

## A Case of Recovery of Oral Function with Dental Implants Following Facial Bone Trauma

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### Abstract

A 44-year-old woman had sustained facial lacerations, loss of several teeth, alveolar bone fracture, and severe vertical bone resorption in conjunction with a shattered alveolar bone and marked loss of intraoral function and facial disfigurement in a car accident. She underwent 9 surgical procedures by plastic surgeons to treat the facial lesions, including hold facial scar formation reduction surgery, reduction of fractures of the nasal and cheek bones, and bone transplants. To restore intraoral function and improve facial appearance, plastic surgeons transplanted a rib into the maxillary sinus while dental surgeons simultaneously inserted 5 dental implants. Eleven months after the dental implant surgery, a complete upper denture and a mandibular gingival ceramometal-casting crown were fitted. After insertion of the final prosthodontics, regular follow-up examinations were performed to check dental occlusion, oral hygiene, and the condition of the gingival tissue. In the years since the upper dental implants were fitted, there have been no bone resorption and no functional problems. Transplantation of rib bones is an effective method for maxillary reconstruction and remains effective even after the insertion of dental implants. The patient is extremely satisfied with the results. A means of maintaining oral health over the long term, and of motivating the patient to maintain oral health, should be established.

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**Key words:** facial bone trauma, autologous bone transplantation, dental implants

### Introduction

Guided bone regeneration<sup>1</sup>, filling with artificial grafting material, and autologous grafting are methods that have been used to replenish deficient bone mass at the site of a dental implant. However, as treatments for widespread maxillary bone, alveolar bone, and soft-tissue defects caused by maxillofacial injury, these methods do not always

achieve functional recovery or provide sufficient space for dental implants. To overcome these problems, bone transplantation has been used to replace lost bone mass and to increase vertical and horizontal bone mass<sup>2</sup>.

The present patient was involved in a car accident that caused severe vertical bone resorption, a loss of intraoral function, alveolar bone fracture and shattering, and facial disfigurement. Autologous transplantation of a rib bone in conjunction with

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dental implants resulted in the recovery of dental occlusion and aesthetic improvement.

### Case

Patient: A 44-year-old woman.

Clinical history: She was involved in a head-on automobile collision on March 29, 2001, and sustained hemorrhagic shock, left rib fractures, facial bone fractures, a basal skull fracture, a left facial crushing wound, and trauma to the bilateral internal carotid arteries.

Family history and preexisting conditions: None

Clinical characteristics: When the patient was brought into the emergency room, her consciousness level was 30 Japan Coma Scale, blood pressure was 128/87 mmHg, and cerebrospinal fluid was leaking from both ears and the nasal passages. Several wounds were present on the face and inside the mouth. She was blind in the left eye. She was transferred to the Department of Neurosurgery owing to the discovery of left internal carotid artery detachment, after which she was examined by the Department of Rehabilitation and the Department of Otolaryngology. Extensive treatment of the facial wounds was performed by the Department of Plastic Surgery.

Dental treatment: She first visited our department in June 2001 through a referral from the Department of Plastic Surgery. Four teeth (upper #16, #14, #12, and #22) were extracted because they could not be saved. A stable bite and improved chewing ability were achieved by the fitting of upper and lower dentures.

Partial denture set: Regular denture adjustments and repairs were performed from July 2001 through July 2005. During this same 4-year period, the patient underwent 9 surgical procedures, including surgery to reduce hold facial scar formation, surgery to correct nasal bone fracture malunion, and surgery to correct cheekbone fracture malunion, and bone grafts.

Taking into consideration the desire of the patient and the recovery of chewing ability and facial appearance, dental implant treatment was planned. However, because the upper and lower left and



Fig. 1 Panoramic radiograph at the first visit  
Car accident, there is bone crushing. No alveolar bone height of the left maxillary molar.

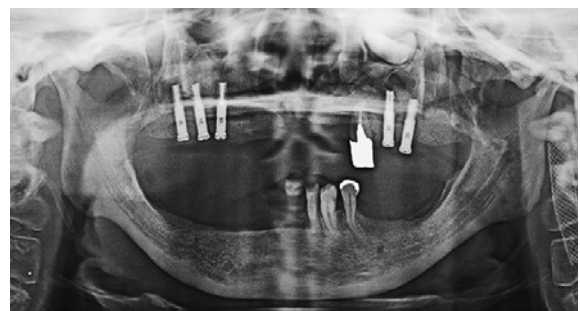


Fig. 2 Panoramic radiograph after the upper jaw implant fixture placement  
Five GC screw-implants (Re 3.8×18 mm), 3 on the left and 2 on the right, were implanted at the same time as the rib transplant operation

right alveolar bones had been shattered in the car accident, ensuring a sufficient depth of bone for the dental implants was difficult. For this reason, this time, we decided dental implants would be inserted simultaneously as a rib was transplanted (**Fig. 1**).

### Dental Implant Treatment

In August 2005, the 9th left rib was excised and transplanted into the left and right upper maxillary sinuses. 5 GC COMPANY, screw implants, 3 on the left and 2 on the right, were inserted at the same time the rib transplant operation was performed (**Fig. 2**). In November 2005, 4 GC COMPANY screw implants (3 Re™ 3.8 × 10 mm and 1 Re™ 3.8 × 12 mm) were inserted into the right mandible. In February 2006, 2 GC COMPANY screw implants (Re™ 3.8 × 10 mm) were inserted into the left mandible.

A secondary operation in which a cover screw was replaced with a gingival cuff was performed, and tooth extraction was the upper #24 and #25 had to leave at the same time to stabilize the occlusion in June 2006. Following gingival treatment, a dental impression was taken, and a bite check was performed. In July 2006, restoration was completed with final prosthodontics consisting of a bar-type, upper, removable complete denture and a mandibular, gingival, ceramometal-casting crown. In

addition, the remaining teeth, mandibular #32, #33 and #34, were saved because of the lack of tooth movement and the good condition of the periodontal tissue (**Fig. 3**).

Maintenance therapy: After application of the final prosthetic appliances, a bite check and examination of condition of the oral cavity and periodontal tissue were performed every week for the first month, then every 2 weeks, and finally every month thereafter. After that, I went to at regular intervals of 2 months, the same examinations. Five years have passed since the upper appliance was inserted, no bone resorption has been observed, there have been no particular problems, and final prosthetic appliances are functioning normally (**Fig. 4**).



Fig. 3 Panoramic radiograph after the final implant fixture placement  
4 GC screw-implants (3 Re 3.8×10 mm and one Re 3.8×12 mm) were implanted in the right mandible. 2 GC screw-implant Re 3.8×10 mm implants were implanted in the left mandible.

### Discussion and Conclusions

For cases of dental implantation with a high level of bone resorption, autotransplantation is used to ensure bone width and bone height. To ensure proper attachment of the grafted bone, autotransplantation of bone is the first choice if one considers such factors as blood supply, vasculature reconstruction, and substitution with new bone<sup>3</sup>. In

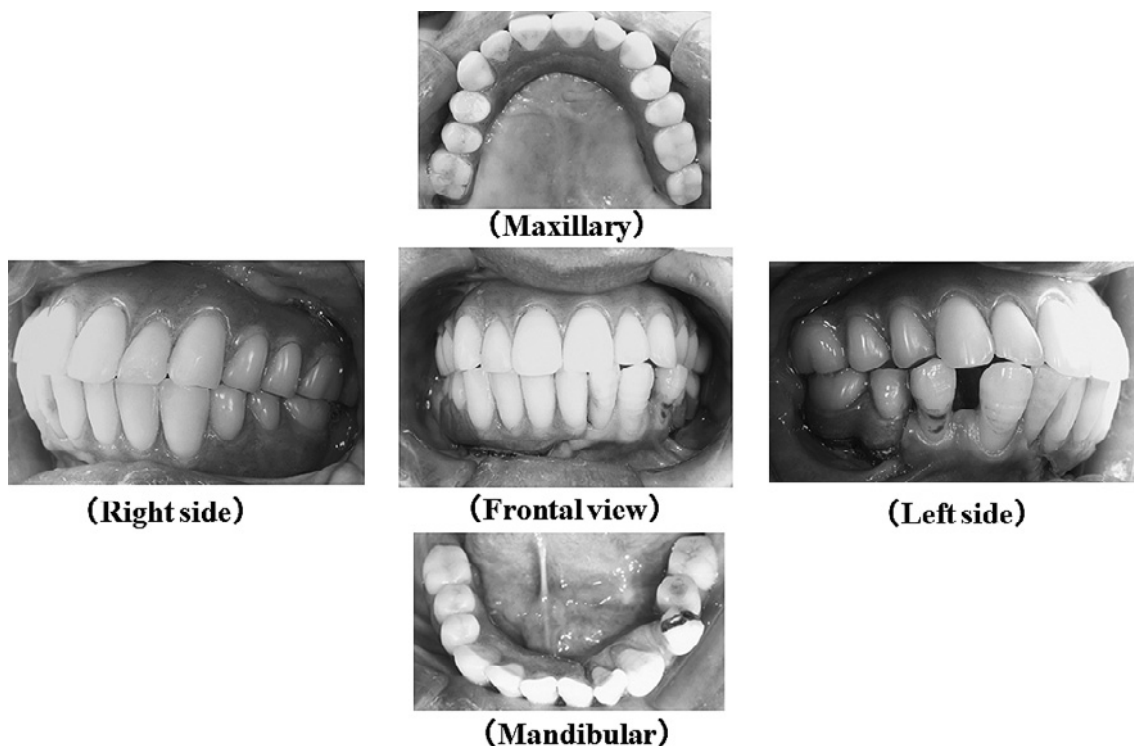


Fig. 4 Intraoral views just after the final prosthesis was inserted

the present case, the necessary bone mass for the dental implants was obtained with transplanted bone.

Rib grafting, by plastic surgeons, in part, by removing the cortical bone of the surface, cancellous bone is exposed bone, blood vessel early has become possible.

The advantages of rib grafting, easy machining, is rich in amount. In addition, a high capacity for regeneration of the collection. A disadvantage is scarring of the chest. In addition, the cause absorption as well as other bone transplantation, exposure, and infection. The timing of implant surgery differs among the 2 methods currently used. In the first method, the implants are implanted on 2 separate occasions, after bone transplantation and again after the firm attachment of the transplanted bone has been confirmed<sup>4</sup>. In the second method, the implants are all implanted together at the same time as bone transplant is performed after solid attachment of the transplanted bone has been confirmed<sup>5</sup>. In the first method, the usual waiting times following bone transplantation are 6 months for the maxilla and 3 to 4 months for the mandible<sup>6</sup>; however, no changes in the bone are seen in computed tomographic images obtained immediately following autologous bone grafting or 4 to 5 months later<sup>7</sup>, indicating that appropriate timing of implant insertion is a factor in favorable results. The success rate for osteointegration in implant therapy has been compared by determining the ratio of the total mass of calcified bone as the ratio of calcified bone to cancellous bone<sup>8</sup>. The amount of calcified bone in a rib, like that used in the present case, was reported to be less than that in the maxilla, and concern has been expressed about osteointegration of the implants after transplantation and inadequate chewing ability<sup>9</sup>. However, because implant insertion was performed with the one-time method simultaneously with the bone transplantation procedure in the present case, the length of the implant was 18 mm, there was an 11-month waiting period following implantation, and stable osteointegration was achieved between the implants and the transplanted bone. Furthermore, after attachment of the final prosthodontic appliance, no

problems were encountered with respect to resorption of the transplanted bone or chewing ability during mastication, and no untoward effects or bone resorption was observed during the maintenance period.

Although anterior maxillary implants were not possible in this case because of severe alveolar bone loss due to the accident and the various operations the patient had undergone, sufficient chewing strength was achieved by grafting bone to the molar region in conjunction with the insertion of dental implants. However, regular maintenance was required because plaque was seen on the inside of the dentures when the appliance was removed.

The implants in the mandibular area were inserted successfully because there were no problems associated with bone mass; however, an appliance with a gingival attachment was produced, in consideration of aesthetics, because marked bone resorption was observed in some areas. Gingival grafting was not performed because there was sufficient width to the gingival attachment area, which if not adequate, can have an effect on plaque control.

Implant therapy performed with bone grafting restored both intraoral function and esthetic function, and the results suggest such treatment is more effective for restoring function than is the use of removable appliances alone. The patient expressed satisfaction with the results of oral restoration, but a means of maintaining oral health over the long term, and of motivating the patient to maintain oral health, should be established.

Rib grafting is an effective method for reconstructing maxillary bone because there is little bone resorption following transplantation and sufficient bone fragments can be harvested. Furthermore, the present results show that rib grafting is also effective for dental implants. The results also suggest that close cooperation with allied clinical areas, such as plastic surgery, will increase in importance and broaden the indications for dental implants.

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