

# Vascularized Condyle Reconstruction with Free Medial Femoral Trochlea and Fibular Flow-through Flaps

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**Summary:** The free fibula flap is the gold standard in reconstruction of oncologic mandibular defects. When the mandibular condyle is resected, reconstruction of the temporomandibular joint (TMJ) continues to pose a unique challenge to the reconstructive surgeon. Several conventional methods have been described, including costochondral grafts, bone grafts, and alloplastic prostheses. These nonvascularized options are rarely employed in the oncologic patient receiving postoperative radiation therapy due to high rates of resorption, nonunion, and failure. The authors describe a novel technique for mandibular and TMJ reconstruction utilizing the fibula free flap as a flow through for a medial femoral trochlea flap for vascularized mandible and condylar reconstruction. This technique provides a vascularized cartilaginous surface to articulate with the glenoid fossa, making it an attractive option for the oncologic patient undergoing postoperative radiation therapy. (*Plast Reconstr Surg Glob Open* 2023; 11:e4738; doi: 10.1097/GOX.0000000000004738; Published online 13 January 2023.)

Reconstruction of oncologic mandibular defects are treated with vascularized osseous transfer, with the gold standard being the free fibula flap. Resection of the mandibular condyle, although rare, creates a unique reconstructive challenge. Conventional options for condylar reconstruction include costochondral grafts or alloplastic temporomandibular joint (TMJ) prostheses. In our institutional experience, these nonvascularized options experience high rates of resorption and failure due to postoperative radiation in the oncologic patient. The girdle stone technique is employed by simple suture fixation of the distal fibular segment to the glenoid capsule. Although this technique provides reasonable outcomes in older low-demand patients, postoperative radiation therapy often results in trismus, condylar migration, and malocclusion over time.<sup>1,2</sup>

The application of the medial femoral trochlea (MFT) flap is well described in upper extremity surgery and recently by oral maxillofacial surgeons for isolated TMJ pain.<sup>3,4</sup> The MFT flap is based off the transverse

branch of the descending geniculate artery (DGA) and offers a cartilage-bearing segment from the MFT, whereas the longitudinal branch supplies the cortico-cancellous portion of the more common medial femoral condyle flap.<sup>5</sup>

We present the novel application of the MFT flap for mandibular condyle reconstruction using a free fibula flap as a flow through in an oncologic hemi-mandibular resection.

## CASE PRESENTATION

A 60-year-old woman presented with squamous cell carcinoma involving the left mandibular body, angle, and ramus (T4a, N0, M0) requiring condylar resection. Preoperatively, the patient was feeding tube dependent due to severe trismus secondary to pathologic fracture and minimal incisal opening. Virtual surgical planning was utilized with a standard two segment fibula from the contralateral right leg. The distal/ramus fibular segment was planned to match the height of the native ramus and condyle. A 3×2 cm free MFT flap was harvested concomitantly from the right knee. The MFT was fixated onto the distal fibula segment by creating a 3-cm lateral hemi-cortical resection of the distal fibula which overlapped the final hole on the reconstruction plate (Fig. 1). The MFT was then placed into the slot after the pedicle/periosteum was elevated with a freer for 1 cm to allow placement of a 10-mm screw through the distal plate hole spanning the

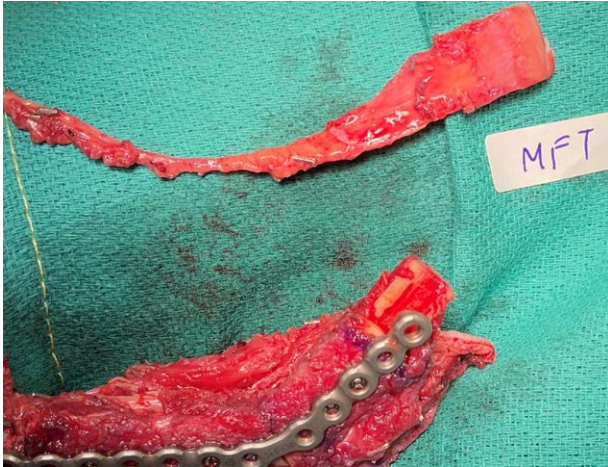
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**Fig. 1.** MFT flap with cartilage cap and lateral hemi-cortical osteotomy on distal fibula for MFT placement.



**Fig. 2.** MFT pedicle elevated off cortical bone for 1 cm to allow for sliding into hemi-cortical groove and before bicortical screw fixation including distal reconstruction plate hole.

MFT cortex and medial fibular cortex (Fig. 2). A second free hand bicortical screw provided two-point fixation. This created a vascularized cartilaginous cap to the distal fibular segment while maintaining appropriate length for condylar seating and occlusion. The DGA pedicle was anastomosed to the distal peroneal vessels in a flow-through fashion. The distal fibula/MFT construct was then seated into the glenoid fossa and centric occlusion, and centric relation was confirmed. Flap monitoring was performed with an implantable doppler. The patient was placed in maxillomandibular fixation (MMF) followed by guiding elastics for 2 weeks. She underwent postoperative radiotherapy at 4 weeks with 6000 cGY in 30 fractions. She experienced significant acute radiation dermatitis of her native cheek and neck skin, requiring short-course admission for pain management and local wound care. She otherwise recovered uneventfully and achieved pre-morbid occlusion with significant improvement in preoperative

trismus and resumption of oral diet. Postoperative CT at 6 months demonstrated bony union and seating of the MFT within the glenoid fossa (Fig. 3).

## DISCUSSION

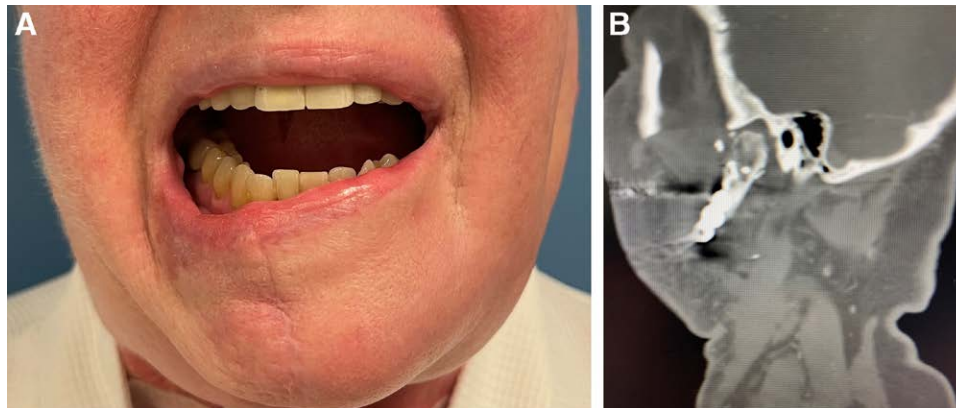
Replacing like with like is the ideal approach to optimizing form and function in head and neck reconstruction where the facial aesthetics, mastication, occlusion, and deglutition are impacted. Mandibular reconstruction is well addressed with free fibula transfer. However, condylar resection poses a unique challenge in the oncologic patient in whom traditional nonvascularized methods are ill-advised in the setting of immediate postoperative radiation. Costochondral grafts and alloplastic prosthetics experience high rates of resorption, nonunion, infection, and failure in our high-volume institutional experience. Therefore, simple girdle stone fixation with permanent suture of the distal fibula to the glenoid capsule is the standard. These patients often experience high rates of trismus and malocclusion over time. For isolated posterior defects including the condyle, soft tissue only reconstruction may be considered. Although this is tolerated in low-demand edentulous patients, it does result in mandibular deviation to the unaffected side, significant malocclusion, and facial asymmetry/loss of projection with flap atrophy post-radiation. Given these challenges, numerous authors have reported vascularized options for condyle reconstruction. The first metatarsal phalangeal joint has been reported by numerous authors but results in significant donor site morbidity.<sup>6,7</sup> Inclusion of the fibular head in condylar reconstruction is an enticing option but risks common peroneal nerve injury and shortens the peroneal pedicle. Additionally, numerous studies have demonstrated that the proximal fibula is primarily supplied by the anterior tibial system.<sup>8,9</sup>

The use of the MFT for TMJ reconstruction was first reported in the oral maxillofacial literature by Lee et al in 2014.<sup>10</sup> Recently, Xia et al<sup>4</sup> reported TMJ reconstruction in four patients with satisfactory outcomes and negligible morbidity using the MFT flap. These cases utilized the MFT in isolation for benign TMJ pain. We report the first use of the MFT flap for condylar reconstruction in the oncologic patient utilizing a free fibula for flow-through anastomosis. We believe the oncologic patient to be the optimal candidate, given the need for postoperative radiation.

In our experience, short-course maxillomandibular fixation optimizes occlusion in the dentulous patient but is infrequently employed as significant trismus occurs in the setting of girdle stone fixation. We hypothesize that a more anatomic vascularized cartilaginous joint reconstruction may allow for short-course MMF to optimize occlusion without significant trismus. The case presented improved from severe baseline trismus and feeding tube dependency to pre-morbid occlusion and improvement in incisal opening with return to oral diet.

## CONCLUSIONS

Combining the MFT flap with a free fibula flow-through flap for mandibulectomy with condyle resection is a novel



**Fig. 3.** Excursion at 6-months improved from severe baseline trismus. A, Six-month postoperative photograph. B, Radiographic bony union and neo-condylar seating at 6 months.

approach in the oncologic patient requiring postoperative radiation and provides a vascularized cartilaginous interface with the glenoid fossa. Larger series and long-term follow-up are needed to determine the functional benefit of this technique compared to traditional methods.

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