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Original Article

Treatment of atrophic maxilla with zygomatic implants in 29 consecutives patients

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Abstract: Atrophic maxilla is a common condition in older population; some treatments are proposed with bone reconstruction or zygomatic implant. Long-term follow up show the efficiencies of zygomatic implant but limited data are associated to consecutive patient. The aim of this study was to evaluate retrospectively the zygomatic implants performed consecutively in 29 patients. Data from clinical records of 29 patients treated with zygomatic implants were analyzed; were include patient with at least 10 month of prosthetic function. Four surgeons realized all surgeries using local anesthesia with a slot technique on local anesthesia; the variables analyzed were implant survival, complications, prosthetic load and satisfaction of patient; data collection was analyzed by descriptive statistic and chi-square test with $p<0.05$ for significance statistical. 67 zygomatic implants and 84 conventional implants were installed in patients between 35 and 69 year old being 18 (62%) female and 11 (38%) male. The main indication was the case of severe alveolar resorption in 21 cases (72.41%), followed by failures in maxillary reconstruction with bone graft in 4 (13.79%). The implant success was 79.1% and the immediate or delayed load was not associated to statistical difference ($p=0.104$). The main complication was the loss of osseointegration and mucositis. Analogue Visual Scale (AVS) for satisfaction show acceptable esthetic and function. Finally we conclude that zygomatic implant present adequate survivor and a good response of patient; important complication can be present in a learn curve for this surgery.

Keywords: Zygomatic implants, atrophic maxilla, surgical technique

Introduction

The rehabilitation of an atrophic maxilla is a challenge for oral and maxillofacial surgeon. In many patients, treatment with conventional implants cannot be performed because the lack of alveolar bone caused by the pneumatization of the maxillary sinus [1]. Traditionally, the severely absorbed jaws have been treated with cortical-medullar bone grafts from the iliac crest performed under general anesthesia [1-3].

Reconstructive procedures is complex technique because they need a second surgical area to remove the graft, soft tissue with good quality to coat the graft, cooperation from the patient and a general health situation conducive to repair the donor site [4]. Many patients seeking treatment with osseointegrated implants meet the situation of severe resorption of alveolar bone and often they do not want pass thru a reconstructive surgery (increases morbidity, hospitalization, increases the treatment time, costs, surgical risks and other). In this and other cases, the zygomatic implants have been presented as a viable option to reestablish the oral health of these patients [5].

The zygomatic implants were first developed by Brånemark for maxillectomized patients resulted from oral cancer treatment [6]. Posteriorly, zygomatic implant was used for total edentulous patient with severely resorbed maxilla [7,

8]; initially was recommended the creation of a window in the most superior and lateral wall of the maxillary sinus meaning to lift or remove the sinus membrane. In this technique, the zygomatic implant is located on the crest of the alveolar bone, passing thru the sinus cavity, guided by the zygomatic pillar, reaching the zygomatic bone under general anesthesia [9]. This protocol was modified by Stella & Warner, that developed the slot technique meaning to help the visualization of the angle and position allow local anesthesia surgery [10].

Zygomatic implant for maxillary rehabilitation showed a history of success, presented over to 90% of survivor in retrospective studies for 3, 6 and 10 years follow-up [7, 11, 12]. Recently research showed similar results in 7 year follow-up of 77 zygomatic implant with 2 implant lost [13]. Traditional complications of this surgery are secondary infection, sinusitis, pain, periimplantitis and bone resorption related to implant function [7, 14]. Learn curve in this surgery is complex and poor data exist about the survivor and success of zygomatic implant in consecutive patients.

The aim of this research was to evaluate retrospectively function and survivor of 29 patients with zygomatic implant rehabilitation.

Materials and methods

It was analyzed 29 medical records of consecutive patients treated with zygomatic implants at Piracicaba Dental School, State University of Campinas and School of Dentistry, University of Guarulhos. Surgeons in training in the second, third or four year of his residency executed all the zygomatic implants surgeries. This research was submitted and approved by the Ethics in Research Committee in Human Subjects at State University of Campinas with protocol number 098/09. All the data was collected after the knowledge and consent of the patients.

The inclusion criteria were patients submitted to zygomatic implant surgeries by postgraduate students with at least 10 months follow-up with prosthetic function and the exclusion criteria was patients with the records incomplete, and patients who did not agreed to be part of the study after the explanation of the informed consent form. Variables of analysis were gender, age, systemic condition, smoke condition, type of rehabilitation, type and quantity of zygomatic or regular implants, complications and long term outcomes.

The treatment protocol for all patients was with cast and initial rehabilitation analysis, panoramic radiography and cone beam computed tomography for analysis of the anatomic condition, maxillary sinus, analysis of zygomatic body bone and residual alveolar bone. After that, the surgery was realized under local anesthesia and sedation (when was necessary) with 7.5 to 15 mg midazolam by oral administration 1 h after surgery; and was administered antibiotic and NAIDs for postoperative period.

The zygomatic implant surgery was executed with the Stella & Warner [10] technique and regular implant was installed in agreed with a manufacturer protocol. In some cases, full arch rehabilitation was with immediate load and other cases present delayed rehabilitation in agreed with routine prosthetic treatment. The implant system used was external hexagon connection for zygomatic implant with surface treatment and internal connection for conventional implants (Conexão®, São Paulo, Brazil).

To value the patient's satisfaction, a 10 cm analog visual scale (AVS) were filled by one postgraduate student of each institution, meaning to assess their satisfaction with the zygomatic fixation treatment, surgical trauma, occlusal function, phonatory function and aesthetics result.

Data analyses was realized with descriptive statistic and Qui-Square with $p<0.05$ for statistical significance when was necessary.

Results

Twenty-nine patients were treated with zygomatic implants by oral and maxillofacial surgeons in train, being 18 (62%) female and 11 (38%) male. The age range was 35 to 69 years. The average follow-up was 20 months, with a standard deviation of 9 month. The follow up period ranged from 10 to 40 month. Success was observed for 79.1%.

Systemic diseases were observed in 6 cases being hypertension, rheumatoid arthritis or hepatitis without any complications related to implant surgery. Three patient (10.4%) were

Table 1. Distribution of cases with surgical and prosthetic conditions in 29 patients treated with 67 zygomatic implant

Condition	Distribution of cases
Implant location and distribution (by patient)	4 zygomatic implant (n=5 patient, 17.4%)
	2 zygomatic implant and 2 conventional implant (n=4 patient, 13.8%)
	2 zygomatic implant and 3 conventional implant (n=4 patient, 13.8%)
	2 zygomatic implant and 4 conventional implant (n=15 patient, 51.7%)
	1 zygomatic implant and 4 conventional implant (n=1 patient, 3.3%)
Prosthetic load (by patient)	Immediate load (n=10 cases, 34.5%)
	Delayed load (n=19 cases, 65.5%)
Complication (by zygomatic implant) - 31.3%	Osseointegration failure (n=8 implant, 38.1%)
	Mucositis (n=4 implants, 19%)
	Sinusitis (n=4 implants, 19%)
	Persist pain (n=3 implants, 14.3%)
	Externalization of zygomatic implant (n=2 implants, 9.6%)

smoking and four patient (13.7%) showing sinusitis history previous to zygomatic implant surgery; this 7 patient were evaluated by otorhinolaryngologist been approved to zygomatic implant surgery.

The motivation of patient for zygomatic implant installation was dental and facial appearance (7%), occlusal and dental function (17%) and a combination of functional compliment and esthetic in 76%. In this 29 patient was necessary zygomatic implant because alveolar bone resorption (72.4%), deficiencies or failure of maxillary bone reconstruction with intra oral donor (13.7%) and lost and failure of regular implants in posterior area (13.7%). The implant distribution can be observed in **Table 1**.

The prosthetic rehabilitation were immediately loaded (**Table 1**), with 10 cases (34.5%), and delayed loading with 19 cases (65.5%) with an average of healing period priory to loading of 6.7 months, with a standard deviation of 3.5 months.

When analyzed the zygomatic fixation failure, 14 (20.9%) of the 67 implants lost their integration, being nine (13.4% of the delayed load), and 5 (7.5% of the immediate loading). No differences between immediate load and delayed loaded prosthesis were noted when chi-square statistical test was applied (p=0.104).

Analogue visual scale (AVS) was performed In order to assess patients' satisfaction when treated with zygomatic implants. It was applied on the last 12 patients treated by the surgeons in train showing that satisfaction with treatment was 6.47 (SD ± 3.24, with range from 1.1 to 9.4). When asked how traumatic the surgery was, the average was 7.13 (SD = ± 2.68); the range was between 1.5 and 9.6.

Occlusal function received an average of 7.61 (SD = ± 2.87). The worst result was when speech and phonetic was analyzed, with an average of 5.92 (SD = ± 3.71). In terms of prosthesis aesthetics the average was 7.86 (SD = ± 3.37), receiving the best result.

Discussion

The scientific and technological advances have provided great benefit to patients in the rehabilitation of the maxilla. Nowadays, total edentulous patients with severe atrophy of the maxilla have some possibilities for rehabilitation, considering traditional implants, bone reconstruction or zygomatic implants [15].

The impossibility of installing conventional implants in posterior maxilla due to maxillary sinus pneumatization or the lack of bone volume is currently the main indication for the using of zygomatic implants [16, 17]; for our sample the principal indication was a severe alveolar bone resorption. Since the main motivating factor was the functional complaint (75.86%), followed by combining function and beauty treatments (17.24%) and esthetic complaint (7%), the desire for zygomatic rehabilitation treatment suggests that these patients had already obtained information about the treatment option in some source.

The present study noted only 79.10% survival; several studies about zygomatic implants

reported survival rate between 94% to 100% [5, 11, 12, 16, 18]. A possible explanation for the difference between our results and other research centers may be the fact of surgeons is in ascending learn curve. In orthognathic surgery, de Santana Santos [19] showed no significant differences between resident or surgeons when was evaluated complications of surgery; and Jaibout [20] presented adequately performance of undergraduate dental student when was trained for conventional implant surgery. Zygomatic implant surgery is a complex technique that need, in a traditional protocol, "blind" surgery when drill top is in zygomatic body, and depends largely on the surgeon.

For other hand, bone implants contact in zygomatic implant present great variability [21]. In the research of Balshi [12], male presented more bone-implant contact than female; our sample presented 62% female being associated to minor area with osseointegration.

Our result shows that immediate load or delayed load can be success without differences. We believe that proper position and distribution of implant are important factor for success of treatment [22]; in agree with our result, Migliorança [17] reported 95% success of prosthesis with immediate load in zygomatic implants in a 8 year follow-up.

Complications was observed in 31.3% of 67 zygomatic implants; analyzing the complications founded in this study the main was osseointegration failure (40%), followed by mucositis (20%) and persistent pain (15%). In two cases it was also possible to observe the exteriorization of the zygomatic implants, being one treated conservative, considering the absence of complaining, and other removed because the patient related to fill it on the zygoma. Brånemark in 2004 [7], reporting drainage thru the prosthetic rehabilitation in some patients, being some treated successfully with recurrent sinus antrostomy. In our research four cases presented maxillary sinus surgery and 2 cases had lost of implant.

Peñarrocha [23] used the AVS to analyze the satisfaction index between two types of prosthesis, installed over regular dental implants or zygomatic implants. There were not differences between these two types of rehabilitation. Hirsch [18] performed a multicenter study, using the AVS to value the functional and aesthetic results after one year of prosthesis follow-up, noting that the aesthetics were related to be good or excellent in 83%. Sartori [24], in a research with 16 patients treated with zygomatic implant under general anesthesia by the same group of surgeons, showing that 50% were completely satisfied and 50% presented some complains related to hygiene, esthetic, phonetics or discomfort during chewing. Our result showing that only three patients were not fully satisfied and 8% were not completely satisfied when asked about occlusal function. The esthetic and functional results presented the best results and phonetic condition was the hardest for patient.

Finally, we conclude an adequately survivor of zygomatic implant with a complex learn curve in this consecutive patients series.

Disclosure of conflict of interest

The authors declare that they have no competing financial interests.

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