Early Implant Survival in Posterior Maxilla With or Without β-Tricalcium Phosphate Sinus Floor Graft

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Purpose: The sinus lift procedure provides a way to increase the amount of available bone and the placement of longer implants. The aim of this study was to evaluate and compare the survival rates of implants inserted in the posterior maxilla (without sinus lift) to simultaneous implant insertion with sinus lift.

Patients and Methods: Seventy maxillary sinuses in 62 patients were augmented by β-tricalcium phosphate and 121 implants were inserted into these augmented sinuses (study group) and 136 implants were inserted in the posterior maxilla in 65 patients (control group). Follow-up times were 29.8 and 32.3 months for the study and control groups, respectively.

Results: One implant in the study group and 1 implant in the control group failed. All other implants in both groups were functioning well without any significant clinical finding. Implant survivals were 99.17% in the study group and 99.26% in the control group.

Conclusion: Simultaneous implant insertion and sinus lift with β-tricalcium phosphate is a safe surgical procedure, and survival rates of implants inserted in the augmented sinus were similar to those of implants inserted in the posterior maxilla without sinus lift.

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Implant-supported prosthesis has become common practice for the rehabilitation of partially or totally edentulous patients. However, edentulous alveolar bone may be unfavorable for implant insertion. The posterior maxilla represents a special challenge for oral and maxillofacial surgeons due to lack of bone, alveolar ridge resorption, and hyperpneumatization of the maxillary sinus.[1-6]

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If insufficient bone height is due to pneumatization of the maxillary sinus, there are 2 surgical treatment options: sinus lift with a crestal approach (internal lift) and sinus lift with a lateral wall approach (external lift).[7]

Sinus lift with a lateral wall approach is the most common and well-documented procedure in which the residual alveolar crest height is less than 7 to 8 mm above the maxillary sinus. This procedure was introduced by Boyne and James[8] and modified by others and uses an access window through the lateral wall of the maxillary sinus for graft insertion. Different materials including autogenous bone, allogenic and alloplastic materials, xenografts, or a combination of these have been used for sinus augmentation.[5] Even sinus membrane elevation without any biomaterial or graft has been reported.[9]

In the present study, survival rates of simultaneous implant insertion with sinus lifting with a lateral wall approach was compared to implants inserted in the posterior maxilla without sinus lifting.

Patients and Methods

Seventy sinus lift operations were performed in 62 patients and 121 implants were inserted in these aug-

mented sinuses in the study group. Patients' age range was 31 to 76 years (mean, 52.96 years). Thirty patients (48.3%) were men (67 implants) and 32 (51.7%) were women (54 implants). Residual crest height was a minimum of 3 mm and a maximum of 7 mm above the maxillary sinus. Sinus augmentation and implant insertion were performed in 1 stage. If the residual crest height was 10 mm or higher, a conventional approach without sinus surgery was used. Patients with 8 to 9 mm residual crest height were not included in this study because an internal lift (crestal approach) technique was the method of treatment in these patients.

In the study group, the surgical augmentation technique used was the lateral wall approach. β-Tricalcium phosphate (β-TCP) was used as a graft material. Under local anesthesia (Ultracaine DS-Forte; 1/100,000 epinephrine; Sanofi Aventis, Istanbul, Turkey), after the crestal and relaxing lateral incision and elevating the full thickness flap, a trap door on the lateral buttress of the maxilla was performed with a round bur, and bone was fractured by a mirror handle and mallet. Then, the sinus membrane was lifted gently from the sinus floor in all directions and the palatal aspect of the space was filled with TCP. After the augmentation procedure, all implants were inserted simultaneously and covered with the rest of the TCP material. Lengths of the implants ranged from 10 to 14 mm (mean, 11.9 mm), and the implant lengths preferred were 11.12 and 13 mm (Fig 1). Localization and the number of implants in the posterior maxilla are listed in Table 1.

In the control group, 136 implants (65 patients) were inserted in the posterior edentulous maxilla where the bone height was adequate for implant insertion without a need for sinus augmentation (≥10 mm). Patients' age range was 29 to 67 years (mean, 48.17 years). Twenty-six patients were men (68 implants) and 39 were women (68 implants). Length of the implants ranged from 9 to 13 mm (mean, 10.8 mm; Fig 1).

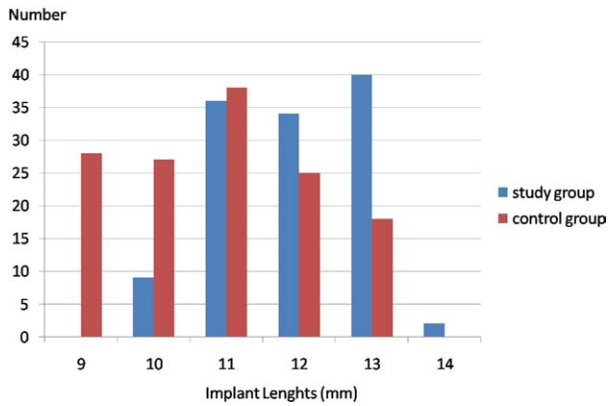

FIGURE 1. Comparison of implant lengths in the study and control groups.

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Table 1. LOCATION OF INSERTED IMPLANTS IN THE POSTERIOR MAXILLA IN SINUS LIFT GROUP

Implant Location	Number of Implants
1. Molar	60
2. Molar	18
1. Premolar	21
2. Premolar	22

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According to the American Society of Anesthesiology health status classification, patients in the study and control groups were Class I or II.

Antibiotics (amoxicillin 500 mg, orally 3 times daily), analgesics (paracetamol 500 mg, as needed), and mouth rinse (0.12% chlorhexidine) 3 times for 5 days were prescribed in all patients, and decongestant was added for the postoperative 3 days in the study group. Sutures were removed 7 days after operation. Panoramic radiographs were taken preoperatively and 6 months postoperatively in all patients.

Results

One implant failure was observed in each group before functional loading. All other implants in both groups were functioning well without any significant clinical finding. Implant survival rates were 99.17% in the study group and 99.26% in the control group. Mean follow-up times were 29.8 and 32.3 months for the study and control groups, respectively.

At the second surgical phase 6 months after implant insertion, a crestal incision was performed and a lateral sinus wall was observed and 2-mm–diameter augmented material was removed from 1 patient. Histologic evaluation revealed osseous remodeling areas and formation of bone structure (Fig 2).

Discussion

In the present study, survival rate of implants inserted in grafted sinuses was compared to that of implants inserted in the posterior maxilla where the residual bone was adequate for implant placement. Sixty-two patients with 121 implants received a sinus lift before implant placement.

The study and control groups contained similar numbers of implants. Mean implant length was slightly longer in the study group (11.9 mm) than in the control group (10.8 mm). The height of the implants in the control group was shorter because bone height was limited with available bone.

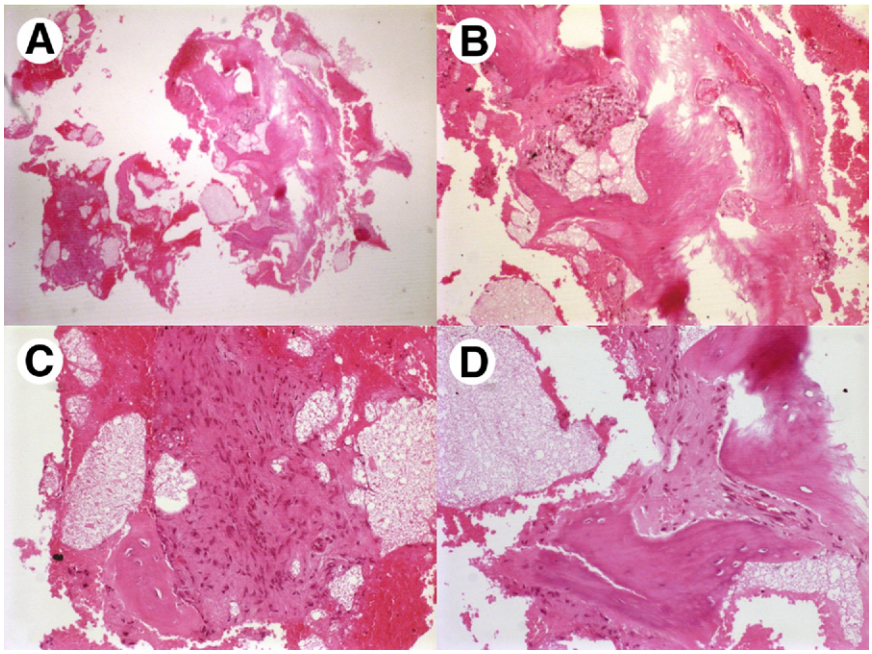

FIGURE 2. *A,* Panoramic view of absorption and ossification areas of tissue (hematoxylin and eosin, original magnification ×40). *B,* Significant resorption was observed in this field. Note the irregular ossification in the middle of the field (hematoxylin and eosin, original magnification ×100). *C,* Significant osteoblast proliferation and activation turns into bone structure gradually (hematoxylin and eosin, original magnification ×200). *D,* Bone structure and osteoblastic activation were noted (hematoxylin and eosin, original magnification ×200).

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Although follow-up time was relatively short (average, 2.5 years), survival rates of implants inserted in the posterior maxilla were similar in the control and study groups.

The sinus lift with a lateral wall approach is a reliable and successful procedure for implant insertion. Papa et al[10] and Smiler et al[11] concluded that the sinus lift is a good operative procedure in cases of atrophic maxillary bone. Olson et al[12] achieved a survival rate of 97.5% after 38.2 months for their sinus augmentations. The survival rate of implants placed in sinuses augmented with the lateral window technique varied from 61.7% to 100%, with an average survival rate of 91.8% in the literature. Survival rates of implants in the present study are compatible with those in the literature.

A meta-analysis of the retrospective literature[13] and the findings of the Sinus Graft Conference of 1996[14] reported similar success rates for implants placed in the maxillary sinus using different materials and combinations. Reinhardt and Kreusser[15] treated 50 patients with a sinus lift using β-TCP as filling material successfully and installing 101 implants of different kinds.

In conclusion, in the present study, the 2.5-year posterior maxillary implant survival (of β-TCP–grafted sinuses) was comparable to that of implants placed when there was adequate bone (for 10-mm implants) and no grafting was necessary.

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