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Clinical Observation

Volume changes of grafted bone after sinus lift procedure using tibia bone: 3 years after prosthesis radiological study



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ABSTRACT

Purpose: This study evaluated patients who have passed 3 years or more after fixed prosthesis and have undergone two-stage sinus lift procedure with tibia bone. The aim of this study was to evaluate the transplanted bone by clinical aspects and panoramic radiographs.

Materials and methods: Twelve patients and 30 implants were evaluated. The average age of the patients was 55.6 ± 8.0 years. Patients were treated with the same surgical procedure by one surgeon. Panoramic radiographs were taken at the time the patients had fixed prosthesis, and 1, 2, and 3 years later accordingly. The radiographs were saved as DICOM data and reconstructed into two-dimensional images using 3D image analysis software in order to measure the distance between the elevated maxillary sinus floor and the apical of the implant body.

Results: The amount of the resorption of the transplanted bone was 3.1 ± 1.6 mm 3 years after implant replacement. Statistical difference was observed in bone resorption in cases of the back site of the zygomaticoalveolar line, when the preoperative maxillary ridge bone was less than 4 mm, among smokers and with complications of sinus membrane perforation. Survival and success rates of the implants were 100%.

Conclusion: Maxillary sinus elevation procedure with tibia bone was a predictable treatment method for implant rehabilitation.

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1. Introduction

In the posterior maxilla, standard implant placement is often restricted because of the reduced bone quality and quantity, according to the presence of sinus and nose, and bone resorption after tooth extraction and atmospheric pressure of sinus [1]. In cases of severe bone resorption, preparation of a trap door including the Schneiderian membrane in the lateral sinus wall according to the Caldwell-Luc sinus lift procedure was performed by Boyne and James in 1980 [2], and was established by Tatum in 1986

[3]. According to this procedure, long-term satisfied convalescence is expected [4].

Grafting materials are diverse from autogenous bone, allografts, xenografts to artificial materials. Xenografts have the risk of Creutzfeldt–Jakob disease. Allografts have the risk of transmission of other infectious diseases, such as acquired immunodeficiency syndrome [5]. Therefore, the use of xenogenic and allogenic material for medical products and devices poses several questions. Above all, autogenous bone is the only well-documented material that allows sinus grafting and simultaneous correction of the vertical/horizontal defects of the atrophic maxilla. As far as donor sites are concerned, intraoral sites were zygomatic arch, sidewall of the sinus, maxillary tuber, coronoid process, ramus mandibulae and mentum, while extraoral sites were iliac, tibia, costae and calvarium. So far, iliac was the common extraoral site to harvest bone because the volume of the bone from intraoral sites is limited. However, harvesting from the iliac was followed by a non-negligible, although temporary, incidence of complications,

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mainly represented by gait disorder, prolonged pain and wound. Therefore, in this study, tibia was used as the extraoral donor site and satisfactory results were achieved. The volume of the bone harvested by tibia was the same of iliac. Operating time was shorter, bleeding volume during operation was smaller and less complication was observed compared with bone harvesting from iliac [6,7]. Autologous cancellous bone graft has been considered more osteogenic as compared with cortical bone graft because the presence of spaces within their structure allows the diffusion of nutrients and limited revascularization by microanastomosis of its circulating vessels [8]. Cancellous graft integrates quickly and ultimately achieves strength equivalent to cortical graft within 6–12 months [9]. Accordingly, in our clinic, tibia is used as the donor site when cancellous bone is needed in the procedure for sinus lift and bone reconstruction. This study assessed the change of bone volume and the prognosis of implants and prosthesis of implant placement in sites with bone graft for the elevation of maxillary sinus floor according to the implant placement region, residual alveolar bone height, smoking, and surgical complication.

2. Materials and methods

2.1. Patient selection

A retrospective review was conducted on all patients who visited Aichigakuin University Dental Hospital, Department of Oral Surgery starting from April 2005 to March 2009. The subjects of this study were 12 cases and 30 implants that have passed 36 months or more after prosthesis. There were eight female and four male patients; mean age 55.6 ± 8.0 years and range 44.8–72.3

years. The subjects in this study were relatively healthy (ASA-1 and ASA-2) and had no significant systemic conditions. Patients with uncontrolled diabetes, ongoing maxillary sinus infection, and compromised immunity were excluded. The prognosis of the implants and prosthesis were subject to the criteria made by Albrektson et al. [10]. The criteria is that osseointegration is obtained under the circumstance of occlusion by final prosthesis and no spontaneous pain, mobility or radiolucent area around the implant is observed in the X-ray photograph. Written informed consent was obtained from all subjects included. The ethics committee of Aichigakuin University Dental Hospital approved our experimental protocols (Ethical Approval Number 261).

2.2. Sinus lift procedures and two-stage implant placement

Sinus lift procedures were all conducted by the same surgeon under general anesthesia. The approach to the anterior wall of the maxillary sinus was obtained after the elevation of a mucoperiosteal flap with a crestal incision and the vertical-releasing incisions on the distal and the mesial aspects according to surgical needs. A bony wall was created carefully not to tear the anterolateral mucosa. When there was a wall inside the sinus, two windows were created. Once the mobility of the bony window was checked, the antral mucosa was carefully elevated inferiorly, anteriorly, and posteriorly until the desired mucosa was obtained. On an occasion when perforation of the sinus membrane occurred, it was covered with a resorbable membrane (GC MEMBRANE®, GC, Japan). The elevated area of the maxillary sinus was filled with a mixture of autogenous cancellous bone harvested from the tibia and the recipient site flaps were accurately sutured. Healing time varied

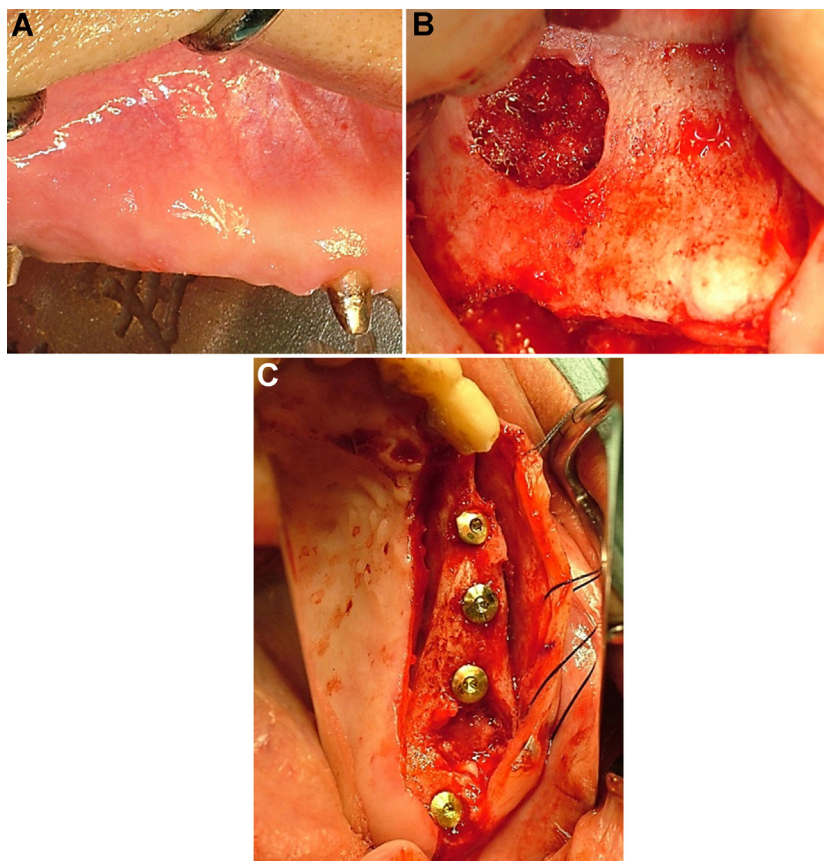


Fig. 1. Sinus lift procedures and two-stage implant placement. (A) The posterior portions of maxillae were edentulous and lacked sufficient bone for implant placement without sinus augmentation. (B) The elevated area of the maxillary sinus was filled with a mixture of autogenous cancellous bone harvested from the tibia. (C) Healing time was 5 months, and four implants were placed after.

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