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TECHNICAL NOTE

Anatomical reconstruction of the medial collateral ligament and the posterior oblique ligament of the knee

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Chronic medial knee instability is frequently due to a combination of superficial medial collateral ligament (sMCL) and posterior oblique ligament (POL) insufficiency. We present a new technique for simultaneous anatomical reconstruction of sMCL and POL, using an anterior tibialis tendon allograft with three reconstruction tunnels.

Keywords : superficial medial collateral ligament ; posterior oblique ligament ; chronic medial knee instability ; anatomical reconstruction.

INTRODUCTION

Injuries to the medial knee structures are the most common knee ligament injuries (*1*). The popularity of sports, particularly those involving valgus knee loading such as skiing, soccer, football and ice hockey has contributed to the frequency of injuries to the medial knee structures (*6*).

Many previous anatomical and biomechanical studies have demonstrated that the superficial medial collateral ligament (sMCL) and the posterior oblique ligament (POL) are the two main static stabilizers of the medial side of the knee (*15*). The sMCL is a broad ligament running from an area just in front of the adductor tubercle at the medial femoral condyle to the distal tibial condyle approximately 6 cm under the joint line and below the pes anserinus insertion. Posterior to the MCL lies the posterior oblique ligament (POL), which is a condensation of the capsule of the posteromedial corner (*9*). The sMCL is the primary static stabilizer preventing valgus translation and assists in restraining knee rotation (*7*). The POL is a primary restraint to internal rotation and a secondary restraint to valgus translation and external rotation. The combined action of both ligaments is to control posteromedial stability of the knee (*8,10,16*). Lesions to these structures can result in clinically significant valgus or rotational instability (*15*).

With chronic medial knee instability the combined sMCL and POL insufficiency is frequent. Severe medial knee instability will result in functional limitations and eventually in osteoarthritis (*11*). Therefore, surgical treatment of chronic medial knee instability may be necessary. Few techniques restore the anatomy of both the sMCL and

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the POL. The present study describes an anatomical reconstruction procedure of sMCL and POL for chronic medial knee instability, routing an anterior tibialis tendon allograft through three tunnels. We purposely avoided using the hamstrings and weakening the dynamic medial stabilizers (*12*).

SURGICAL TECHNIQUE

Under general or regional anaesthesia, with the patient in supine position, the medial knee structures are first evaluated. A valgus load is applied at 0°, 30°, and 60° of knee flexion to detect medial joint opening at each flexion angle. Rotation is assessed in comparison with the contralateral knee. Both cruciate ligaments are clinically tested (*3*).

A cryopreserved anterior tibialis tendon is thawed for approximately 20 minutes in warm saline before the surgical procedure. The diameter and length of the tendon are measured to make sure the adequate length of tendon is no less than 24 cm. A n° 2 Ethibond nonabsorbable suture (Ethicon, Somerville, NJ) is weaved through the last 25 mm of one free end of the allograft. At this time graft sutures n° 1 Ethibond Vicryl are placed at the end of the allograft.

With the leg exsanguinated and the tourniquet inflated, diagnostic arthroscopy is performed through standard vertical inferomedial and inferolateral portals. Associated injuries to the medial meniscocapsular junction, the cruciate ligaments, articular cartilage or meniscus are dealt with. After the arthroscopic procedure, a medial longitudinal incision is made from 1 cm above the adductor tubercle down to 7 cm beyond the joint line. Attention is paid to safeguard the saphenous nerve and vein. The medial femoral epicondyle is exposed and the femoral anatomical attachment points of the sMCL and the POL are identified. Attention is then directed to the distal tibial attachment of the sMCL, approximately 6 cm distal to the joint line (*12*). With blunt dissection the tibial attachment of the POL is identified at the posteromedial tibia near the direct arm of the semimembranosus tendon (*13*).

Starting at the tibial attachment point of the sMCL a tunnel is drilled using a drill guide and a 2.0-mm guide wire into the center of the tibial attachment point of the POL, while the rear structures of the knee joint are protected by a periosteal elevator (Fig. 1). A cannulated reamer with the diameter of the single-bundle allograft overdrills the 2.0-mm guide pin to prepare the tibial tunnel. The sutured end of the graft is pulled through the tibial tunnel (Fig. 2).

Fig. 1. — A guide pin is drilled into the center of the tibial attachment of the POL from the center of the tibial attachment of the sMCL using a guide.

One 2 mm eyelet pin is drilled into the center of the femoral attachment of the POL and one into the center of the sMCL, both to come out at the lateral condyle of the femur. The two pins are then overdrilled with a reamer to the size of the allograft and to a depth of 30 mm to prepare the femoral attachments of the graft. The allograft is reduced to the appropriate length. A n° 2 Ethibond non-absorbable

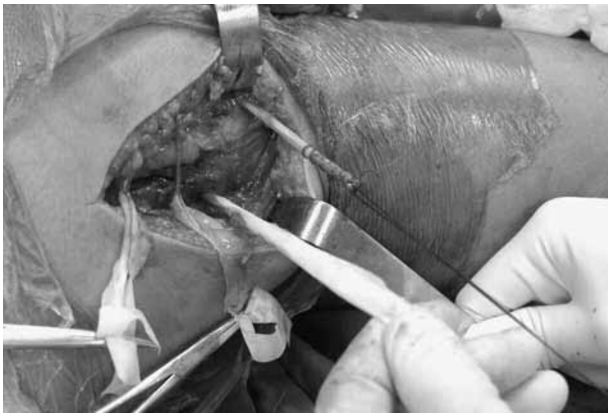

Fig. 2. — The allograft is threaded through the tibial tunnel with the graft sutures.

Fig. 3. — The two femoral tunnels are reamed to a depth of 30 mm.

suture (Ethicon, Somerville, NJ, USA) is weaved in the last 25 mm of the remaining free end of the allograft in a similar fashion as the other end (Fig. 3). The sutures placed in the free ends of the allograft are passed through the eyelet of the pins and the pins are pulled out from the lateral side of the knee. The position of the allograft is adjusted and the two bundles of the graft are separately brought under tension. PDS sutures to the neighbouring soft tissues stabilize the allograft within the tibial bone tunnel. A 25-mm bioabsorbable screw equal to the diameter of the femoral tunnel is then placed in the POL femoral tunnel with the knee in 0° of flexion (the POL has the greatest role as a primary restraint of internal rotation at 0° of knee flexion) (*3,4,8*).

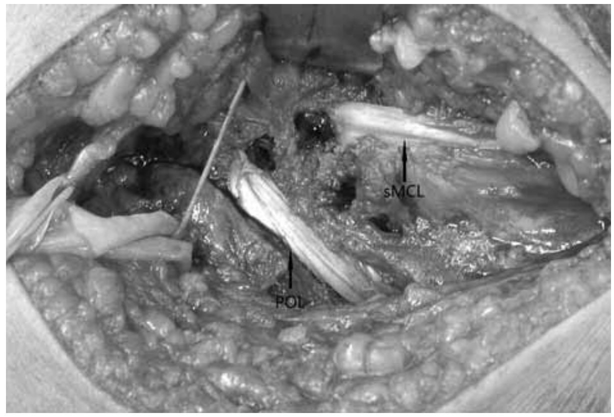

Fig. 4. — The reconstructed sMCL and the POL

Another 25-mm bioabsorbable interference screw equal to the diameter of the sMCL femoral tunnel is placed into the sMCL femoral tunnel at 30° of knee flexion (biomechanical studies demonstrate that sectioning the medial structures at this flexion angle creates the greatest change in valgus laxity) (*3,4,7,10, 16*).

Valgus laxity and rotational stability are now reassessed at various flexion degrees and compared with the preoperative values. The wound is thoroughly irrigated with normal saline and sutured layer by layer.

Postoperatively a hinged brace is used for 6 weeks. During the first 2 weeks range-of-motion exercises are restricted from 0° to 90° of knee flexion and only partial weight bearing is allowed. After the initial two weeks, knee flexion progresses to a full range of motion as tolerated. After 6 weeks, unprotected mobilisation is allowed and closed-kinetic-chain exercises are permitted for functional strengthening. After 8 weeks, free weight bearing is permitted. Controlled sports activities were allowed after 3 months and contact sports after 6 months.

DISCUSSION

The MCL is one of the most commonly injured ligaments of the knee. Because of the high endogenous healing capacity, medial knee instability caused by an isolated MCL injury is seen very

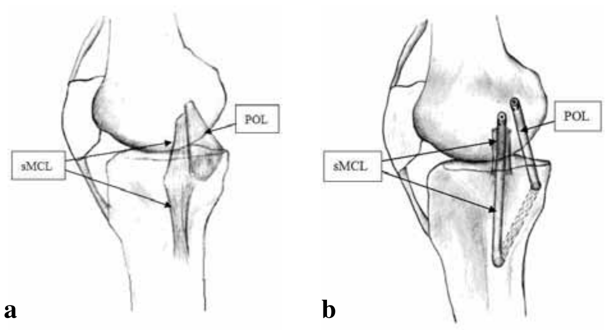

Fig. 5. — a) Drawing of the normal anatomy of sMCL and POL ; b) Medial ligament reconstruction of the right knee. The superficial medial collateral ligament (sMCL) and posterior oblique ligament (POL) are anatomically reconstructed using an allograft of the anterior tibialis tendon running through three reconstruction tunnels.

rarely and is mostly due to multi-ligament injuries. Combined sMCL and POL injuries are frequently found in patients with chronic medial knee instability (*9*). Operative treatment is maybe indicated in patients with symptomatic instability and excessive medial joint laxity (*5*). Various reconstructive techniques for treatment of chronic medial knee instability have been described. Yoshiya *et al* (*17*) and Borden *et al* (*3*) described a technique for sMCL reconstruction for chronic medial knee instability with autograft or allograft. The problem in their procedure is that only the sMCL was reconstructed and medial rotatory instability persists because of POL insufficiency. Furthermore, stability under valgus stress through the complete range of motion may not be restored.

Lind *et al* (*14*) and Azar (*2*) reconstructed the sMCL and the POL starting from the same femoral tunnel or from the same insertion at the medial femoral condyle. As we know the sMCL and the POL have distinctly different attachment points (*12*). Unfortunately these authors used the semitendinosus tendon for the transfer and thus weakened the medial dynamic stabilizers.

Previous studies have demonstrated that anatomical reconstructions better restore normal knee biomechanics. Coobs *et al* (*4*) reported nearly normal biomechanical knee stability and satisfying clinical outcome after an anatomical medial reconstruction technique with the grafts for both the sMCL and the POL at their anatomical attachment. However, on the tibia two eyelet pins are drilled from medial to lateral endangering the peroneal nerve, and requiring four internal fixation points.

We describe a new anatomical medial reconstruction technique for chronic medial instability. A tibialis anterior allograft is used to avoid weakening of the dynamic medial stabilizers (hamstring tendons) (*12*). Only one tibial tunnel is drilled from the anterior sMCL attachment to the posteromedial POL attachment. Our technique does not require internal fixation in the tibial tunnel, reducing the risk of fixation failure. Clinical experience with 23 patients confirmed restoration of medial knee stability and improvement of knee function without special complications. Clinical studies are currently in progress to evaluate the long-term outcome of this reconstruction technique.

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