Clinical Application of Zygomatic Implants for Rehabilitation of the Severely Resorbed Maxilla: A Clinical Report

Hidetaka Nakai, DDS, PhD[1]/Yasuhiro Okazaki, DDS, PhD[2]/Minoru Ueda, DDS, PhD[3]

Purpose: *A zygomatic implant can be an effective device for rehabilitation of the severely resorbed maxilla. If zygomatic implants are used, onlay bone grafting or sinus augmentation would likely not be necessary. Where an anterior onlay bone graft is required, extension of the graft in the posterior region could be reduced. The results of the application of zygomatic implants in 9 patients and clinical evaluation of this therapy are reported.* ***Materials and Methods:*** *Nine patients received a total of 15 zygomatic implants. Six to 8 months elapsed for healing before second-stage surgery was performed. Six months after prosthetic treatment, patients' opinions were solicited by means of a questionnaire.* ***Results:*** *No implant was removed at the time of abutment connection surgery or during the follow-up period. In many cases, the zygomatic implant platform was located palatal to the alveolar ridge. However, no patients complained of any continuing speech impediment following superstructure fabrication. Computed tomograms taken before implant placement and 6 months after implant placement showed no sign of sinusitis in any patient.* ***Discussion:*** *The zygomatic implant allows shorter treatment time and hospitalization. However, there can be some problems in the application of zygomatic implants.* ***Conclusion:*** *It is necessary to investigate long-term clinical prognosis.* (INT J ORAL MAXILLOFAC IMPLANTS 2003;18:566–570)

Key words: *endosseous dental implants, maxillary sinus, maxillectomy, mouth rehabilitation, zygoma*

An osseointegrated implant can be advantageous for dental reconstruction and masticatory rehabilitation. For treatment of the severely resorbed maxilla, implants have been used in combination with sinus augmentation or onlay bone grafting.[1–7] Recently, zygomatic implants designed by Nobel Biocare (Göteborg, Sweden) have been used for treatment of severely resorbed maxillae.[8–11] If a zygomatic implant is used, onlay bone grafting or sinus augmentation may not be necessary when there is still sufficient anterior bone volume for the placement of standard implants and the alveolar ridge crest in the posterior region is severely resorbed. In the situation in which an anterior onlay bone graft is required, extension of the graft into the posterior region can be reduced.

The zygomatic implant can be placed from the alveolar crest and pass through the maxillary sinus close to the crest of the zygomatic bone. Thus, preoperative and postoperative evaluation of the maxillary sinus is important. In many cases, the zygomatic implant platform is located palatal to the alveolar ridge.

A total of 9 patients were treated with zygomatic implants. This article describes the results of 9 patients and a clinical evaluation of zygomatic implant therapy.

[1]Oral Surgeon, Division of Oral Surgery, Fukuroi Municipal Hospital, Fukuroi, Japan.
[2]Assistant Professor, Department of Oral and Maxillofacial Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan.
[3]Professor and Chairman, Department of Oral and Maxillofacial Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan.

Reprint requests: Dr Hidetaka Nakai, Division of Oral Surgery, Fukuroi Municipal Hospital, Fukuroi, Japan, 2515-1 Fukuroi 437-0061, Japan. Fax: +81-538-44-1295. E-mail: hidenakai@livedoor.com

MATERIALS AND METHODS

The present study involved 9 patients (3 men and 6 women) ranging in age from 37 to 73 years (average of 54.2 years). All patients had severe resorption of the subantral region of the maxilla, which was therefore insufficient for standard implant placement. Zygomatic implants (Z Fixture, Nobel Biocare) were placed from the alveolar crest and passed through the maxillary sinus close to the crest of the zygoma. The apices perforated the cortical bone of the zygoma at approximately a 90-degree angle between the zygomatic arch and the lateral and medial surfaces of the frontal process of the zygoma. Before implant placement, a small window on the lateral wall of the maxillary sinus was created, and the sinus mucosa was lifted away from an area where the implant would pass through the sinus.

The period from implant placement to abutment connection ranged from 6 to 8 months. In all cases, a MirusCone abutment or Multi-unit abutments (Nobel Biocare) were connected to the zygomatic implant at the time of implant uncovering surgery.

In all patients, the maxillary sinus condition was evaluated using computed tomography before and after implant placement surgery. After 6 months following prosthetic treatment, for all but patient 6, patient opinions were assessed by means of questionnaires prepared according to the format shown in Fig 1.

RESULTS

A total of 15 zygomatic implants were placed in 9 patients (Table 1): bilaterally in 5 patients (patients 1, 2, 4, 7, and 9) and unilaterally in 4 patients (patients 3, 5, 6, and 8) (Figs 2a to 2c). For patient 6, who underwent hemimaxillectomy for resection of a malignant tumor, 2 zygomatic implants were placed in the residual maxilla unilaterally, simultaneous with the hemimaxillectomy (Fig 3a). In patients 3, 7, 8, and 9, there were residual natural teeth on the contralateral side of the maxilla. In

1-1. Did you feel an impediment in your speech after superstructure fabrication?
☐ Yes ☐ No

1-2. How long did you feel an impediment in your speech after superstructure fabrication?
☐ 1 week ☐ 2 weeks
☐ 1 month ☐ 3 months
☐ Over 3 months
☐ Now feeling impediment in speech

2. Was the palatal location of zygomaticus implant platform causing an impediment in your speech?
☐ Yes ☐ No

3-1. Is it difficult to clean around the implants in the maxilla?
☐ Yes ☐ No

3-2. What part of the superstructure is difficult to clean?
☐ Anterior ☐ Posterior
☐ Both

4-1. Did you feel discomfort in the cheek region after superstructure fabrication?
☐ Yes ☐ No

4-2. How long did you feel discomfort in the cheek region after superstructure fabrication?
☐ 1 week ☐ 2 weeks
☐ 1 month ☐ 3 months
☐ Over 3 months
☐ Now feeling discomfort

Fig 1 Questionnaire for assessment of patients' opinions of their treatment.

Table 1 Patient Characteristics

Patient	Age	Gender	No. of implants placed	Opposing dentition	Follow-up period from implant placement (mo)
1	65	F	2 (bilaterally)	IFP	48
2	51	M	2 (bilaterally)	IFP	46
3	51	M	1 (unilaterally)	ND+IFP	40
4	56	F	2 (bilaterally)	ND	40
5	55	M	1 (unilaterally)	IFP	39
6	73	F	2 (unilaterally)	CD	27
7	44	F	2 (bilaterally)	ND	25
8	56	F	1 (unilaterally)	ND+IFP	25
9	37	F	2 (bilaterally)	ND	18

IFP = implant-supported fixed prosthesis; ND = natural dentition; CD = complete denture.

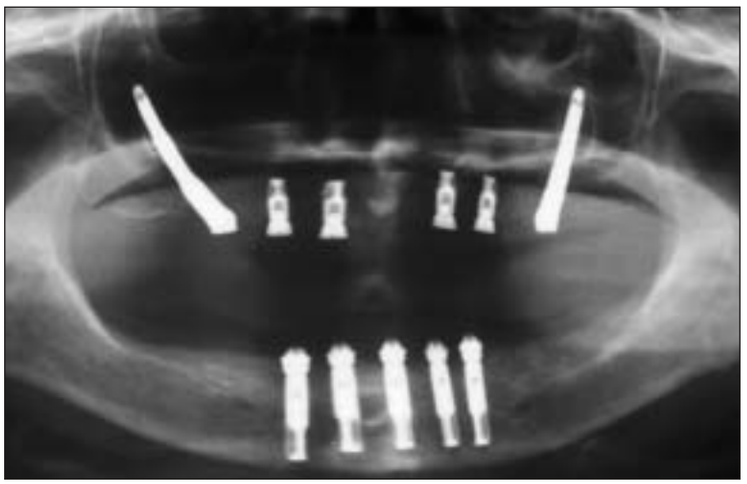

Fig 2a Radiograph taken after implant placement (patient 4). Zygomatic implants were placed bilaterally.

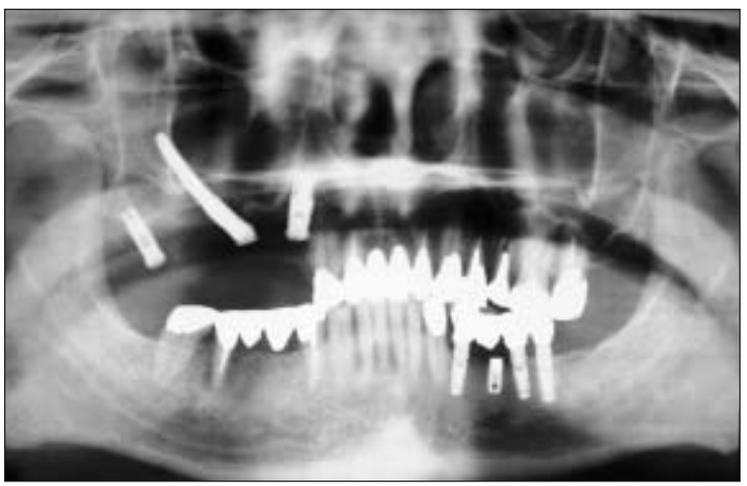

Fig 2b Radiograph taken after implant placement (patient 3). A zygomatic implant was placed unilaterally.

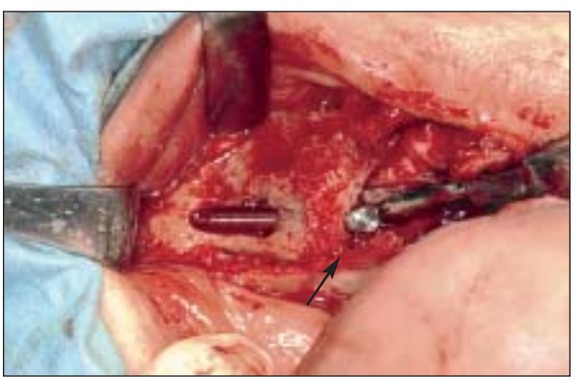

Fig 2c A zygomatic implant was placed at the alveolar crest *(arrow)* and passed through the maxillary sinus.

patient 5, there was sufficient bone volume in the subantral region of the opposite side of the maxilla. In 2 patients, the sinus mucosa was torn slightly during the surgery by lifting the sinus mucosa away from the area where the implant passed through the sinus (patients 2 and 4). In all cases, standard implants were placed in the anterior region or the pterygoid region.

In patient 6, a maxillary obturator prosthesis supported by implants, bar attachments, and magnetic attachments was fabricated (Figs 3b and 3c). In the other 8 patients, a fixed prosthesis supported by implants was fabricated (Fig 4). The opposing dentition was provided by a conventional complete denture in 1 patient, natural dentition in 4 patients, and implant-supported fixed prostheses in 4

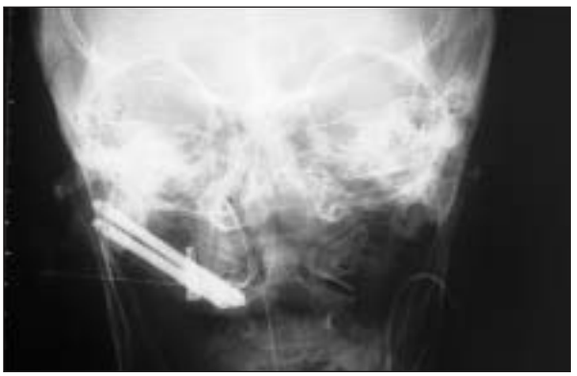

Fig 3a Radiograph taken after implant placement. Two zygomatic implants and 1 standard implant were placed in the residual maxilla unilaterally simultaneous with hemimaxillectomy (patient 6).

Fig 3b Bar superstructure including magnetic attachments for retention of maxillary overdenture (patient 6).

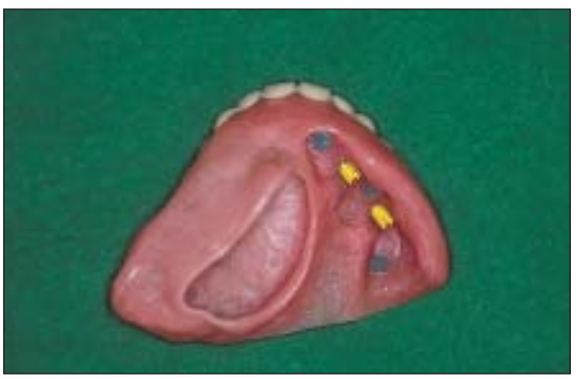

Fig 3c Maxillary overdenture with magnets and yellow clips (patient 6).

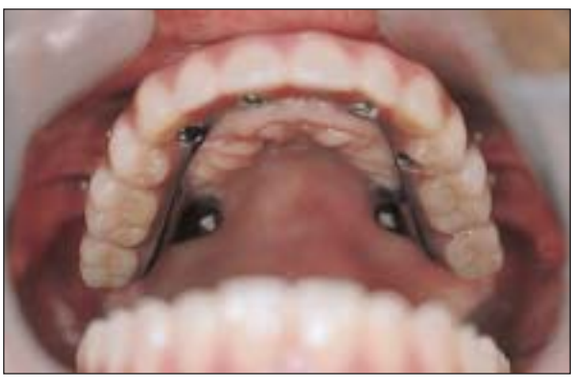

Fig 4 Intraoral view after prosthesis fabrication (patient 4).

patients. The follow-up period from the time of zygomatic implant placement ranged from 17 to 47 months.

For the patients in whom 15 zygomatic implants and the other standard implants were placed, no implants were removed at the time of abutment connection surgery or during the follow-up period. On computed tomograms taken before implant placement and 6 months following implant placement, there were no signs of sinusitis or swelling of maxillary sinus mucosa in any case. One patient complained of an impediment in articulation for 3 months after superstructure fabrication (patient 5). Three patients complained of an impediment in articulation for 1 or 2 weeks after superstructure fabrication (patients 2, 4, and 7). Two patients reported difficulty in cleaning around the abutment connected to the zygomatic implant.

DISCUSSION

The use of zygomatic implants can avoid the need for bone grafting and shorten the length of treatment. However, zygomatic implant platforms may be located palatal to the alveolar ridge in many cases. The results of questionnaires revealed that 2 patients complained of a problem with articulation for 1 or 2 weeks after superstructure fabrication. Two others experienced difficulty in cleaning around the posterior part of the superstructure.

When proposing a treatment plan, the clinician must explain to the patient the possibility of an impediment in articulation and difficulty in cleaning related to the palatal location of the implant platform. Recently, implant placement simulation software SIM/Plant (Materialise, Leuven, Belgium) has been used to assess a pathologically altered residual

ridge for possible implant therapy, and it was suggested that this kind of simulation software could provide important information regarding anatomic structure. When this software is used prior to zygomatic implant placement, it is possible to predict the location of the implant platform after placement. However, in this patient series, there were fewer articulation difficulties caused by the palatal location of an implant platform than expected.

In patient 6, 2 zygomatic implants were placed in 1 zygoma, and sinus augmentation or vascularized bone grafting was not necessary. Generally, for partially edentulous maxillae with unilateral loss of premolars and molars with severe bone resorption, a zygomatic implant is combined with 1 or 2 standard implants placed in the canine area to offer sufficient support. In patient 6, there were no natural teeth, and standard implants could not be placed in the anterior region; thus, 2 zygomatic implants were placed in 1 zygoma. This modification is useful for patients who have undergone maxillectomy. However, in this procedure, additional implants should be placed in the pterygoid region or anterior region. Long-term successful results will be needed to confirm the reliability of this procedure.

The results of postoperative computed tomography revealed no signs of sinusitis, and the mucosa of the maxillary sinus appeared normal in all cases. In 2 patients, the sinus mucosa tore slightly during the surgery. These perforations apparently closed spontaneously, because there were no problems caused by the slight perforation of the sinus mucosa.

A zygomatic implant can offer the patient shorter treatment time and shorter hospitalization. However, there are some problems with the application of zygomatic implants. It is necessary to investigate the long-term clinical outcomes.

CONCLUSIONS

The zygomatic implant has proven effective for the treatment of severely resorbed maxillae in this small patient population. If zygomatic implants are used, sinus augmentation may not be necessary. The zygomatic implant platform can be located palatal to the alveolar ridge. Apparently, compromised speech was not a long-term problem resulting from the palatal location of the implant platform. Further investigation is necessary with regard to stress distribution in the maxilla after zygomatic implant placement and occlusal loading of the maxilla and zygomatic bone.

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