Technique in ACL reconstruction: patellar tendon

**Definition**

This chapter will describe in detail arthroscopically assisted single-incision anterior cruciate ligament (ACL) reconstruction using bone-patellar tendon-bone graft.

**History**

Surgical treatment of ACL tears has evolved over the past century, with primary repair done as early as about 1900. Poor results including recurrent instability eventually led to attempts at reconstruction in the 1970s, first with extra-articular procedures. Some of these procedures, such as the MacIntosh 1 and the Ellison procedure, made use of the iliotibial band. Results of these procedures were inconsistent, with a high incidence of arthrofibrosis, leading to a transition to more anatomic intra-articular reconstructions in the 1980s using a variety of grafts, including iliotibial band, bone-patellar tendon-bone, and hamstrings. Synthetic grafts made of such materials as polypropylene and Gore-Tex were also used. However, failure rates were high because they either stretched out or fragmented over time, causing recurrent sterile effusions, pain, and instability (1).

Advances in technology in the 1980s allowed a transition from open to arthroscopically-assisted reconstruction. Bone-patellar tendon-bone grafts and, to a lesser extent, hamstring grafts became grafts of choice. Initially, a two-incision technique was used, with an anterior tibial incision and a lateral femoral incision. Each end of the graft was fixed through each of these incisions. Development of arthroscopic guides and instruments allowed the popularization, in the early 1990s, of the single-incision technique, in which the femoral tunnel drilling and femoral fixation are performed intra-articularly (1). This technique has remained the technique of choice for many surgeons and is described here with use of bone-patellar tendon-bone graft.

**Indications**

Reconstruction of the ACL is indicated in those patients with symptomatic instability and those who plan on returning to sporting activities that involve cutting and pivoting. Such activities place the ACL-deficient knee at significant risk for further intra-articular injury.

**Contraindications**

Contraindications for ACL reconstruction include active infection, significant arthritis, and medical conditions making the surgical risk unacceptably high.

**Preoperative physical findings**

Physical findings in an ACL-deficient knee include positive Lachman’s, anterior drawer, and pivot shift tests. Lachman’s test is performed with the knee in 20–30° of flexion. An anterior translation force is placed on the proximal tibia while the distal femur is stabilized by the examiner’s other hand. The amount of translation of the tibia and the firmness of the endpoint are assessed. Translation is measured as the amount of increase in millimeters compared to the normal contralateral side. The anterior drawer test also involves anteriorly translating the proximal tibia, but with the knee in 90° of flexion and the foot stabilized. An ACL-deficient knee typically has a variable amount of increased translation with no firm endpoint on Lachman’s test. Anterior drawer testing is not very accurate for ACL deficiency and may or may not be positive with an ACL tear.

The pivot shift test is performed by placing a valgus stress on the knee with axial loading and internal rotation of the tibia while flexing the knee from an extended position. The subluxed lateral plateau of the tibia shifts to a reduced position relative to the femur at about 30° of flexion, giving a positive test.
The test is graded as follows: 0 – negative, 1 – positive for a glide, 2 – positive for a clunk, 3 – positive for a gross clunk.

**Imaging and other diagnostic studies**

Imaging studies include x-rays and MRI. X-rays may reveal a pathognomonic lateral capsular avulsion of the proximal tibia, or Segond’s fracture. They may also reveal degenerative changes, malalignment, tibial eminence avulsion in younger patients, and acute fractures of the proximal tibia or distal femur. MRI is highly accurate in detecting ACL tears. In addition, it is useful for evaluating associated injuries to the menisci and chondral surfaces as well as bone bruises. KT-1000 instrumented laxity testing may be used to supplement the clinical exam. However, we do not routinely use it.

**Surgical technique**

**Preoperative planning**

Surgical timing is a key consideration in ACL reconstruction. To reduce risk of poor postoperative range of motion (ROM), reconstruction should not be performed until full ROM is regained and the effusion resolves. This typically takes 2–4 weeks of physical therapy after acute injury.

**Positioning of the patient**

The patient is positioned supine on the operating table. An examination under anesthesia is performed. The lower extremity is shaved from mid-thigh to mid-leg over the entire anterior, medial, and lateral sides. A tourniquet is placed as proximally as possible on the thigh. A post is placed lateral to the thigh to assist in creating a valgus stress during visualization of the medial compartment during arthroscopy. The lower extremity is then prepared and draped, making sure that the thigh is exposed to as proximally as possible (Fig. 1). A first-generation cephalosporin is administered prophylactically just prior to starting the surgical portion of the procedure.

**Examination under anesthesia**

Lachman’s, anterior drawer, and pivot shift tests are performed after general anesthesia has been established. The pivot shift often cannot be elicited due to guarding with the patient awake but can become positive with the patient relaxed under general anesthesia. A complete ligamentous examination of the knee is always performed, including posterior drawer testing, varus and valgus laxity testing at 0° and 30° of flexion and assessment of external rotation of the tibia on the femur at both 30° and 90° of flexion.

**Graft harvest**

If examination under anesthesia confirms an ACL tear, as it does in most cases, graft harvest commences after preparation and draping of the affected extremity. In the rare cases when diagnosis is still not definitive, diagnostic arthroscopy is performed prior to graft harvest.

Graft harvest is performed without inflating the tourniquet. A 5-cm-longitudinal incision is marked from 1 cm medial to the inferior pole of the patella to 1 cm medial to the center of the tibial tubercle. The superolateral, anteromedial, and anterolateral arthroscopic portals are also marked (Fig. 2).