe, Magliano dei Marsi, Italy) leaving the distal outlet free to facilitate inflammatory exudate drainage in the first hours after surgery (7).

At the end of the procedure, an intravenous infiltration of dexamethasone (4 mg) was performed. Orthopantomography was carried out after surgery to evaluate the correct position of the fixtures (Fig. 2 A, B). A warm and soft diet was recommended for two weeks, supported by a thorough oral hygiene protocol. In order to preserve the intestinal microbiome, the intake of lactic acid bacteria (Biocult Strong, Italfarmacia, Rome-Italy) was also prescribed. Seven days after the procedure the surgical suture was removed. Before the next implant uncovering, patients were allowed to use removable dentures with the aid of adhesive pastes. The second surgical phase was carried out after 3 months, in which the healing abutments of the implants were positioned. A temporary restoration was carried out in acrylic resin, finished, polished and cemented approximately 4 weeks after the second phase implant surgery. The final prosthetic restoration was screwed in and completed after 8 weeks of loading with the acrylic prosthesis. All the subjects were included in a rigid oral hygiene recall program. Patients were asked to complete a questionnaire to measure the degree of satisfaction before and after prosthetic rehabilitation with a score ranging from 1 to 10, where 10 represented the maximum level of comfort of masticatory function comparable to the natural teeth, and 1 corresponded to poor results comparable to a mobile and unstable dental prosthesis. The questionnaire was completed 1 month after surgery and 6 months after loading with the final prosthesis.

RESULTS

After the surgical procedure all patients reported the sensitivity of the area but no cases of neurological damage were observed. No pain or purulent secretion on palpation were reported to be associated with any of the inserted implants either conventional or zygomatic. The postoperative radiographs showed the implants engaged in zygomatic bone following a sinus path as per the planning of the surgical treatment. One patient reported extensive bruising of the face which resolved almost completely after 5 days. All implants appeared stable and the patients showed a high degree of satisfaction 6±0.4, while before treatment patients attributed a score 1±0.3, and after 6 months, the degree of satisfaction was 8±0.4. No cases of implant loosening or fracture were observed during the period of follow-up.

Fig. 3. *An intrasinusal technique and extra-sinus procedure approach depends upon the concavity or convexity that describes the outer wall of the maxillary sinus.*

DISCUSSION

The zygomatic implant proved to be an effective option in the management of atrophic edentulous maxilla, as well as defects in the maxillectomia (8).

The use of multiple zygomatic implants (two or three on each side) combined with two or four anterior maxillary axial implants to support a prosthesis has been suggested by Bothur and coll. (9). The technique for atrophic patients, not subjected to maxillectomia, involves the opening of the maxillary sinus without lifting the sinus membrane to drive the cutter towards the zygomatic bone (5). There are essentially two surgical techniques for the insertion of the zygomatic implants: an intrasinusal technique and an extra-sinus procedure, and the approach depends upon the concavity or convexity that describes the outer wall of the maxillary sinus The sinus morphology affects the passage or otherwise of the alveolar crest to anchor to the zygomatic bone (Fig. 3).

Several retrospective studies document a percentage of implant survival rate of 90-100% (9-10). Contraindications to the zygomatic treatment include chronic infectious sinusitis, maxilla or zygomatic disease, the use of bisphosphonates, and smoking more than 20 cigarettes a day (7). Computed tomography is crucial for the evaluation of the zygomatic implant site and the sinus condition, as well as for the implant path.

The use of this new technique provides for the possibility of an extra-sinus implant path, with promising results (11). In this research we used one zygomatic implant per side and 2 implants in the anterior maxilla. The post procedure management is very important, in fact a soft diet was prescribed for 12 weeks, the time consistent with the proper periimplant healing intended as bone remodelling induced by the load.

After 18 weeks, the subjects introduced foods with greater consistency to the exclusion of hard foods, and those which require the application of strong masticatory forces. After 24 weeks the patients were given freedom of choice of food. Even the occlusion is important, patients were given a bilateral occlusion with a front group, the cusps were also little accentuated in order to limit the lateral components of the occlusal forces. The results observed in the present study show the ease of implant placement with self-tapping apex which makes it possible to easily center the hole in the zygomatic bone. The zygomatic implants represent a good alternative to regenerative surgery, taking advantage of the available bone anchored in the zygomatic region to native and non-regenerated bone with obvious biomechanical advantages (3).

ACKNOWLEDGEMENTS

The authors acknowledge the helpful technical assistance of Dr. Mauro di Berardino (radiology technician) for elaboration of CBCT.

REFERENCES

1. Wagner F, Dvorak G, Nemec S, Pietschmann P, Figl M, Seemann R. A principal components analysis: how pneumatization and edentulism contribute to maxillary atrophy. Oral Dis 2017; 23(1):55-61.
2. Schlund M, Nicot R, Lauwers L, Raoul G, Ferri J. Le Fort 1 osteotomy and calvarial bone grafting for severely resorbed maxillae. J Craniomaxillofac Surg 2016; 44(7):859-67.
3. Brånemark P-I, Gröndahl K, Ohrnell L-O, et al. Zygoma fixture in the management of advanced atrophy of the maxilla: technique and long-term results. Scand J Plast Reconstr Surg Hand Surg 2004; 38(2):70-85.
4. Stella JP, Warner MR. Sinus slot technique for simplification and improved orientation of zygomaticus dental implants: a technical note. Int J Oral Maxillofac Implants 2000; 15(6):889-93.
5. Lima de Andrade C, Carvalho MA, Bordin D, da Silva WJ, Del Bel Cury AA, Sotto-Maior BS. Biomechanical behavior of the dental implant macrodesign. Int J Oral Maxillofac Implants 2017; 32(2):264-70.
6. Scarano A, Degidi M, Perrotti V, Degidi D, Piattelli A, Iezzi G. Experimental evaluation in rabbits of the effects of thread concavities in bone formation with different titanium implant surfaces. Clin Implant Dent Relat Res 2014; 16(4):572-81.
7. Scarano A, Lorusso F, Arcangelo M, D'Arcangelo C, Celletti R. Lateral sinus floor elevation performed with trapezoidal and modified triangular flap designs:

a randomized pilot study of post-operative pain using thermal infrared imaging. Int J Environ Res Public Health 2018; 15(6): pii: E1277.

8. Araújo PP, Sousa SA, Diniz VB, Gomes PP, da Silva JSP, Germano AR. Evaluation of patients undergoing placement of zygomatic implants using sinus slot technique. Int J Implant Dent 2016; 2(1):1-10.
9. The treatment of maxillary severe atrophies related to the traumatic loss of the dental elements, incorrect prosthetic loads or oncologic resection needs reconstructive surgery procedures, preparatory to implant-prosthetic support (1).
10. Scarano A, Crocetta E, Quaranta A, Lorusso F. Influence of the thermal treatment to address a better osseointegration of Ti6Al4V dental implants: histological and histomorphometrical study in a rabbit model. Biomed Res Int 2018; Doi: 10.1155/2018/2349698.
11. Scarano A, Carinci F, Mangano C, Quaranta A, Piattelli A. Removal torque values of titanium implants inserted into bone defects filled with hydroxyapatite: a histologic and histomorphometric analysis in rabbit. Int J Immunopathol Pharmacol 2007; 20(1 S1):49-53.
12. Bothur S, Jonsson G, Sandahl L. Modified technique using multiple zygomatic implants in reconstruction of the atrophic maxilla: a technical note. Int J Oral Maxillofac Implants 2003; 18(6):902-4.