

A retrospective study on the prognosis of single implant placed at the sinus bone graft site

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Objectives. The purposes of this study were to evaluate survival of single implants placed at the sinus bone graft site and to estimate influencing factors on the survival.

Study design. The patients treated with single implant at the sinus bone graft site at Seoul National University Bundang Hospital from June 2003 to December 2006 were included. All the patients' data were collected by reviewing and analyzing dental record and radiograph.

Results. Total 60 patients (65 implants) were included in this study. The overall survival rate was 86.2%. Survival rate of maxillary sinusitis group (40.0%) was significantly lower than that of no maxillary sinusitis group (90.0%) ($P = .038$).

Conclusion. From the result, incidence of maxillary sinusitis was detected as an influencing factor on the survival of single implant at the sinus bone graft site. It was important to prevent maxillary sinusitis for the improvement of the prognosis. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;■:e1-e6)

It was recently reported that dental implants showed a high success rate and stability in restoring a single tooth in the long term. Bragger et al.¹ reported that the effects of single implants were superb from an economic standpoint compared with commonly used fixed prosthesis. However, some literature reported that single implant placement in the maxillary posterior area showed a low success rate compared with that in the maxillary anterior area and was more likely to cause complications.^{2,3} As the maxillary posterior area had thinner cortical bone than other regions and was made up of mostly cancellous bone, it might cause difficulty with initial stability at implant placement and the rise in air pressure within the maxillary sinus brought pneumatization. Also, there were more than a few cases with deficient vertical bone height due to rapid physiological resorption of alveolar bone. To solve these problems, Boyne et al.⁴ conducted a sinus lift technique using the Caldwell-Luc operation, Tatum⁵ presented two methods approaching via the alveolar ridge and lateral window and Summers⁶ introduced an alveolar crest approach that involved implant placement simultaneously with the bone graft using osteotome. At sinus lift, choice of surgical technique is determined by residual bone height, implant fixture length, required bone graft quantity, etc.⁷⁻¹⁰ Wallace et al.¹¹ reported that the implant success rate in

the region where sinus bone graft was performed through lateral approach was 91.8%, Hurzeler et al.¹² reported the implant success rate accompanied by a sinus bone graft was 90.3%, and Del Fabbro et al.¹³ reported the survival rate of the implant placed following sinus bone graft as 91.49%. Although performing such a sinus lift might show remarkable implant survival rates, some influencing factors were suggested in relation with implant failure in the maxillary posterior area.¹⁴ There have been many reports related to sinus lifts and bone grafts, but not many papers existed on single implant placed at the sinus bone graft site.

The purposes of this study were to evaluate survival of single implant placed at the sinus bone graft site and to estimate influencing factors on the survival of single implant placed at the sinus bone graft site.

MATERIAL AND METHODS

The patients who were treated with single implant at the sinus bone graft site at Seoul National University Bundang Hospital from June 2003 to December 2006 were included. The patients who were classified as American Society of Anesthesiologist (ASA) class I or II were included. All the patients who took antiplatelet agents discontinued medication for 5-7 days before implant surgery after consultation with physician. All

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Statement of Clinical Relevance

This study tried to evaluate survival of single implants placed at the sinus bone graft site and to estimate influencing factors on the survival of single implants placed at the sinus bone graft site. The result of our study would be helpful to clinicians.

the patients' data were collected by reviewing and analyzing dental record and radiograph. This retrospective study was approved by Institutional Review Board at Seoul National University Bundang Hospital.

Clinical outcomes of single implant cases at the sinus bone graft site including surgical complications and failure were evaluated. All cases and implants were evaluated in terms of patient-related factors, surgery-related factors and material-related factors. There were gender, age and residual bone height in the category of patient-related factors. The residual bone height was measured using the IMPAX system (Agfa Co., Mortsel, Belgium) based on the radiographs that were taken before and immediately after surgery and the average value was obtained. Based on the height of the placed implants, the magnification rate was adjusted and measured. There were implant location, approach technique of sinus bone graft operation (crestal approach vs. lateral approach), implantation method (non-submerged vs. submerged), time of implant placement (simultaneous vs. delayed), sinus membrane perforation and postoperative infection in the category of surgery-related factors. The cases that implant placement was done simultaneously with sinus bone graft were included in the immediate implant group. There were connection type of implant system, implant fixture diameter and length, and main graft in the category of material-related factors. The implant systems were divided into external hex group and internal hex group on the base of abutment connection type. The external hex implant systems used in this study were Maestro (Biohorizon IPH Inc., Birmingham, AL, USA), 3i Osseotite (Biomet Inc., Palm Beach Gardens, FL, USA). The internal hex implant systems were GSII (Osstem Implant Co., Busan, Korea), Implantium (Dentium Co., Yongin, Korea).

The relationships between categorical variables were analyzed by Chi-square test or Fisher's exact test. The cumulative survival rate of the implant was assessed by the Kaplan–Meier method. For the evaluation of influencing factors on single implant survival at the sinus bone graft site, multivariable logistic regression was applied with the variables which passed cut-off significance ($P < .25$) at the preceded univariable analysis. Statistical analyses were done using SPSS 18.0 for Windows (SPSS Inc., Chicago, IL, USA). It was considered statistically significant for P values $< .05$.

RESULT

Clinical outcome

Total 65 implants from 60 patients were included in this study. The range of age was between 26 and 81 years and the average was 50.4 (SD = 9.2) years. The 36 implants were placed in male patients and 29 were in female patients. Most of the patients were distributed in the age group of 5th decade (17 implants) and 6th

decade (28 implants). In terms of placement location, the first molar region accounted for a great part of it, making up 63.5%.

Total survival rate of the single implant placement following sinus bone graft

Among the 65 single implants at the sinus bone graft site, 9 implants failed. Total survival rate was 86.2%. The estimate of cumulative survival rate at the time point of 11 months was 85.6% (Figure 1). The follow-up period after implant placement was 41.6 ± 20.7 months on average.

Evaluation of influencing factors on the survival of single implant at the sinus bone graft site

Patient-related factors. The survival rate by gender of the single implant placed after a sinus bone graft showed 83.3% for males and 89.7% for females, showing no statistically significant difference ($P = .463$) (Table I).

The survival rate of under 50-year-old group was 92.6%, while that of over 50-year-old group was 81.6%. There was also no significant difference ($P = .205$). The survival rate by residual bone height showed 71.4% for cases less than 5.0 mm, which was lower than 93.2% for cases over 5.0 mm, exhibiting a statistically significant difference ($P = .018$).

Surgery-related factors. The survival rate by implant location after a sinus bone graft showed the second molar region to be the lowest with 78.6% and the second premolar region to be the highest with 90.0%, which exhibited no statistically significant difference ($P = .640$).

The survival rate by the approach technique of sinus bone graft operation showed 85.3% for the crestal approach and 87.1% for the lateral approach, indicating no statistically significant difference ($P = .834$).

The survival rate by single implantation method showed 81.8% for the non-submerged type and 85.3% for the submerged type, indicating no statistically significant difference ($P = .648$).

In terms of the time of implant placement, immediate group with sinus bone graft showed 80.0% and delayed group showed 87.3%, also indicating no statistically significant difference ($P = .540$).

The survival rate from sinus membrane perforation showed 82.4% for cases with perforation and 87.5% for cases without perforation, exhibiting no statistically significant difference ($P = .597$). Sinus membrane perforation developed during surgery in 17 cases. Other minor intra-operative complications such as buccal alveolar bone greenstick fracture (in 1 case) and mucous retention cyst rupture (in 1 case) were not considered as variable in this study.

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