Double-flap Mandibular Reconstruction around the Condylar Head Using Fibula and Anterolateral Thigh Flaps

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Summary: We applied double-flap reconstruction with a vascularized fibula osteo flap and a Y-shaped anterolateral thigh (ALT) flap, which was separated into a fascial flap and a de-epithelialized fat flap to replace the temporomandibular joint capsule and temporal soft tissue volume, respectively. This technique achieved excellent functional and cosmetic results with acceptable operation time and donor site scarring. A 16-year-old girl had a rapidly growing mandibular osteosarcoma. Right mandibulectomy from the right first premolar tooth to right condylar head (including temporalis muscle, masseter muscle, buccal mucosa, and part of the right maxilla) was performed. A left fibula osteo flap and left ALT flap were prepared in a prefabricated manner using a three-dimensional model and a prebent titanium plate. The area of the ALT flap was 23 × 6 cm. A proximal 8 × 4 cm skin flap was positioned to replace the left cheek mucosa, and the distal part was divided into two layers: a de-epithelialized fat flap and a fascial flap. The de-epithelialized fat flap was used to prevent the depression deformation at the temporal area, and the fascial flap was used to cover around the alternate condylar head made by the fibula instead of the resected temporomandibular joint capsule. The peroneal artery and veins were microscopically anastomosed to the distal end of the artery and veins of the descending branch of the ALT flap in a flow-through manner. At 12 months after surgery, the occlusal function and aesthetic balance were excellent. (Plast Reconstr Surg Glob Open 2022;10:e4607; doi: 10.1097/GOX.0000000000004607; Published online 16 November 2022.)

CASE REPORT

A 16-year-old girl with no medical history had a rapidly growing right mandibular tumor, which resulted in an 8-cm mass with complaints of pain and trismus. Biopsy led to a diagnosis of mandibular osteosarcoma. After 2 months of preoperative chemotherapy, right mandibulectomy (including the right condylar head, right upper jaw partial resection, and right supra-omohyoid neck dissection) was scheduled by otolaryngologists.

Right mandibulectomy from the right first premolar tooth to right condylar head as a body unilateral free end mandibulectomy was performed. The right temporalis muscle was resected at the zygomatic arch level, while the right masseter muscle, buccal mucosa, and coronoid process were excised together with the temporomandibular joint capsule. The right maxilla was partially resected with the sixth and seventh teeth. Facial nerves, including the
frontal branch and the marginal mandibular branch, were preserved in the parotid gland (Fig. 1).

The flap elevations for reconstructive surgery were started at the same time as tumor resection. First, a left fibula osteo flap was elevated using a tourniquet at the left thigh. Referring to a three-dimensional (3D) mandibular model (Cross Medical, Kyoto, Japan) constructed preoperatively using CT data, fibula osteotomy was performed at two locations: 15 cm distal to the head of the fibula and 6 cm proximal to the lateral malleolus. A 16-cm fibula osteo flap with the left peroneal artery and veins was prepared. With blood flow maintained, a 5-cm proximal bone was resected and 11 cm was made into two pieces (size: 6 and 5 cm). We had prebent the 2-mm-thick titanium plate (Matrix Mandible angle reconstruction plate; Johnson and Johnson, USA) according to the 3D model, and fixed the two pieces of fibula bone with 2.4-mm locking screws in a prefabricated manner (Fig. 2A).

Next, the left-thigh tourniquet was removed, and an ALT flap was elevated from the left thigh. Part of the vastus lateralis muscle was attached, and one perforator from the descending branch of the lateral circumflex femoral artery was dissected. The distal end of the descending branch was maintained to anastomose the fibula artery and veins of the left fibula osteo flap in a flow-through manner. The ALT flap area was 23 × 6 cm. A proximal 8 × 4 cm skin flap was planned to replace the right cheek mucosa, and the distal part was separated into two layers before cutting the pedicle: a de-epithelialized fat flap and a fascial flap. The

![Fig. 1](image1.png)

**Fig. 1.** In a 16-year-old female patient, osteosarcoma was excised by body unilateral free end mandibulectomy from the lower right fourth tooth to the right condylar head, including the temporalis muscle, masseter muscle, and part of the maxilla.

![Fig. 2](image2.png)

**Fig. 2.** Double free flaps of the left ALT and left fibula. Yellow circles indicate the position of the reconstructed condylar head and temporomandibular joint capsule by fibula and vascularized fascial flap (A). The de-epithelialized fat of the Y-shaped ALT flap was placed at the temporal region to prevent depression deformation of temporalis muscle atrophy, and the fascial flap was used to cover around the alternate condylar head made by the fibula (B). The reconstructed condylar head made by the fibula was covered by a vascularized fascial ALT flap (C).

Y-shaped position was planned to cover the edge of the fibula bone reconstructed as a condylar head (Fig. 2B).

The ALT flap was then positioned as follows: the skin flap area was sutured to the oral cavity defect, the de-epithelialized fat flap was placed in the temporal region to prevent depression deformation of temporalis muscle atrophy, and the fascial flap was used to cover around the
alternate condylar head made by the fibula (Fig. 2C). A right thyroid artery, right common facial vein, and right external jugular vein were microscopically anastomosed with the descending branch of left lateral circumflex femoral artery and veins using 10-0 Nylon.

Finally, the free fibula osteo flap was fixed to residual mandibular bone bicortically using 2.4-mm locking screws after dentists performed intermaxillary fixation. The peroneal artery and two peroneal veins were microscopically anastomosed to the distal end artery and veins of the descending branch in a flow-through manner. The fascial flap of the ALT wrapped around the reconstructed fibula instead of the resected temporomandibular joint capsule. The ischemic time for the ALT and fibula flaps was 90 and 62 minutes, respectively. The total operative time was 17 hours and 52 minutes. (See figure, Supplemental Digital Content 1, which shows a postoperative orthopantomographic image. http://links.lww.com/PRSGO/C218.)

The pathological diagnosis was osteosarcoma, pT1pN0M0. The surgical margin was negative. Postoperative chemotherapy was applied for 7 months. No postoperative complications including neuropraxia of the facial nerve had appeared. The occlusal function and aesthetic balance were excellent within 12 months after surgery. Moreover, the donor sites of left thigh and lower leg showed aesthetically acceptable linear scars without any movement disorder. (See figure, Supplemental Digital Content 2, which shows the findings of the reconstructed mandible, http://links.lww.com/PRSGO/C219.)

**DISCUSSION**

Excellent aesthetic and functional reconstruction results were obtained using an ALT flap as two divided layers: a vascularized fascial flap and a de-epithelialized fat flap. Anatomical studies have shown that ALT flaps have two horizontal vascular networks: a suprafascial plexus and a subdermal plexus. To maintain the vascularity of the fascial flap, we maintained 2–3 mm of subcutaneous fatty tissue on the fascia. Recent photoacoustic imaging advances may make these separated flap designs safer.

A metallic condyle on a reconstruction plate is another choice; however, a double-free flap of simultaneous soft tissue and vascularized bone flap showed less infection and a decreased incidence of long-term pain. Moreover, the reconstructed temporomandibular joint is better for interpositioning by vascularized fascia or muscle.

The long operative time is a limitation of complex double flaps; however, the prefabricated approach helped avoid additional time to a long albeit very difficult surgery. A left fibula osteo flap was first elevated using a tourniquet on the left thigh until fixation to a prebent titanium plate at the donor sites using a 3D model; then the tourniquet was removed to elevate a left ALT flap from the same extremity. Both flaps were completely prefabricated when the tumor was removed. This double-flap method was considered an excellent method for large mandibular defects (including those in the condyle, oral cavity, and temporal region), especially for younger cases.

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