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SHORT COMMUNICATION

Zygomatic Bone Implants: A meta-analysis

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ABSTRACT

Now a day, dental implants are being used successfully in the management of missing teeth. The technique requires adequate bone height specially in case of maxillary edentulous patients where the procedure is more complicated due to its proximity to the maxillary antrum. The research put forward the concept of zygomatic bone implants to manage such patients. The purpose of the present article is to describe the zygomatic implantology with special emphasis on case selection, radiological aspect and clinical outcomes based on the literature.

INTRODUCTION:

Replacement of missing teeth is one of the common complaint for which the patient visits the dentist. There are basically three techniques to manage these conditions in mouth i.e. removable denture, tooth supported fixed denture and implant supported fixed dentures. Every technique has its own advantages and disadvantages. Implant supported fixed treatment is preferred by the patients because favourable outcomes. In many patients conventional implant treatment cannot be performed in the edentulous maxilla because of extensive bone resorption and the presence of extensive maxillary sinuses, leading to inadequate amounts of bone tissue for anchorage of the implants. The treatment option for these patients has often been some type of bone-augmentation procedure in order to increase the volume of load-bearing bone. Traditionally, the atrophic maxilla has been treated with large bone grafts from the iliac crest. This procedure is more invasive and requires general anesthesia. The bone grafts have been used as onlays, in combination with a Le Fort I osteotomy, or as maxillary sinus inlays. Implants have been inserted simultaneously or after an initial healing period. Long-term follow-up studies have shown varying degrees of implant survival in grafted bone. A recent literature review based on 23 publications revealed an overall survival rate of 82– 84% after a follow-up time from 12 to 60 months.[1] A 10% higher survival rate was seen for implants placed after initial healing of the bone graft than if the implants were placed simultaneously with the bone graft. It can be argued that bone-augmentation procedures are resource demanding, take a long time and may present risks for morbidity of the donor site of the bone graft. It is also obvious that failure rates are higher in grafted than in nongrafted maxillae.[2]

One alternative to bone grafting that has been considered in the atrophied maxilla is the use of the zygomatic implants.[3] The zygomatic fixture is the result of

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developments of reconstructive techniques for prosthetic rehabilitation of patients with extensive defects of the maxilla caused by tumor resections, trauma and congenital defects.[4] The bone of the zygomatic arch was used for anchorage of a long fixture, which, together with ordinary fixtures, could be used as an anchor for epistheses, prostheses and obturators. The technique has enabled sufficient rehabilitation of these patients, with restored function and improved esthetics as a result, and thus has given many patients back a normal social life. The purpose of the present article is to describe the concept of the zygomatic implantology with emphasis on case selection, radiological aspect and clinical outcomes based on the literature.

Case selection for zygomatic implant

The zygomatic bone has a pyramidal shape and contains dense cortical and trabecular bone.[5,6] According to a cadaver study, the mean length of available bone in this region is about 14 mm.[6] In general, zygomatic fixtures can be used in patients with severely resorbed edentulous maxillary arches posterior to canine region (i.e. <4 mm bone height distal to the canines), but with sufficient amounts of bone in the anterior region. Together with conventional implants in the anterior region of maxilla, the zygomatic fixture offers anchorage for a fixed bridge using less invasive surgery compared with bone-augmentation procedures. For patients with smaller bone volumes in the anterior part of the maxilla, the zygomatic implant can be used in conjunction with a bone-augmentation procedure of the anterior segment. In this way, fewer bone grafts are needed for the augmentation procedure. Zygomatic implants are also indicated when contraindications exist for harvesting of the iliac crest bone graft. The main advantage with the technique is that it can be performed as an outpatient procedure under local anesthesia and conscious sedation. However, for better comfort for the patient, the routine procedure is usually performed under general anesthesia.

Radiological Aspect:

The radiology plays a big role in the case selection of the present modality. Starting from the intraoral peiapical radiographs, can be used to estimate the remaining thickness of the floor of maxillary sinus in the first molar area. Panoramic view can be used just for the screening of patients for overall look of sinus anatomy (Figure 1 and 2), remaining alveolar bone height and the remaining thickness of alveolar bone between sinus floor and alveolar crest. Advanced imaging modalities like CBCT and computed tomographic imaging can be used to evaluate the zygomatic implant site for the amount of bone in the zygomatic arch and in the residual alveolar crest. The angulation, expected emergence site and the relationship of the implant body to the maxillary sinus and lateral wall should be evaluated (Figure 3 and 4). With the original technique, the path of the zygomatic fixture is inside the maxillary sinus. The emergence of the head of the implant in relation to the alveolar crest, typically in the palatal aspect of the second premolar region, is therefore dependent on the spatial relationship between the zygomatic bone, the maxillary sinus and the alveolar crest. All of these aspects can be pre-planned with the use of 3D reconstruction and available softwares with advanced imaging techniques, prior to surgery. A new technique, including extrasinus passage of the implant, has been evaluated with promising results.[7] It facilitates an optimal positioning of the zygomatic fixture head in relation to the alveolar crest and the occlusal table of the prosthetic construction.

Zygomatic Implant design

The original zygomatic fixture is a self-tapping titanium implant with a machined surface and is available in lengths from 30 to 52.5 mm. The threaded apical part has a diameter of 4 mm and the crestal part has a diameter of 4.5 mm. The implant head has an angulation of 45° and an inner thread for connection of Branemark System abutments. Zygomatic fixtures are currently commercially available from at least three different companies that offer implants with an oxidized rough surface, a smooth midimplant body, a wider neck at the alveolar crest and a 55° angulation of the implant head.

Clinical outcome of using the zygomatic implant

In a literature review of 18 studies presenting clinical outcomes with the zygomatic fixture were found (Table 1). The publications included 537 patients and 1056 zygomatic implants and 1174 other implants, with a follow-up of 6 months– 12 years. A total of 18 zygomatic implants and 72 other implants were reported as failures, giving an overall survival rate of 98.29% for zygomatic implants and 93.87% for other implants. However, it should be noted that some studies in part cover the same patient groups and therefore the true numbers of unique patients and implants are not known in detail. Nevertheless, the data show that the zygomatic implant technique is highly predictable and results in better clinical outcomes than other implants.

Conclusion

To conclude zygomatic implants are very useful in the management of the severely resorbed maxilla, regardless of whether it is totally edentulous or partially edentulous individuals. Imaging modalities like CBCT and CT drastically improved the accessibility of the surgeon to have proper case selection and overview of the technique prior to surgery. A review of literature showed that good clinical outcome can be achieved by proper knowledge of emerging these three dimensional imaging modalities.

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Table 1: Clinical outcomes of Zygomatic Implants

Study	Reference No.	No. of Patients	Time period of Follow up	Total No. of Zygomatic Implants	Total no. of Faliures	Total No. of Other implants	Total no. of Faliures
Branemark et al.	3	81	1-10	164	4	?	?
Parel et al.	8	27	1-12	65	0	?	?
Bedrossian et al.	9	22	34 months	44	0	80	7
Vrielinck et al.	10	29	< 2years	46	3	80	9
Boyes-Varley et al.	11	45	6-30 months	77	0	?	?
Malevez et al.	12	55	0.-4 years	103	0	194	16
Hirsch et al.	13	66	1 year	124	3	?	?
Branemark et al.	14	28	5-10 years	52	3	106	29
Becktor et al.	15	16	1-6 years	31	3	74	3
Penarrocha et al.	16	5	1-1.5 years	10	0	16	0
Farzad et al.	17	11	1.5-4 years	22	0	42	1
Ahlgren et al.	18	13	1-4 years	25	0	46	0
Aparicio et al.	19	69	0.5-5 years	131	0	304	2
Bedrossian et al.	20	14	>12 months	28	0	55	0
Chow et al.	21	5	10 months	10	0	20	0
Duarte et al.	22	12	30 months	48	2	-	-
Penarrocha et al.	23	21	12-45 months	40	0	89	2
Davo et al.	24	18	6-29 months	36	0	68	3

Figure:

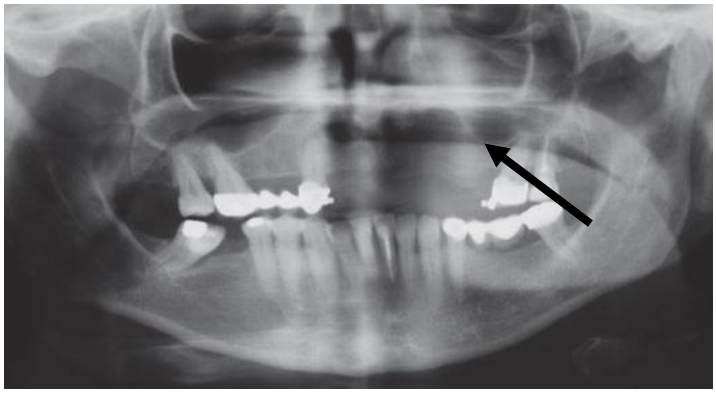

Figure 1: Pre-operative OPG of a case of partial edentulism treated with Zygomatic implant (Arrow showing the remaining thickness of floor of sinus).

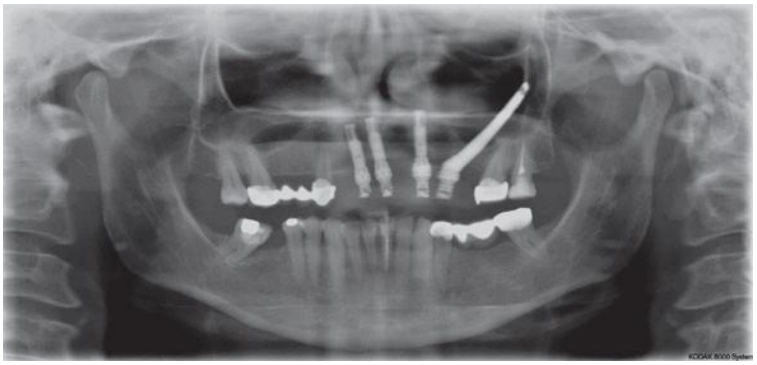

Figure 2: Post-operative OPG of a case of partial edentulism treated with Zygomatic implant.

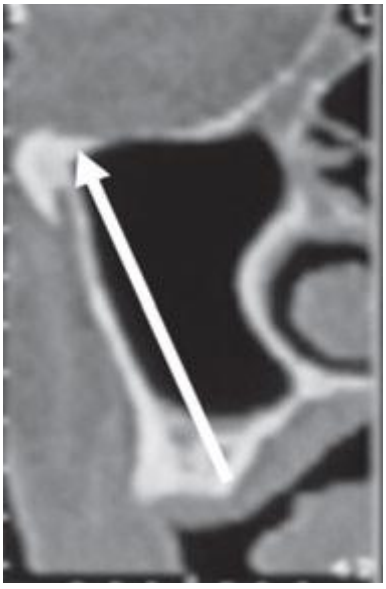

Figure 3: Tomographic section showing the estimation of path of the zygomatic implant (arrow)

Figure 4: Clinical photograph showing a lateral window of the maxillary sinus for visual control of implant insertion.