

Decontaminating and Regenerative Treatment of Peri-Implantitis with Implacure Protocol in Zygomatic Implants

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Abstract

The rehabilitation of the severely atrophied edentulous maxilla poses a great challenge to surgeons and prosthodontics that work on this particular area. The classic approach implies bone augmentation techniques by means of bone grafting, bone distraction techniques and others. All of these require major surgery, sometimes associated with morbidity at donor and receptor sites and functional rehabilitation of the patient must occur in two surgical stages.

Since the development of the zygomatic implants by Per-Ingvar Brånemark, there's an alternative to bone grafting techniques, using the body of the zygomatic bone as major point of anchorage to a intraoral osseointegrated implant. This procedure allows the patient to regain orofacial function in only one surgical stage, with high predictability, less morbidity, time spend and costs.

Peri-implant diseases are defined as pathological inflammatory reactions in the tissue surrounding the osseointegrated implant. They are classified into two categories: mucositis - defined as peri-implant soft tissue inflammation and peri-implantitis - bone loss in the peri-implant region.

A clinical case of a 55 years old female with a zygomatic implant at the anatomical position of 1.6 and a follow-up of 6 years is presented. A bone defect was observed in the cervical region of the implant accompanied by mucosal dehiscence.

The proposed approach in the exposed clinical case involves the use of Implacure® Protocol, whose combination of the mechanical decontamination technique, together with the use of disinfectant chlorhexidine and orthophosphoric acid, added with the combination Piperacillin + Tazobactam together with hyaluronic acid, provide a base that allows to regenerate the bone and increase the survival time of the implant.

Keywords: Zygomatic Implant; Peri-implantitis; Implacure® Protocol

Introduction

The rehabilitation of the orofacial function of totally and partially edentulous patients before the advent of the concept of osseointegration was carried out using removable prostheses. In 1965 osseointegrated implants were used for the first time to treat edentulous patients [1].

The osseointegration techniques for maxillary rehabilitation are more complex than those of mandibular rehabilitation, due to the proximity of the nasal cavities and maxillary sinuses, to the degree of maxillary bone resorption (particularly in the posterior region by early extractions, pneumatization of the maxillary sinuses) and quality of the maxillary bone, more vascularized and less dense than the mandibular bone [1]. Patients with adequate maxillary bone availability are the exceptions, most of them present different degrees of atrophy, which require alternative techniques for the use of existing bone (e.g. pterygoid implants), autogenous or alloplastic bone grafts (e.g. bone grafts onlay maxilla, maxillary

sinus bone grafts) or osteogenic distraction techniques (e.g. Le Fort I maxillary fracture) [2]. These procedures, in spite of being able to offer higher success rates for osseointegration, present disadvantages, namely the need for multiple surgical interventions, restriction of prosthesis use for a long transitional period (minimum 4 months), increased morbidity, higher surgical costs and hospitalization [1,2].

In the early 1990s, with her experience in animal and human research, PI Brånemark acknowledged that the introduction of implants in the maxillary sinuses did not necessarily compromise breast health and considered the use of the zygomatic bone as an anchorage point for implants, which would ensure the prosthetic rehabilitation of mutilated patients, resulting from surgeries of tumor resection, trauma or congenital facial defects [3,4]. As these interventions were successful and the long-term stability of these implants was verified, in 1997 Brånemark developed the zygomatic implant, which provides bone fixation under conditions of

severe resorption or bone loss in the posterior maxilla, with the advantage of eliminating the need for grafts bone in its intervention area [1-4].

Zygomatic implants are commercially pure titanium screws, available in 13 different lengths from 30 to 62.5 mm. They have an angled head of 45°, which compensates for the angulation between the zygomatic bone and the maxilla.

The contact tip with the zygomatic bone has a diameter of 4.0mm and the contact tip with the alveolar process of the maxilla has the diameter of 4.4mm [3-6].

The original concept of P. I. Brånemark considers the use of two zygomatic implants at the posterior maxilla level, combined with 2 to 4 conventional premaxilla implants.

This method may not exclude the use of bone grafts in the region below the nasal opening (premaxilla) [2-5]. Consequently, in the effort to provide surgery without bone grafts, modified techniques have been developed that use multiple zygomatic implants anchored in the zygomatic bone - Quadrix Technique [6,7].

However, bone loss in the cervical region of the implant is one of the complications of this type of treatment, and its resolution is of crucial importance, as shown in the clinical case described.

Surgical protocol

Surgery for the placement of zygomatic implants is an outpatient procedure and is performed normally under general anesthesia, and the patient may be discharged a few hours after their termination [2-6,10]. The procedure begins with a palatine incision along the entire maxillary border, or optionally with incision at the bottom of the maxillary vestibule (Le Fort I type), and discharge incisions may be necessary to facilitate soft tissue detachment throughout the thickness of the maxilla from the posterior aspect to the nasal fossae and the folding of the tissue from the maxillary crest to the region of the zygomatic bone body [2-8]. The infra-orbital nerve and vessels must be identified, the zygomatic process of the maxilla and the zygomatic arch [3-5]. Then, the palatine fibromucosa is removed and folded, identifying the posterior orifices [3-6]. At this stage the whole jaw is exposed.

A bony window is opened in the supero-lateral region of the anterior wall of the maxilla, at the border between the zygomatic bone and the maxillary sinus, to allow access to the interior of the maxillary sinus, removal of the Schneiderian membrane, visual-

ization and referral of the implant [3-6]. This access is also useful, during the surgical procedure, for cooling the drills, irrigating and cleaning the sinus during and after placement of the implant [3-6].

Surgical instrumentation is now underway, with perforation and widening of the implant receptor bone bed. The perforations are made in the palatal aspect of the alveolar region of the maxilla, reach the maxillary sinus and continue along the lateral wall of the maxillary zygomatic process, until it penetrates cortical bone again into the body of the zygomatic bone [4-6]. It is intended to transfer the zygomatic bone body so as to ensure a bicortical anchorage and the use of the entire osseointegrating area [4-6]. Once the maxillary and zygomatic bone bed is created, the implant is inserted using a low-rotation motor or a suitable manual key.

After placement of the implant, the cervical end is enclosed with a cap screw or multi-unit and the soft tissues sutured [3]. There is no evidence to support the closure of maxillary sinus trepanation [3].

The original technique described above can be adapted and simplified in certain cases, so as to enable the implant to emerge on the alveolar crest and in the more anterior regions of the maxilla. In this procedure, referred to as the Sinus Slot Technique, the implant does not pass through the maxillary sinus, a groove is created in the outer face of the anterior wall of the maxilla, through which the implant is guided from the intraoral piercing site to the insertion site at the junction between the lateral orbital edge and the zygomatic arch [2,8].

According to the original PI Brånemark protocol, the anterior maxilla area is rehabilitated by placing 2 to 4 conventional osseointegrated implants according to local bone availability, and it is sometimes necessary to perform bone grafting techniques to ensure the viability of the implants [2-5]. The Quadrix concept modifies the original protocol by using four zygomatic implants in order to eliminate the need for bone grafts or other bone enhancement techniques [6,7]. This technique allows the rehabilitation of the patient in only one surgical time, and although it is more demanding in technical terms for the surgeon, it does not present more postoperative complications than the original procedure [7].

Post-operative complications

Peri and postoperative complications are uncommon, prospective follow-up studies of patients between 6 months and 10 years after placement of zygomatic implants report success rates above 90% [2,9,11]. The most prevalent complications are: sinusitis, peri-

implant infection, implant dehiscence, orbital floor perforation, false pathway in the implant course, oro-sinusal fistula, neurological lesions (facial paraesthesia), hygiene difficulties, dysarthria (usually resolved with alteration of the prosthesis or use of speech therapy) and aesthetic dissatisfaction [8,9,11,12].

Risk factors

Among the most important risk factors are the lack of oral hygiene, history of periodontitis and smoking. Other factors, such as metabolic control of diabetes, alcohol consumption, genetic susceptibility, lack of keratinized mucosa, type of implant surface or the role of occlusion may also increase the risk of peri-implantitis [13,14].

Despite this treatment options for peri-implantitis have been little studied; a Cochrane review in 2011, concluded that the available evidence on the treatment for peri-implantitis is of insufficient quality and quantity and therefore more and better research is needed [15].

Treatment options

Non-surgical treatment of peri-implantitis using laser or air abrasive systems has shown insufficient results. Studies evaluating therapy with chemotherapy and mechanical debridement show minimal resolution. The attempt to use photodynamic therapy for the treatment of peri-implantitis was also unsuccessful. We can therefore state that, non-surgical treatments are not able to stop the progression of the condition [16-18].

The only treatment that demonstrates efficacy in peri-implantitis resolution seems to be the surgical one. However, resection surgery is only partially effective; Leonhardt, *et al.* [19] described effective surgical and antimicrobial treatment in slightly more than half of the peri-implantitis lesions over a five-year period. Heitz-Mayfield, *et al.* [20] demonstrated that an antimicrobial protocol with access to the surgical flap was able to stop peri-implantitis progression in 90% of the cases in the short one year term, but bleeding on the probe persisted in almost 50% of those same cases. Although a surgical resection approach seems to improve outcomes, it is the combination of surgical approach and regenerative procedures where the highest success rate is found. Schwarz, *et al.* [21] found that regenerative surgical treatment is effective over 2 years, resulting in stagnation of peri-implant bone loss and reduction of bleeding from 80% to 34%.

Unfortunately, not all peri-implant lesions are amenable to regeneration. In some of these cases, the defect will present as a

complete loss of surrounding bone walls leaving regeneration as an unpredictable treatment option. The implantoplasty promotes the production of a surface that is less conducive to bacterial colonization and is an effective way of mechanical decontamination.

Im placure® protocol

The novel Im placure® protocol consists of the application of an antibiotic solution of piperacillin and tazobactam in the peri-implant pocket in two sessions, separated by 4 - 7 days as the initial procedure. The tip of the needle should be folded imitating a periodontal probe, and carefully the liquid inserted into the pocket, similar to the periodontal probe. When it reaches the bottom of the bag, the solution should be injected until the bag is completely filled. The entire surface of the infected implant is covered with liquid.

Subsequently, the decontamination protocol of the implant is followed: a full thickness flap is performed to obtain adequate access to the treatment area, if possible with removal of the implant-supported crown if it is screwed. Perform complete curettage of the infected bone; using bur 1 (black ring) to clean the implant surface on the cervical part and bur 2 (green ring) to clean the most apical loops on the implant surface. A sterile dressing is placed around the implant to protect bone walls and surrounding soft tissue; moisten with saline solution to improve adhesion. The gel composed of 37% of orthophosphoric acid and 2% of chlorhexidine is applied over the entire surface of the implant using the syringe and allow the gel to act for 2 minutes to facilitate the disintegration of the biofilm. After 2 minutes, the gel is removed with a sterile cannula and the implant surface washed with irrigation of saline solution for 10 seconds, then the remaining saline and compress are removed with sterile cannula. The next step involves wrapping the implant with a sterile dressing and impregnating it with the sodium hyaluronate-piperacillin-tazobactam solution; wait 5 minutes and remove the compress. Mix the bone graft with the sodium hyaluronate-piperacillin-tazobactam solution in a sterile vessel, place the bone graft on the defect and cover the area with a collagen membrane previously soaked with the sodium hyaluronate-piperacillin-tazobactam solution and suture.

Clinical Case

A 55-year-old female patient who attended the consultation of Oral Surgery and Implantology of Clitrofa referring to painful symptomatology at the zygomatic implant level in the anatomical position of 1.6 associated with dehiscence. The implant had been placed for about 6 years.

Additional diagnostic tests (orthopantomography and periapical x-ray) were performed, which allowed the diagnosis of a remarkable bone loss of about 40% of the implant length and a depth of probing of more than 6 mm.

It was proposed to perform a surgical treatment combining the Im placure® protocol and bone regeneration.

The patient underwent systemic antibiotic, analgesic and anti-inflammatory therapy for 8 days.

After 12 months of follow-up the patient presents a favorable clinical appearance, radiologically showing a good recovery of bone trabeculation. The patient has no symptoms.



Figure 1: Initial orthopantomography and periapical x-ray of the zygomatic implant of 1.6 with 6 years of follow-up. Significant cervical and vestibular bone loss. Full thickness detachment and implantoplasty of the exposed implant area.



Figure 2: Im placure® protocol with gel application (orthophosphoric acid-chlorhexidine) for 2 minutes with soft tissue protection.



Figure 3: Im placure® protocol with antibiotic solution (sodium hyaluronate-piperacillin-tazobactam) for 5 minutes and bone graft with Cerasorb M® (Curasan®) and Osgide® membrane (Curasan®).



Figure 4: Clinical aspect with silk suture with simple stitches. Orthopantomography and final periapical x-ray after 12 months of follow-up.

Discussion and Conclusion

The development of the zygomatic implant was performed with the aim of rehabilitating patients with large facial mutilations such as hemimaxilectomy, tumor resection, traumas or genetic defects. This procedure has been gaining an increasing number of indications, which include extensive maxillary reabsorption (especially in the posterior sector), cleft palate, dehiscence of bone graft or when it is contraindicated [1-5,9,12,14,15].

The advantages of this technique are clear:

- The time of surgery is significantly reduced, in addition to the rehabilitation of the patient in only one surgery and in some cases the patient may be able to carry immediate orofacial load and function [4-6];
- The success rates of osseointegration with zygomatic implants are over 90% compared to 75% success rates in maxillary sinus grafting techniques without the occurrence of potential complications associated with the collection and application of the bone graft [2,3,9];
- No longer laboratory time or prosthetic tests are required when compared to the use of standard implants [2] and aesthetic results are equivalent;
- Monetary expenditures are significantly lower [2];
- The need for hospitalization is minimized [2];
- The zygomatic implant technique presents high predictability for the rehabilitation of totally or partially edentulous maxillae [3-5].

However, it is essential to establish a maintenance protocol for implants through frequent control consultations and a non-surgical approach to prevent the appearance of peri-implantitis. Once peri-implant established, non-surgical treatment is not effective. The type of defect must be correctly diagnosed to choose the surgical protocol appropriate to each clinical case. Mechanical and

chemical decontamination seems to play an extremely important role in preventing the progression of peri-implantitis.

The usage of Im placure® with the described protocol seems to be a good and strong approach to the treatment of peri-implantitis, with long term results and no adverse side effects. The combination of the physical decontamination technique, alongside the utilization of the disinfectant composed by chlorhexidine and orthophosphoric acid and then the long term support of the piperacillin and tazobactam in combination with the hyaluronic acid, provides a base that allows bone to regenerate and increase the implant survival chances.

The proposed approach in the exposed clinical case presupposes a combined treatment of implantoplasty, chemical decontamination and regenerative treatment that showed results concordant with those of the literature [17]; however, it is necessary to conduct multi-centric clinical studies with more significant samples and longer follow-up periods.

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