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CASE REPORT
Reconstructive

Simultaneous Reconstruction of the Bilateral Maxillae and Nasal Hard Structure Using a Vascularized and Nonvascularized Fibula

Itaru Tsuge, MD, PhD
Hiroki Yamanaka, MD, PhD
Motoki Katsube, MD, PhD
Michiharu Sakamoto, MD, PhD
Naoki Morimoto, MD, PhD

Summary: Midfacial reconstruction for extensive defects of the hard nasal structures and bilateral maxillae is challenging. Postoperative radiotherapy causes skin contracture, making secondary reconstruction extremely difficult. A 57-year-old man underwent resection of the nasal bone, nasal cartilage, and hard palate for cancer of the nasal cavity. Postoperative radiotherapy (70 Gy) resulted in bilateral osteoradionecrosis. Severe depression deformity of the midface causes a disorder in closing the mouth, resulting in difficulty in conversation and oral intake. We performed simultaneous reconstruction of the bilateral maxillary and nasal hard structures using double free flaps (fibular osteocutaneous and anterolateral thigh flaps). A 16-cm right fibular osteocutaneous flap was elevated, and an 8-cm proximal bone was resected to obtain the length of the peroneal vessels. The distal 8 cm was cut into three pieces while maintaining the blood flow. The removed nonvascularized fibula was processed into two pieces of cortex: nasal bridge and columella. All areas of the skin island were de-epithelialized to bilaterally fill the maxillary sinuses. Next, the ipsilateral anterolateral thigh flap was elevated with the central 6-cm part for closure of the palate and the proximal area to fill the nasal cavity. The distal area consisted of a fascial flap to cover the reconstructed nasal structure. The chimeric double flap allowed for oral intake, conversation, and nasomaxillary prominence. Computed tomography performed 8 months postoperatively showed maintained bony structures. We used the extra fibula as a nonvascularized cortex piece to prevent infection and exposure, which enabled simultaneous reconstruction of the bilateral maxillae and hard nasal structure. *(Plast Reconstr Surg Glob Open 2024; 12:e5936; doi: 10.1097/GOX.0000000000005936; Published online 25 June 2024.)*

The reconstruction of midfacial defects, including maxillary bone defects, is challenging. Several algorithms have been proposed for the fundamental surgical theory, resulting in a vascularized fibula flap offering unique properties.[1,2] Bony reconstruction using an omega-shaped fibular flap is ideal for bilateral maxillectomy defects.[3] However, extensive mixed defects of hard nasal structures and bilateral maxillae require a more complicated approach. Owing to the short pedicle of the fibula flap, the proximal part of the fibula is often discarded to lengthen the pedicle of the peroneal vessels. We performed simultaneous reconstruction of the bilateral maxillae and nasal hard structures using a vascularized and nonvascularized fibula to reduce the risk of grafted bone exposure and infection.

From the Department of Plastic and Reconstructive Surgery, Graduate School of Medicine, Kyoto University, Kyoto, Japan.

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CASE

A 57-year-old man had undergone resection of the nasal bone, nasal cartilage, and hard palate for nasal cavity cancer (Fig. 1). Soft-tissue reconstruction was performed using a left anterolateral thigh (ALT) flap because postoperative radiation was highly expected. A pathological examination revealed a positive resection margin; therefore, high-dose postoperative radiotherapy (70 Gy) was administered. Unfortunately, osteoradionecrosis occurred in the remaining maxilla, resulting in collapse of the bilateral maxillae. A severe depression deformity of the

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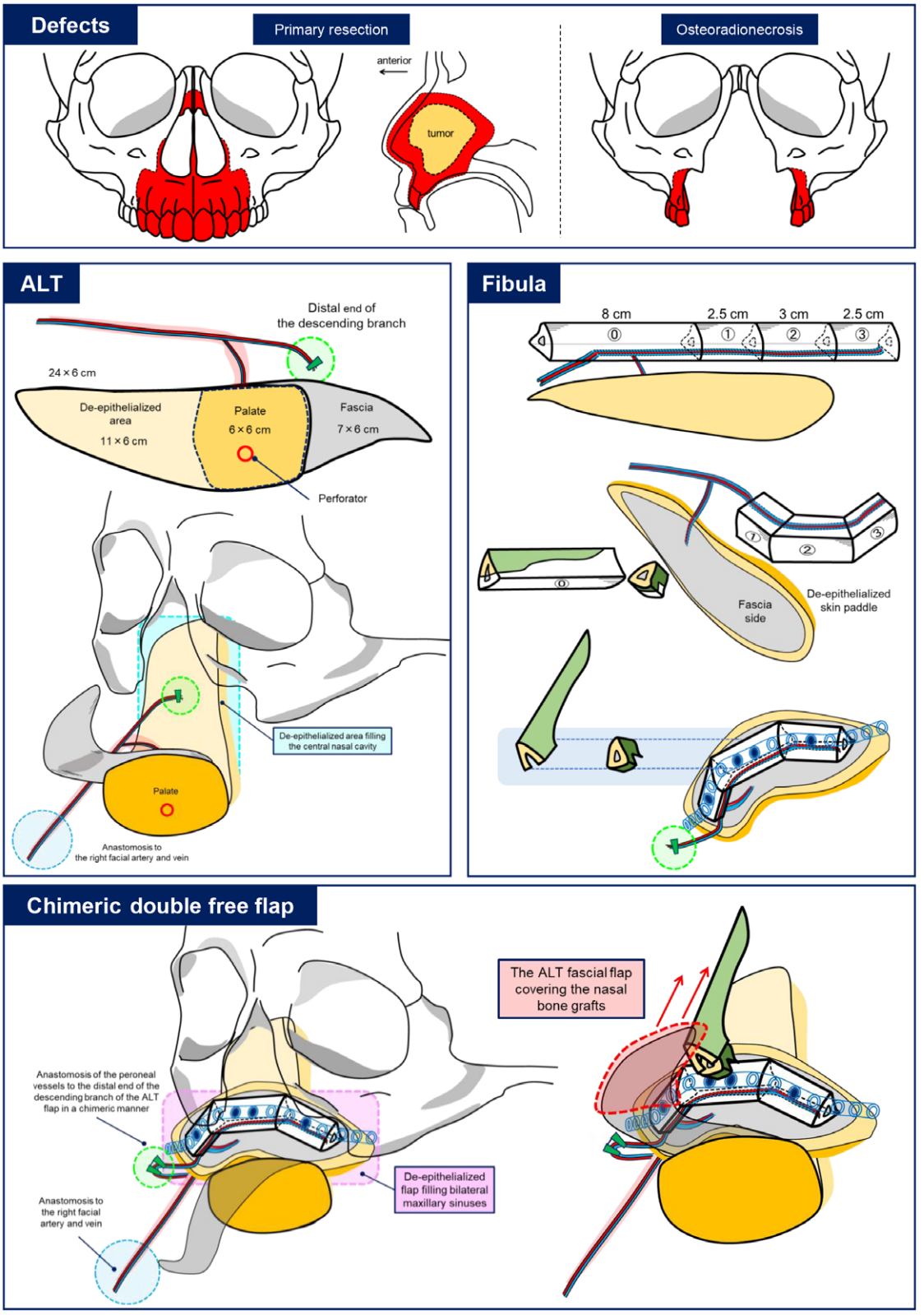

Fig. 1. Details of the nasal and maxillary reconstruction using nonvascularized fibular cortex grafts with ipsilateral double free flaps of fibula and ALT. Three fibular bone segments were vascularized for the bilateral maxillary reconstruction. Segment 0 was removed to obtain the length of peroneal artery and vein as a pedicle, which was made into two cortex pieces and assembled on the reconstructed maxilla. The de-epithelialized fibula flap and ALT flap were positioned to fill the nasal cavity and bilateral maxillary sinuses. Green circles indicate the positions at which the peroneal vessels were anastomosed to the distal end of the descending branch of the ALT flap in a chimeric manner.

Fig. 2. Preoperative findings. Loss of the bilateral maxilla with nasal structures caused severe midfacial depression and problems in closing the mouth.

midface caused a disorder in closing the mouth, resulting in difficulty in conversation and oral intake (Fig. 2). After confirming the absence of recurrence for two and a half years using contrast-enhanced computed tomography (CT), magnetic resonance imaging, and positron emission tomography-CT, we performed secondary midface reconstruction using double free flaps (fibula and ALT flaps).

Before surgery, we bent a 2-mm-thick titanium plate (MatrixMANDIBLE Angle Reconstruction Plate; Johnson and Johnson) using a three-dimensional surgical model. First, a 16-cm right fibular osteocutaneous flap was elevated using a tourniquet on the thigh. Fibular osteotomy was performed: 8 cm of proximal bone was resected to obtain the length of the peroneal vessels, and the distal 8 cm was cut into three pieces (2.5, 3, and 2.5 cm) with blood flow maintained. These pieces were fixed to a prebent titanium plate with 2.4-mm locking screws in a prefabricated manner. The removed 8-cm nonvascularized fibula was processed into two pieces, a nasal bridge and columella (Fig. 1). The skin island was de-epithelialized to bilaterally fill the maxillary sinuses. The right thigh tourniquet was then removed to elevate the ipsilateral ALT flap. A 24 × 6 cm flap was vascularized by a perforator from the descending branch of the lateral circumflex femoral vessels. The central 6 × 6 cm flap was used to close the palate, and the proximal 11 × 6 cm area was de-epithelialized to fill the nasal cavity. The distal 7 × 6 cm area was made into the fascial flap while keeping the suprafascial plexus to cover the bone of the reconstructed nasal structure. The distal end of the descending branch was prepared for anastomosis as a chimeric flap.

The scar contracture around the palatine fistula was released by removing the bilateral medial walls of the maxillary sinuses. The central 6 × 6 cm of the ALT flap was sutured to reconstruct the palate. The descending branch of the lateral femoral circumflex artery and vein were anastomosed to the right facial artery and vein through a subcutaneous tunnel. Next, the three vascularized fibular segments were fixed to the residual zygomatic crest. The peroneal vessels were microscopically anastomosed to the distal end of the descending branch of the ALT flap in a chimeric manner (Fig. 1, green circles). Finally, nonvascularized fibular cortex fragments were assembled to form the nasal bridge and columella. The distal part of the ALT fascial flap covered the nasal bone grafts. (**See figure, Supplemental Digital Content 1**, which shows the vascularized ALT fascial flap. **http://links.lww.com/PRSGO/D316**). The ischemic times of the ALT and fibula flaps were 124 and 210 minutes, respectively. The total operative time was 16 hours and 48 minutes.

CT at 8 months postoperatively showed the preservation of the nonvascularized and vascularized fibula segments (Fig. 3). The patient was orally fed a pasty diet. Total closure of the nasal cavity caused a nasal voice, but the patient regained his conversational ability. The nasal and maxillary prominences were reconstructed, although additional correction of the upper lip and external nose was required. (**See figure, Supplemental Digital Content 2,** which shows the facial appearance 8 months postoperative. **http://links.lww.com/PRSGO/D317**).

DISCUSSION

Bilateral maxillectomy defects are challenging to reconstruct because of the complexity of the defect and short pedicle of the peroneal vessels.[4,5] Moreover, the presence of a mixed defect in the hard nasal hard structure makes the procedure difficult for surgeons. We used an extra fibula segment that is usually discarded as a nonvascularized cortex graft to lengthen the pedicle of the peroneal vessels. Perez et al[6] reported the use of nonvascularized fibular cortex grafts for nasomaxillary buttresses as small pieces. Shan et al[7] showed larger nonvascularized fibula transfers for bimaxillary reconstruction, which were split in half and cut to 3 cm in length, and covered with a vascularized forearm flap to prevent infection. Marechek et al[8] reported that the length of nonvascularized bone grafts is a factor of success; the cutoff value in mandibular reconstruction was 6 cm.

In this case, two techniques were applied in efforts to prevent exposure and infection. The first was filling the nasal cavity and maxillary sinuses, as dead space, with both de-epithelialized ALT and fibula flaps positioned in a crosswise manner. The second was to use the fascial ALT

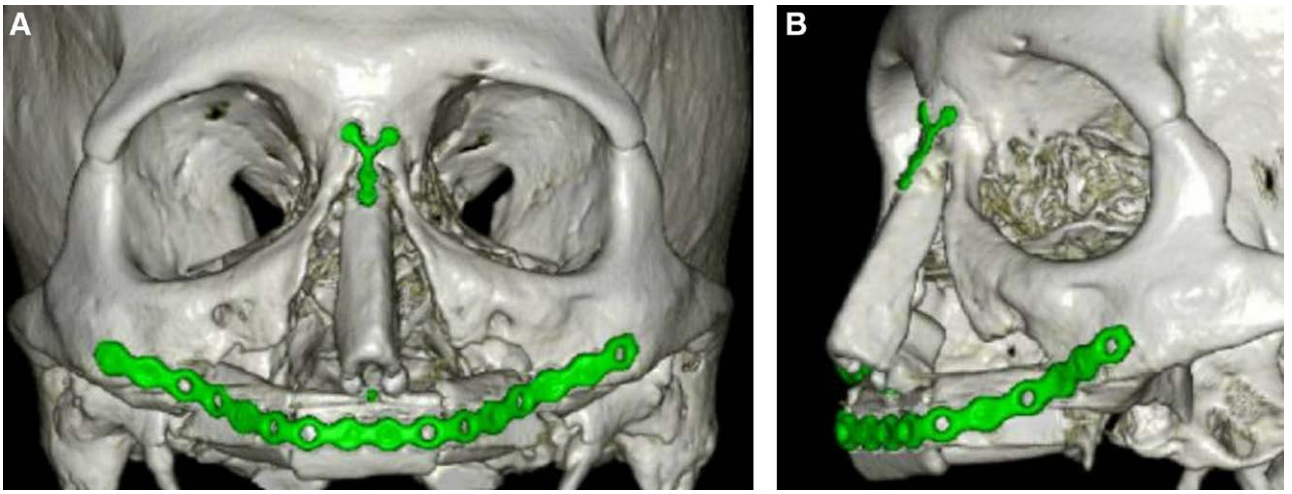

Fig. 3. Postoperative three-dimensional CT image at 8 months postoperative. All five bone segments were maintained without fracture or absorption. A, Front view. B, Oblique view.

flap to cover the reconstructed nasal tip and nasal bridge. The suprafascial plexus of the ALT flap on the fascia lata should remain to maintain blood circulation.[9] The chimeric double flap created by anastomosis of the peroneal vessels to the distal end of the descending branch also solved the problem of the short pedicle of the fibula flap. We hope to place dental implants in the vascularized fibula, reconstructed as the upper jaw, to set an overdenture.

CONCLUSIONS

The mixed use of vascularized and nonvascularized fibula bones enabled simultaneous reconstruction of the bilateral maxillae and hard nasal structure. The ALT flap filling the nasal cavity and covering the nonvascularized bones with vascularized fascia from the anterior surface reduced the risk of exposure and infection of the grafted bones.

Itaru Tsuge, MD, PhD
Department of Plastic and Reconstructive Surgery
Graduate School of Medicine, Kyoto University
54 Shogoin Kawahara-cho, Sakyou-ku
Kyoto 606-8507, Japan
E-mail: itsuge@kuhp.kyoto-u.ac.jp

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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