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Technical Note
Reconstructive Surgery

Reconstruction of the mandibular condyle using the microvascular lateral femoral condyle flap

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Abstract. The lateral femoral condyle (LFC) flap is a new flap first reported in 2015 for the treatment of osteomyelitis in hand surgery. This paper introduces a technique of osteochondral LFC flap harvest for mandibular condyle reconstruction and reports on the use of this flap in temporomandibular joint reconstruction. For condyle resection, a pre-auricular approach saving the temporal artery and vein is performed. A step osteotomy technique is used for condyle resection. LFC harvesting starts with dissection of the popliteal artery and vein. The superior genicular artery and vein are identified and followed along their periosteal branches. An osteochondral flap according to the condyle defect is harvested from the anterior pole of the knee. The flap is banded according to the defect and fixed to the mandibular neck with three miniscrews. Follow-up computed tomography scans should be performed at 1 week, 6 months, and 1 year after surgery. The case of a 58-year-old female patient with osteomyelitis of the left mandibular condyle after multiple preoperative therapies is reported. The LFC flap technique was used for left condyle reconstruction, resulting in good functional and morphological outcomes at the 6-month postoperative follow-up. In conclusion, the osteochondral LFC flap is a new and promising technique for mandibular condyle reconstruction for special indications.

Key words: TMJ; mandibular condyle; lateral femoral condyle flap; microvascular reconstruction; osteomyelitis.

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Reconstruction of the temporomandibular joint (TMJ) is mostly based on prosthetic techniques. There are only a few descriptions of vascularized bone or joint transfer techniques for TMJ reconstruction. Regarding osteomyelitis of the joint, there are only a few case reports on condyle resection and primary reconstruction[1]. Nevertheless, if the joint is resected in dentate patients, there is no stabilization of the occlusion by the resected joint if it is not reconstructed, and malocclusion results. Therefore, early joint reconstruction in the correct occlusion would be helpful to avoid long-lasting occlusal trauma and consequent derangement of the contralateral joint.

Using a vascularized TMJ reconstruction technique can bring two main advantages. First, well-perfused healthy tissue from a non-infected region replaces the

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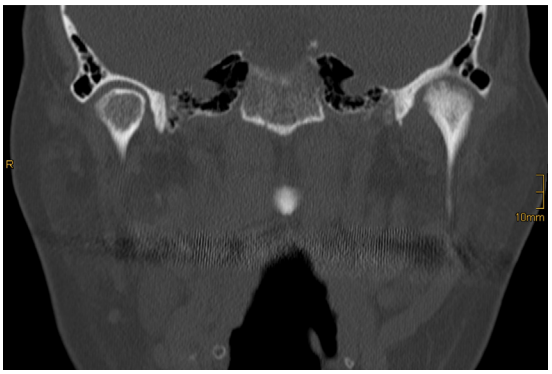

Fig. 1. CT scan of the mandibular condyle obtained preoperatively.

affected TMJ and can therefore support healing, and second, the mandible and the occlusion are stabilized immediately.

The osteochondral medial femoral condyle flap has been used for joint reconstruction in hand surgery for several years[2]. In 2015, Wong et al. described the use of the osteochondral lateral femoral condyle (LFC) flap for joint reconstruction following scaphoid necrosis for the first time[3]. There appears to be no description in the literature of the use of the osteochondral medial femoral condyle flap for TMJ reconstruction. This technical note describes the use of the osteochondral LFC flap for mandibular condyle reconstruction.

Technique

Planning of the operation

Computed tomography (CT) scans of the affected TMJ (Fig. 1) and the distal femur including the condyle are performed. Stereolithography files (STL) are obtained from the CT scan data, and three-dimensional (3D) models of the femoral condyle and the TMJ are printed. The printed mandibular condyle is compared to the printed lateral femoral condyle. A congruent part of the lateral femoral condyle including the bone and cartilage zone, but not lying in the central most used part of the joint, is identified. In most cases, the posterior margin shows best conformance to the mandibular condyle and does not represent a major weight-bearing area. After model operation and sterilization, these models can be taken into the operating room.

Condyle resection

A pre-auricular approach is applied and the temporal superficial artery and vein are identified, prepared, and deflected for later anastomosis. Incision of the temporalis fascia, sub-periosteal preparation of the zygomatic arch, and preparation of the TMJ capsule are then performed. Following the capsule caudally, the mandibular neck is identified for later subcapitular osteotomy. The capsule is incised horizontally to approach the lower TMJ space. The articular disc is prepared and checked for damage. If the disc shows no signs of severe damage, it can be left in place and fixed to the new condyle by suture later. The subcapitular osteotomy of the condyle is then made using a piezoelectric saw. A Z-shaped osteotomy is performed to acquire a sufficiently large bone contact zone for later fixation of the osteochondral flap and to make osteosynthesis with three screws possible. Maxillomandibular fixation (MMF) is then done in maximum intercuspation before a wax model is made. This wax model is made because the cartilage and the soft tissue of the TMJ are not printable and therefore not appreciated in the printed model. The wax model is compared with the 3D model and the condyle model is used to measure the defect and predict the height of the 'neocondyle' to be harvested from the lateral distal femur.

LFC flap harvesting

First the lateral condyle, tibia head, patella, lateral ligament, and the dorsal border of the vastus lateralis muscle are transduced to the overlying skin and marked (Fig. 2).

A 10-cm longitudinal incision from the midpoint between the lateral margin of the patella and the prominence of the lateral femoral condyle, proceeding proximally between the vastus lateralis and biceps femoris muscle, is performed. Following the skin incision, the fascia of the vastus muscle is identified and followed dorsally. The preparation is continued following the intermuscular septum between the vastus lateralis and biceps femoris muscle. Here the popliteal artery and vein are identified. The vessels are followed distally to identify the superior lateral genicular artery (SLGA) and their concomitant veins. The periosteal branches are identified and followed proximally to the anterior pole of the knee joint. The position of the planned flap is identified and the capsule of the joint is incised to identify the cartilage zone to be included in the flap. The cartilage is incised according to the cartilage defect of the TMJ. Next, the osteotomy is performed according to the 3D mandibular condyle model with the use of a piezoelectric saw. Following the osteotomy, the vessels are dissected out to the SLGA and superior lateral genicular vein (SLGV). Then the pedicle is clipped off close to the emergence of the popliteal artery and vein, and flap harvesting is completed (Fig. 3). The LFC flap is transferred to

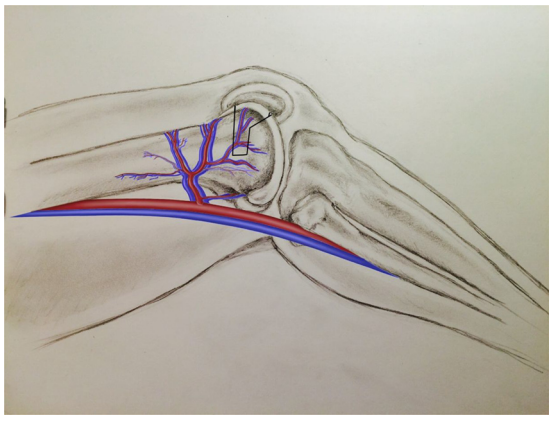

Fig. 2. Drawing of the lateral femoral condyle flap. The figure depicts the superior lateral genicular artery (SLGA) pedicle originating from the popliteal artery along the posterolateral aspect of the knee. One branch runs directly from the SLGA to the anterior pole of the knee cartilage and supplies this area. The planned design of the osteochondral flap is marked.

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