Technical Note

Anatomic Posterolateral Corner Knee Reconstruction

Robert A. Arciero, M.D.

Abstract: Injuries to the lateral collateral ligament and posterolateral corner of the knee, particularly when combined with anterior cruciate or posterior cruciate ligament injuries, can result in profound symptomatic knee instability. Although many surgical improvements have been made in reconstruction of anterior and posterior cruciate ligament injuries, reconstruction of the posterolateral corner has had less predictable results, with residual pathologic laxity especially in the chronic situation. This has stimulated many surgeons to recommend acute repair of posterolateral knee injuries. This article describes a more anatomic reconstruction of the posterolateral corner for chronic instability, recreating the lateral collateral ligament and popliteofibular ligament using either autogenous or allograft soft tissue and an interference screw technique. In a small clinical series, this has proven to restore varus rotation and external rotation patholaxities with a high degree of predictability. **Key Words:** Knee instability—Posterolateral corner instability—Posterolateral corner reconstruction.

Many methods have been described to address residual patholaxity after injury to the posterolateral corner of the knee. Failure to surgically address these injuries has been implicated as a reason for failure in surgical treatment of chronic anterior cruciate, posterior cruciate, and combined injuries.[1-11] These have included advancement and recession of the lateral collateral ligament and arcuate complex, biceps tenodesis, augmentation with biceps femoris or iliotibial band, autogenous or allograft reconstruction through a transfibular tunnel, and combined with transtibial tunnel technique in an attempt to recreate the lateral collateral ligament and fibular collateral ligament.[12-21] Current transfibular techniques describe a tunnel made in a strictly anterior-to-posterior direction in the fibula and a single "isometric" femoral tunnel providing 2 limbs to address varus laxity and pathologic increases in external rotation of the tibia. Although this has been reported to improve posterolateral corner deficiencies, it has been the author's experience that residual patholaxities can remain. To our knowledge there has been one other previous report describing an anatomic reconstruction of the posterolateral corner attempting to re-establish the lateral collateral ligament-popliteus-popliteofibular ligament complex.[22] This technical note describes an anatomic reconstruction of the lateral collateral ligament and popliteofibular ligament using a free soft-tissue graft through a transfibular tunnel, but recreating the insertion sites of the lateral collateral ligament and popliteus on the femur using a dual femoral socket technique.

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SURGICAL TECHNIQUE: POSTEROLATERAL CORNER RECONSTRUCTION

Initial lateral exposure is made through a gently curving L-shaped incision over the lateral aspect of the knee. As described by LaPrade and Terry,[23] 3

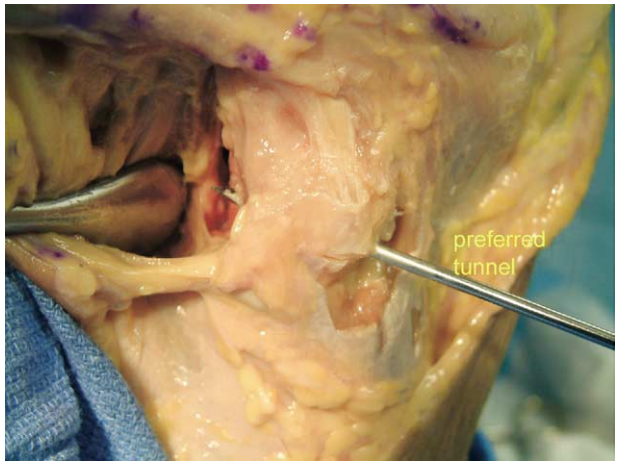

FIGURE 1. Guidewire placed: note orientation of the transfibular tunnel.

FIGURE 3. The 7-mm transfibular tunnel created. Note that the tunnel is immediately inferior to the lateral collateral ligament insertion on the fibula.

fascial incisions are used. The first inferior-most fascial incision is made inferior to the biceps tendon, thereby exposing the peroneal nerve. This is protected throughout the procedure. Through this incision, the posterior aspect of the proximal fibula can be exposed. Using an elevator, the fleshy fibers of the lateral gastrocnemius muscle can be elevated away from the posterior aspect of the fibula. One can easily palpate the posterior aspect of the proximal tibiofibular joint. A small vertical incision is then made over the lateral aspect of the proximal fibula to expose the insertion of the fibular collateral ligament. Using a 3/32-inch guidewire, a pin is directed starting just immediately anterior and distal to the insertion of the lateral collateral ligament (Fig 1). This guidewire is directed posteromedially to exit the posterior aspect of the fibula adjacent to the proximal tibiofibular joint. The direction of this transfibular tunnel is now anterolateral to posteromedial. This is a subtle but important difference in creating this particular tunnel, as compared with the more commonly described anterior to posterior orientation (Fig 2). A 6- or 7-mm tunnel can now be created (Fig 3). A looped passing suture is then placed through this tunnel for future use.

A second fascial incision is made in the interval between the inferior aspect of the iliotibial band and the anterior aspect of the short head of the biceps tendon. Developing this interval will expose the posterolateral joint capsule and the lateral capsular re-

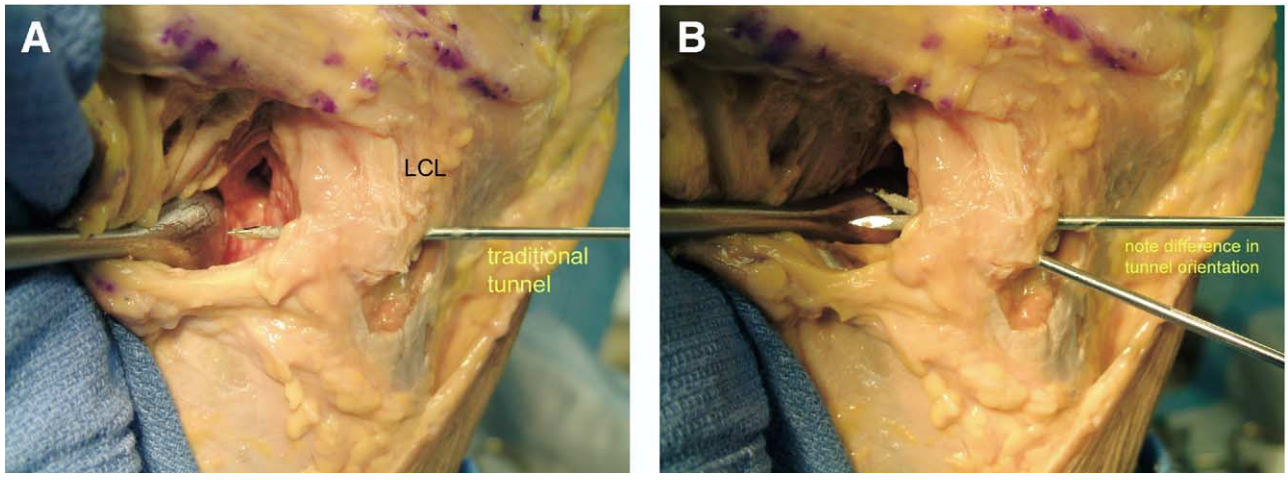

FIGURE 2. (A) Traditional guidewire placement for transfibular tunnel. (B) Comparison of guidewire placement.

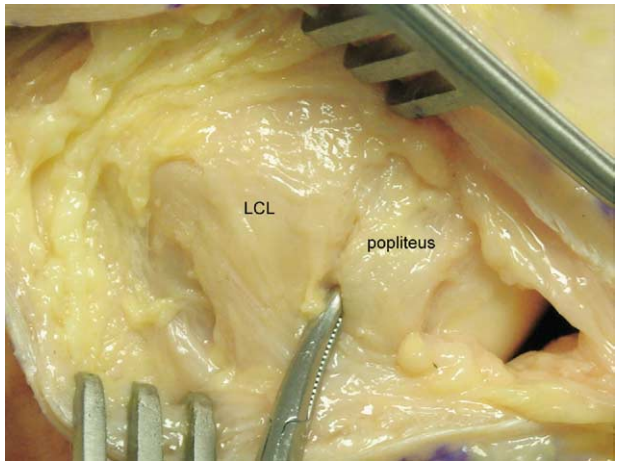

FIGURE 4. Lateral collateral ligament and popliteus tendon attachments on the femur.

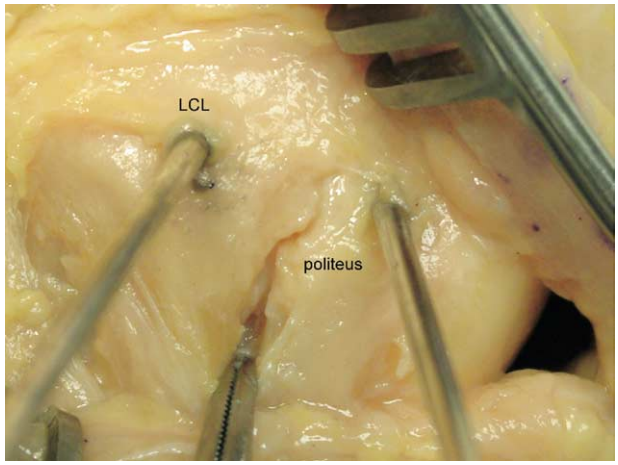

FIGURE 5. Guidewire placement for the femoral tunnels of the lateral collateral ligament and popliteus tendon reconstruction.

gion. Finally, the third fascial incision is made through the iliotibial band, centered over the lateral epicondyle. This incision is carried anteriorly and slightly distally so that an anterior arthrotomy can be performed. Before performing arthrotomy, however, the origin of the lateral collateral ligament is identified. Frequently, a bursal layer will be encountered that will need to be teased off the origin of the lateral collateral ligament. Next, the anterior arthrotomy is made in a vertical fashion to expose the distal lateral condylar articular surface and peripheral edge of the anterolateral lateral meniscus. With gentle retraction, the popliteus tendon can usually be visualized coming in an oblique fashion and inserting distally on the lateral femur close to the articular surface (Fig 4).

Once again using 3/32-inch guidewires, a guidewire is directed approximately 3 to 4 mm anterior to the central origin of the lateral collateral ligament. A 7- or 8-mm lateral collateral ligament femoral socket is then made approximately 30 to 35 mm in length and directed toward the medial cortex. The guidewire can penetrate the medial cortex to facilitate graft passage. It is not necessary to drill a transfemoral tunnel violating the medial cortex. Particularly in the case of a combined posterior cruciate ligament reconstruction, this tunnel will need to be angled slightly more proximal so as to not encroach on the femoral tunnel of the posterior cruciate ligament. The popliteofibular tunnel can now be created. Another 3/32-inch pin is then inserted approximately 3 to 4 mm distal and slightly anterior to the femoral attachment of the popliteus tendon. Once again this pin is directed medially, encroaching the medial cortex between the guidewire proximally used for the lateral collateral ligament and proximal to the posterior cruciate ligament femoral tunnels. A 7- or 8-mm cannulated reamer can now be used to prepare a femoral socket for the popliteus limb of the reconstruction that typically will be drilled to approximately 30 to 40 mm. Figure 5 shows guidewires in position for both femoral tunnels; passing sutures are then placed through both femoral tunnels (Fig 6).

A graft of suitable length, measuring approximately

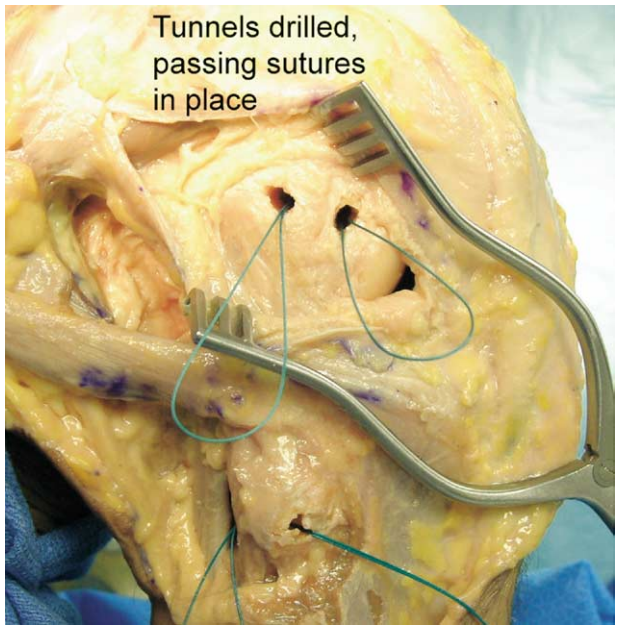

FIGURE 6. Tunnels prepared and passing suture loops in place.

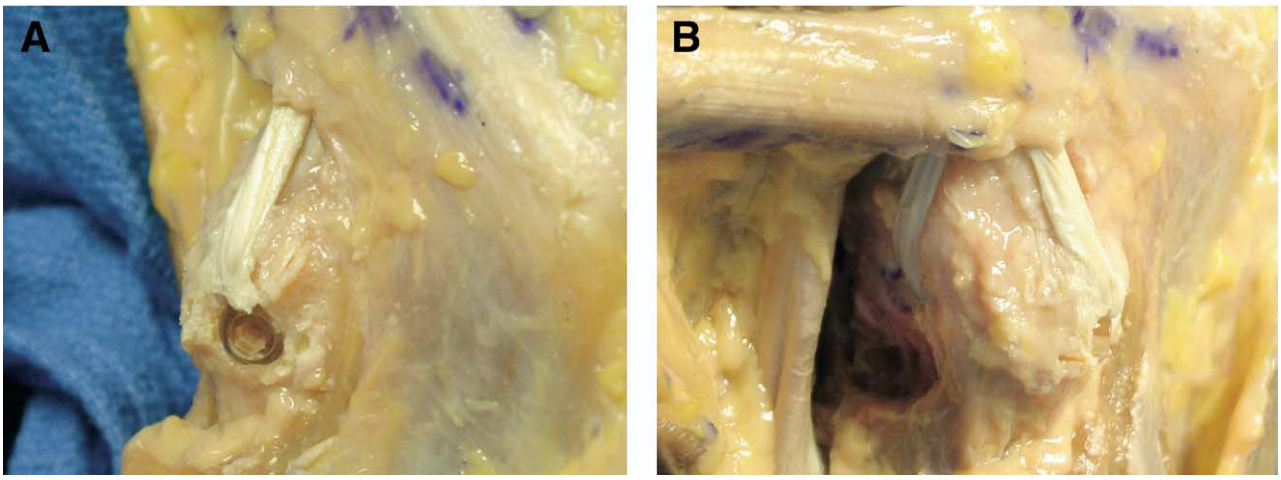

FIGURE 7. (A) Anterior view of graft passed through the fibular tunnel ~~and secured with a 7-mm screw.~~ (B) Posterior view of transfibular graft secured with an interference screw. Note orientation of the graft along the native lateral collateral ligament.

24 to 26 cm, is chosen. We have used autogenous and allograft tissue to include semitendinosus, anterior tibialis, and posterior tibialis tendons. The free ends of the soft tissue graft are tagged with a baseball stitch over a distance of approximately 25 to 30 mm using a No. 2 nonabsorbable suture. The graft is then passed through the transfibular tunnel and firmly tensioned with an equal length of limbs of the graft anterior and posterior. ~~A 7- or 8-mm bioabsorbable interference screw (Arthrex, Naples, FL) is then placed into the fibula for interference fit (Fig 7).~~

The posterior limb of the graft is then tunneled along the posterior aspect of the proximal tibiofibular joint, through the popliteus hiatus, and into the popliteal femoral tunnel. The looped passing suture can be used to pass the graft representing the popliteal fibular limb into the femoral socket to the medial side of the knee. The anterior limb of the graft is now tunneled deep to the biceps femoris tendon insertion and adjacent to the native or remnant of the fibular collateral ligament. Using the passing suture that was in the tunnel for the lateral collateral ligament, this portion of the graft is then transferred into its femoral socket. The passing sutures, as previously mentioned, exit the medial aspect of the knee. With the knee in approximately 30° of flexion, internal rotation, and slight valgus, firm tension is applied medially to both limbs of the graft. A 7 or 8 × 28 mm bioabsorbable interference screw is then placed into each respective tunnel, securing the graft (Fig 8).

The principal features of this reconstruction are dual femoral sockets with 2 separate limbs of soft tissue graft to reproduce the function of the lateral collateral ligament and popliteal fibular ligament. Second, the orientation of the transfibular tunnel is anterolateral to posteromedial. This tunnel is created on the fibula just distal and anterior to the fibular attachment to the lateral collateral ligament. By orienting the tunnel in this fashion, the graft assumes a more anatomic orientation in the coronal plane with the lateral collateral ligament. Furthermore, the posterior limb now travels in a similar direction as the popliteus tendon–popliteofibular ligament component, coming directly into the hiatus and into a separate femoral socket just anterior and distal to the insertion of the popliteus tendon.

In 14 patients, all with combined injuries involving the anterior cruciate ligament, the posterior cruciate ligament, or both cruciate ligaments, this has been a reliable technique used to restore varus stability and diminish abnormal pathologic external rotation of the tibia. This has been especially beneficial in chronic injuries in which the native tissues are extremely deficient.

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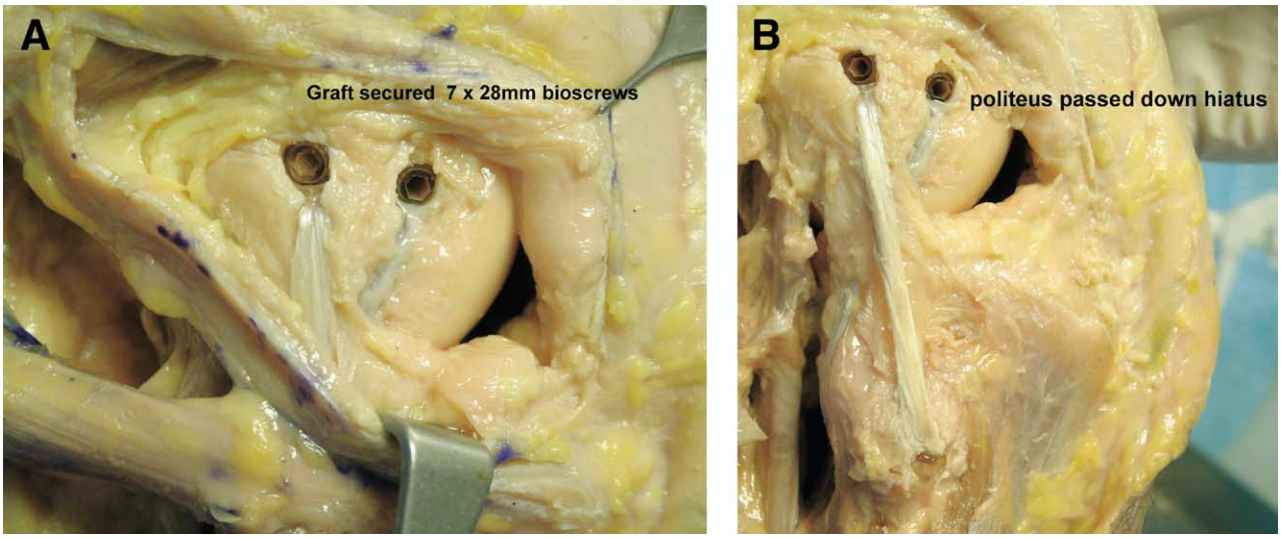

FIGURE 8. (A) Grafts fixed on the femur with interference screws. (B) Finished reconstruction.

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