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Case Report

Dental Implant Treatment with Different Techniques for Sinus Floor Elevation—A Case Report

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Abstract

A 60-year-old man with missing maxillary molar teeth received dental implant therapy for reconstruction of occlusion. Sinus floor elevation with autogenous bone graft consisting of iliac bone block and particulate cancellous bone and marrow (PCBM) was performed in the bilateral maxillary sinuses for implant placement. On the right side, bone height in the molar region was less than 2mm. Therefore, a delayed protocol was applied, and 2 implants were placed 4 months after bone grafting. Bone graft resorption occurred during the healing period of 4 months. On the left side, 3 implants were placed simultaneously with sinus floor elevation, as bone height in the molar region was more than 4–5mm. The bone graft was carried out at the same time as implant placement. After implant placement, resorption of the bone graft stopped, and the superstructures were delivered on both sides. The tissues around the implants were clinically healthy at one year after examination. Sinus floor elevation with autogenous bone graft is an acceptable option for implant treatment in the maxillary molar region where there is adequate height of existing bone. In postoperative care, it is important to undertake adequate follow-up to ascertain occurrence of bone graft resorption.

Key words: Dental implant treatment—Sinus floor elevation—Implant placement timing—Graft bone absorption—Healing time

Introduction

An osseointegrated implant lies in direct contact with the bone, with no soft tissue between bone and implant. Osseointegration of implants is based on the theory of osseointegration propounded by Brånemark. It has been 40 years since the first clinical application of osseointegrated implants, and numerous studies have reported a high success rate

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Fig. 1 Intra-oral view at first examination

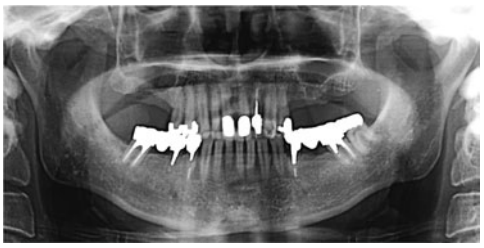


Fig. 2 Panoramic radiograph at first examination

for such treatment[1]. However, implant therapy is often made difficult by lack of adequate bone height in the upper molar region. The sinus floor elevation technique, which allows implant installation by bone grafting, was devised for such cases[2], and this technique has recently been recognized as a predictable procedure[4,6]. Since 1997, 50 patients have received this treatment with good results at our hospital.

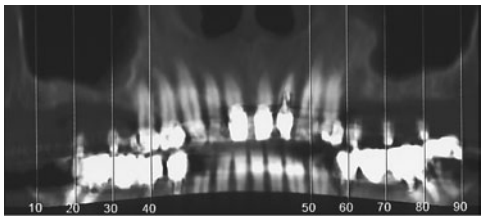
In this article, we describe the reconstruction of occlusion in a patient who was treated with a different technique on each side of the sinus to prepare for the reception of implants.

Case Report

In December 2003, a 60-year-old man visited our hospital with missing upper molars, discomfort and speech impediment when wearing a removable partial denture. The patient's medical history was unremarkable. He was given restorative treatment for carious teeth in the upper molar region by his local dentist in 1990. Later, he developed secondary dental caries around the crown margin of those teeth, including the upper right first and second molars and upper left second premolar. The first and second molars were extracted in 1998. Although the patient only used a denture during meals, his local dentist recommended implant therapy. At the patient's initial visit to our hospital, intraorally, there was no marked alveolar ridge resorption, and both left and right sinuses were healthy (Fig. 1).

Panoramic and CT radiographs were taken as a diagnostic guide. Vertical bone height was measured at the middle of the tooth crowns on the radiographs. The panoramic radiograph revealed that the sinus floor was low on both sides, corresponding to the upper first molar region, and the existing bone height from sinus floor to alveolar ridge was less than 10 mm (Fig. 2). The cross sectional images revealed the existing bone height at the upper molar region in detail: 2 mm at the right first and second molar region, 12 mm at the left second premolar, 4 mm at the left first molar and 5 mm at the left second molar region (Fig. 3). These findings indicated that although alveolar bone width was sufficient, bone height at the upper molar region on both sides was inadequate for occlusal reconstruction using implant therapy. Therefore, implant placement with sinus floor elevation was recommended for this patient. Bilateral sinus floor elevation, using autogenous bone graft from the iliac bone crest, was planned. The diagnosis and treatment plan were explained to the patient in detail, and the patient agreed to the treatment.

In April 2004, a compact bone block and particulate cancellous bone and marrow (PCBM) were taken from the right iliac bone crest under general anesthesia (Fig. 4). Sinus floor elevation with autogenous bone graft was performed bilaterally using lateral window technique. In the left upper molar region, 3 implants (TE implant: diameter, 4.1 mm,



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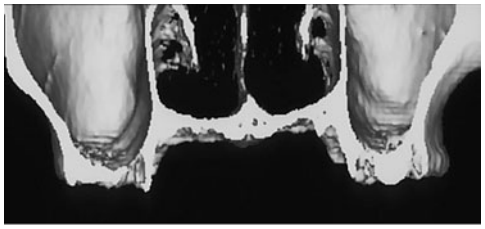

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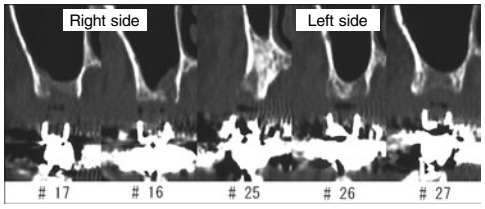


(c)

Fig. 3 Preoperative CT photograph for diagnosis
(a) Panoramic view
(b) 3-D view of sinus
(c) Cross-sectional view of posterior region in maxilla

length, 12 mm; Straumann®) were simultaneously placed with bone graft (Fig. 5). In the right upper molar region, implants were placed after bone grafting.

The CT radiographs revealed resorption of the bone graft in the right sinus when second-stage surgery was performed 4 months later. A decrease in bone volume was clear on the right side. The low density image of the remaining bone graft was identical, and it was difficult to distinguish between compact bone block and PCBM, radiographically (Fig. 6). On the other hand, remaining bone graft material was observed in proximity to the implant tip on the left side.

Implant placement was difficult due to decreased bone quantity on the right side. Therefore, 2 implants (Standard implant: diameter, 4.8 mm, length, 12 mm; Straumann®)

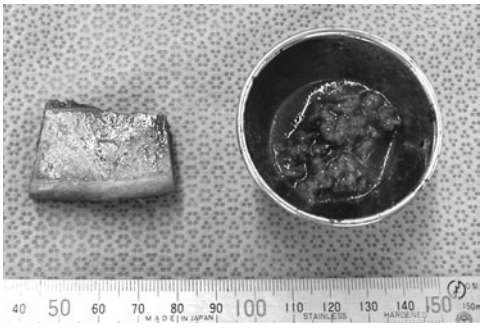
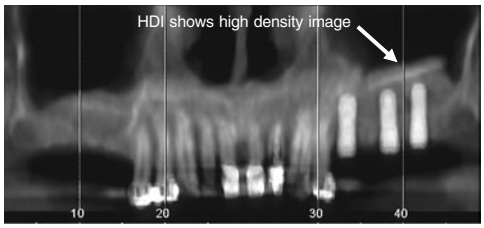


Fig. 4 Block bone and PCBM harvested iliac bone

Fig. 5 Implant placement using one-stage surgery for left side



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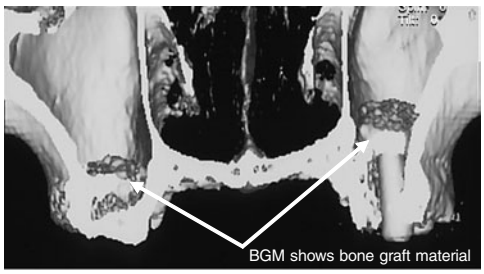
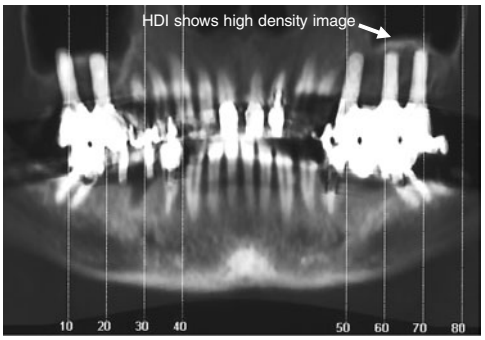


(b)

Fig. 6 CT photograph at 4 months after bone graft
(a) Panoramic view
HDI shows high density image.
(b) 3-D view of sinus
BGM shows bone graft material.



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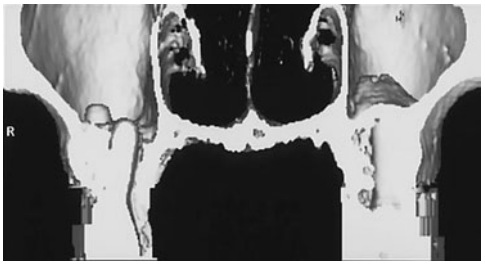

(b)

Fig. 7 CT photograph at one year after treatment
(a) Panoramic view
HDI shows high density image.
(b) 3-D view of sinus

were placed in the right upper molar region in August 2004. Healing abutments were simultaneously connected to the implants on the left side.

Screw-retained provisional restorations were inserted on both sides in October 2004, and the implants were functionally loaded. The final Pt-Au alloy superstructures were placed on the implants on both sides in December 2004.

To date, the implants and superstructures have caused no problems. In November 2005, a CT radiograph was taken for postoperative image diagnosis at the upper molar region and other regions (Fig. 7). No bone graft resorption was observed on the left side. A high density image was observed in proximity to the implant tip. No resorption of the bone graft and no remarkable change in grafted bone were observed one year after superstructure placement on the right side.

Discussion

Osseointegrated implants have shown a high long-term survival rate since 1965[1]. Sinus floor elevation is a technique for extending the application of implants, and was devised for cases in which implant placement was difficult due to lack of adequate bone. Today, this operative method is considered to be highly predictable[2,4,6].

In the present case, it was very difficult to determine the appropriate implant length to ensure long-term implant success, as the existing bone height was 2–5 mm in the upper molar region. The sinus floor elevation technique is roughly classified into two operative methods: in the Lateral Window (LW) method, the bone graft is placed onto the sinus floor through fenestration of the lateral maxillary wall; in the Osteotome (OT) method, an implant hole is first prepared in the designated site on the crest of the alveolar ridge. Subsequently, the sinus floor bone is pushed, fractured and elevated using special instruments through the apex of the implant hole, and, finally, a graft is placed in the sinus[10].

Rosen *et al.*[9] reported the sinus floor elevation technique with regard to implant treatment in a case of multiple missing teeth. The implant survival rates for a residual crest bone height of greater and less than 4 mm were 95% and 86%, respectively. They suggested that residual crest bone height was important in determining the indication for implant treatment. In the present case, it was difficult to use the OT method because the sinus floor had to be elevated by 5–8 mm. Therefore, we chose the LW method.

Based on the protocol for implant placement, sinus floor elevation technique can be classified into two operative methods: in the one-stage method, the implant placement is simultaneously performed with sinus floor elevation; in the two-stage method, the implant placement is delayed until the bone graft placed in the sinus floor matures after an optimum healing time. The choice of procedure is often dictated by the amount of residual crestal bone in the posterior maxilla.

Commonly, a minimum of 4–5 mm in pre-treatment bone height is recommended for the one-stage method[5,8]. Del Fabbro *et al.*[3] reported that the survival rates of implants placed in the grafted sinus were substantially independent of the adopted method. Kan *et al.*[7] suggested that insufficient and conflicting data have been reported relative to the effect of the following factors on implant success: implant type, grafting material, oral hygiene status, and patient history of cigarette smoking. In this case, CT radiographic examination showed that the remaining bone height in the edentulous region on each side was different. Therefore, we decided that the one- and two-stage methods were preferable for the left and right sides, respectively.

The relationship between long-term clinical outcome of peri-implant graft and the procedure, material, and survival rate of the implant itself is not clear. Geurs *et al.*[4] observed change in height of sinus graft by retrospective quantitative radiographic analysis. They reported that amount of native bone had no significant effect on change in mean graft height over a 3-year period.

In the present case, the bone graft was supported by 3 implants, and movement of the bone graft was disturbed on the left side. On the right side, displacement of the bone graft affected bone resorption within 4 months. We believe that the mobility of the bone graft may influence bone graft resorption during the postoperative period.

In postoperative care, it is important to undertake adequate follow-up to ascertain the occurrence of bone graft resorption.

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