

# **Forty-five Cases of Osteotome Sinus Floor Elevation in Atrophic Maxilla Using HA-coated Implants without Bone Graft**

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## **Abstract**

A sinus floor elevation has been used as a common technique using a bone graft in the atrophic posterior maxilla. However, an autograft is occasionally restricted quantitatively for donor condition. The aim of this study was to evaluate clinical cases of Hydroxyapatite(HA)-coated implants in the posterior maxilla using the osteotome sinus floor elevation technique (OSFE) without bone graft. Sixty-eight HA-coated implants were inserted into 45 patients using the OSFE technique. One implant was removed before functioning. All of the other implants were functioning under occlusal force without mobility and peri-implantitis for 3 months to 6 years. The HA-coated implants promoted bone formation and the sinus cavity was filled by the new bone. The OSFE technique using HA-coated implants was effective for filling the sinus cavity without bone graft and successful in treatment of patients with atrophic alveolar ridge of the maxilla.

**Keywords:** sinus floor elevation, osteotome, dental implant, bone graft, OSFE, HA-coated implant

## **1. INTRODUCTION**

An implantation is often limited by a large sinus bone loss caused by periodontal diseases in the posterior maxilla. In the case before implantation a sinus floor elevation or osteotome sinus floor elevation (OSFE) procedures are used for increasing alveolar bone height by elevating the membrane from the original skeletal sinus floor. In the both procedures, grafting materials are necessary for filling the space. The sinus floor elevation using autograft is invasive and sometimes inviting swelling, bruising and infection. When the autograft bone migrates to the sinus cavity through the perforated sinus membrane, persistent sinusitis may occur. Infectious possibilities of unidentified virus by using allograft or xenograft can't be avoided completely. Therefore it is considered ideal to use the OSFE procedures without grafting materials on the posterior maxilla with limited available bone height. This present protocol, conducted with hydroxyapatite(HA)-coated one-stage implants, evaluated predictability of an OSFE procedure without the use of a grafting material.

## **2. METHODS AND PROCEDURES**

### **Inclusion criteria**

To enter this treatment, the inclusion criteria were follows.

- (1) Patients had to require implant treatment in the maxilla, and the bone height between the crest and the sinus floor was not enough to install implants.
- (2) Patients had no sign of sinus inflammation and tumors.
- (3) An OSFE procedure was performed without placing a grafting material.
- (4) Vertical stop was maintained at the other side of implantation.

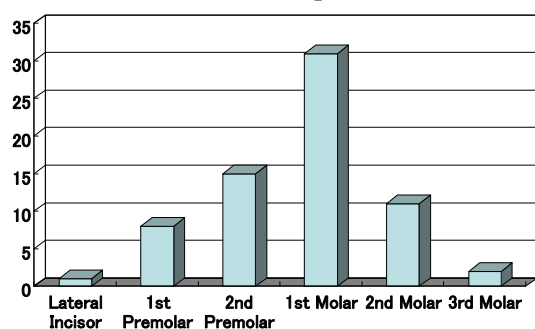
Using OSFE procedures, 68 implants were placed in 45 patients between April 2004 and May 2010. Patients were 25 females and 20 males, varying from 25 to 75 years old(Table 1). HA-coated implants by a plasma spraying technique were inserted in 44 molars, 23 premolars and 1 lateral incisor(Table 2). All the surgical procedures were performed under local anesthesia by one of the authors(Y.K.).

All implants inserted for this study were one piece type AQB implants(®ADVANCE JAPAN), and their length were 6, 8, 10mm, their diameter were 3, 4, 5mm (Table 3). Mid-crestal incision was performed for flap elevation, vertical and periosteal release incision were avoided.

**Table 1: Sex and age distribution**

Age	Male	Female	Total
Under 30	3	4	7
30 to 40	2	4	6
40 to 50	8	4	12
50 to 60	4	3	7
60 to 70	2	9	11
Over 70	1	1	2
Total	20	25	45

**Table 2: Location of implants**



**Table 3: Implant size**

diameter \ length	3mm	4mm	5mm	Total
6mm		16	2	18
8mm	4	33	8	45
10mm		2	3	5
Total	4	51	13	68

To gain access to the sinus floor, cortical bone perforation was performed with a round bar. Alveolar bone was drilled up to 1 mm away from the sinus floor with  $\varnothing$  2.0 and  $\varnothing$  2.5 mm drills. In cases with very thin alveolar bone, upper layer of the alveolar bone was carefully removed by a diamond bar instead of drilling. The  $\varnothing$  2.5 mm osteotome was used to push axially the sinus floor by light malleting, The osteotomy was then enlarged with the  $\varnothing$  2.8 mm osteotome and more when it was needed. Implants were placed in the prepared osteotomy sites. A space was created between the sinus floor and the elevated

sinus membrane that was maintained by the implant apex. At seating, majority of the implants achieved primary stability, but a few needed splinting to next implant or to next tooth because of mobility. The flap was sutured around the implant neck and the area was maintained prosthesis-free over the entire healing period.

After a 2- to 6-month healing period(Table 4), all implants except one which led to a implant failure were radiographed and clinical integration was assessed, confirming no existence of mobility, pain or rotation. When implants were stable, the classical prosthetic steps were conducted and porcelain fused to metal crowns or full cast metal crowns were prepared and cemented. Very careful attention was paid for occlusion. Anterior guidance, canine guidance and disclusion were necessary. If there was not one of them, a night guard was compulsory.

**Table 4: Duration of healing period**

Healing period	Number	Percentage
2 to 3 months	14	20.9%
3 to 4 months	28	41.8%
4 to 5 months	17	25.4%
Over 5 months	8	11.9%

### 3. RESULTS AND DISCUSSION

Membrane perforations were recorded at least at 3 implant sites, in other sites, it was not observed clearly. After surgery, no nasal bleeding was recorded, and none had a sensation of a blocked up nose. Healing was uneventful except one which led to a implant failure, it was with perforated membrane. Sixty-seven implants among 68 gained osseointegration, but one lost. All implants prosthesis were conducted were clinically stable during 3-month to 6-year observation period, the definitive prosthesis were in function.

Representative 2 cases

#### CASE 1

A 40-year-old woman came to our clinic for rehabilitation of her right edentulous posterior maxilla. She also had a second premolar tooth required extraction because of periodontitis. The panoramic X-ray(Fig.1) taken revealed a large precident sinus cavity, extending around the apex of the second premolar tooth and up to the alveolar cortical bone(Fig.2).

For the definite diagnosis, before OSFE procedure, this tooth had to be removed in order to deny the

perforation from the tooth socket to the sinus cavity. Ten days after tooth extraction(Fig.3), an OSFE procedure was performed. Implant primary stability for the second premolar was not gained, but the first molar and the second molar achieved. Implants between the second premolar, the first molar and the second molar were splinted. The healing period was uneventful, 4 months later, a cemented porcelain-fused-to-metal prosthesis composed of 3 splinted crowns was placed. At the 3-month follow-up, all implants were clinically stable and newly formed mineralized tissue was clearly visible around the implant neck and apex(Fig.4). The final prosthesis was in function.

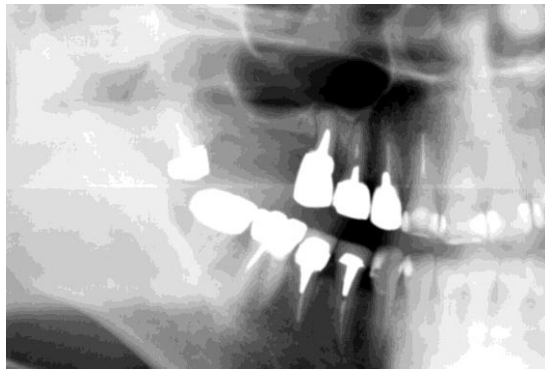


Fig. 1 Panoramic X-ray

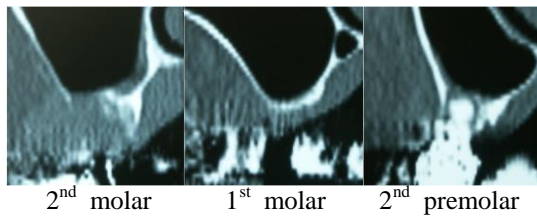


Fig. 2 CT images



Fig. 3 Dental X-ray(after extraction)

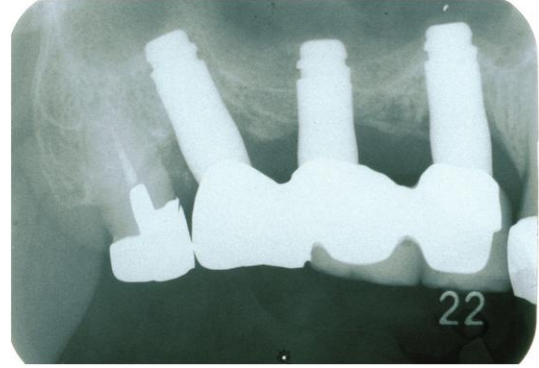


Fig.4 Dental X-ray(3-month follow-up)

**Case 2**

A 49-year-old man presented complaining of tooth fracture. The panoramic X-ray taken revealed there was a radicular cyst around the apex of the second premolar root(Fig.5), just beneath the sinus cavity. Buccal alveolar bone facing buccal root of the second premolar was very thin. Removal of radicular cyst and immediate implant placement was performed, applying an OSFE procedure(Fig.6). The implant achieved primary stability. After an uneventful healing period of 3 months, the implant was clinically stable. Newly formed mineralized tissue was clearly visible around the implant neck and apex(Fig.7). The final prosthesis was functioning at the 3-month follow-up visit.



Fig.5 Dental X-ray and CT image

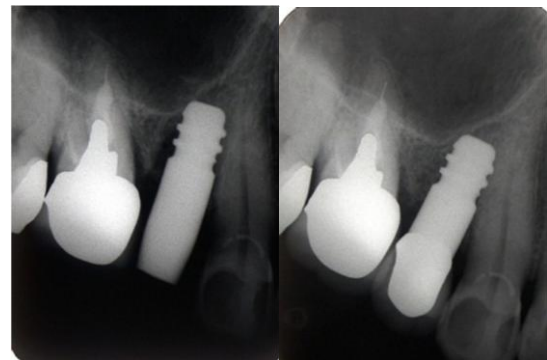


Fig. 6 Dental X-ray (at implant placement)

Fig. 7 Dental X-ray (final prosthesis)

If the Schneiderian membrane is perforated, the filling material can migrate into the sinus cavity and cause inflammation. The present protocol, by avoiding use of a grafting material, has eliminated this risk. It has now well been documented that rough-surfaced short implants are as reliable as longer implants [5], so that short implants were used in this study to minimize the risk of membrane perforation. The advantages of this OSFE procedure were simple, avoidance of invasive surgery, and permitting treatment within a single step. As a result, it reduced the patient's discomfort, pain, swelling, bruising, the risk of infection, and made the treatment period short. Most of the implants achieved primary stability, but a few did not gain it. To make the stability firm or to reduce the mobility, implants were often splinted each other or to next tooth. Implants were often placed deeper with the flared neck against the crestal bone, this contributed to the achievement of stability. Aoki and his colleagues have developed dental implants made of HA-coated titanium using plasma spraying, thermal decomposition, and sputtering techniques. After coating, HA is recrystallized under hydrothermal condition. The crystallinity of the HA is very high and pure. Three hundred of dental implants were placed in the oral cavity of 100 patients ranging in age from 17 to 74 during 8 years. The success rate was extremely high, over 99% [7]. Using grafting material, healing times of 6-9 months before implantation are recommended for sinus floor elevation [1], furthermore an additional 3-6 months of implant healing time are needed. Healing time in our study (Table 4), using HA-coated implants, was shorter than the 6 months reported by Lundgren for the simultaneous insertion of TiUnite implants used in sinus membrane elevation procedure without grafting material [2]. Brägger allotted the 6-month healing time for an OSFE procedure with bone grafting material [3]. Nedir documented that 3 months are sufficient for SLA implants, using an OSFE procedure without grafting material, to resist a 35 Ncm torque even when the alveolar bone height is limited [4]. Palma reported sinus floor elevation in an animal study comparing with and without bone graft. New bone formation was observed in contact with the Schneiderian membrane in a membrane-elevated site, on the other hand, a bone chip trapped in fibrous tissue was observed in a bone-grafted site. He discussed that bone deposition is a continuous process from the beginning at elevated sites without bone grafts, whereas a resorptive pattern of the bone particles predominates in bone graft sites, despite the expected bone remodeling that takes place in all sites [6]. It is possible that implant healing time is

shortened by applying an OSFE procedure, using HA coated-implant.

#### 4. CONCLUSION

The sixty-eight HA-coated implants were inserted into the atrophic maxilla of 45 patients by the OSFE techniques without using any bone graft. Bone formation quickly occurred around the HA coating surface in the cavity of sinus floor and 67 implants usefully functioned for three months to six years. These clinical results concluded that the HA-coated implants were effective on bone formation without any bone graft and invasive procedure for the treatment of the sinus floor elevation. Also the technique was successful in the implant treatment of patients with atrophic alveolar ridge of the maxilla.

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