

## Technical Note

# Extra-articular Lateral Reconstruction Technique

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**Summary:** This article describes an anterolateral reconstruction procedure that, when used in combination with an intra-articular anterior cruciate ligament (ACL) reconstruction, restores rotary and anterior knee stability. We believe that failing to recognize lateral instabilities and to perform an extra-articular reconstruction is an under-recognized cause of failure of ACL reconstruction. We also describe the indications, medical histories, and physical examination tests used to determine when an anterolateral reconstruction is needed. One should suspect a compromise of the lateral structures when presented with a failed ACL reconstruction in which the tunnels, the graft, and the rehabilitation all seem to have been done properly, or when a prior lateral procedure has been attempted and failed. In our experience, if a second ACL reconstruction is undertaken without the benefit of a lateral reconstruction, it may fail as well. **Key Words:** Lateral reconstruction—Lateral instability—ACL reconstruction.

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Over the past decade, operative procedures for treating anterior translation instabilities have improved substantially. Testing has shown that the anterior cruciate ligament (ACL) is the primary restraint to anterior tibial translation<sup>1</sup> and, as a result, the single-tissue replacement graft has become the gold standard when treating anterior translation instability. However, it is important to understand that an injury to the ACL is often associated with a complex injury mechanism rather than an isolated anterior force. As a result, the other soft-tissue restraints within the knee may be injured. This complex relationship between the ACL and the surrounding structures of the knee is especially important in chronic cases. In these, the absence of the ACL places additional demands on the secondary restraints.<sup>1</sup> With this in mind, it is important to realize that both acute and chronic simple ACL tears may involve a more complex injury than earlier considered.

Specifically, the lateral structures may be compro-

mised in chronic and acute ACL disruption, resulting in severe rotary instability. In such instances, the secondary restraints may be so damaged and the rotary instability so severe that an isolated ACL reconstruction using any graft source may fail. This is especially true in those patients with prior lateral reconstructions that may have affected the lateral structures. If severe anterolateral rotary instability is diagnosed, we have found that an extra-articular anterolateral reconstruction (ALR) should be performed in conjunction with the primary ACL reconstruction. Failure to recognize such severe instability and to perform the appropriate extra-articular reconstruction is an under-recognized cause of ACL reconstruction failure. In this article, we outline the indications and the surgical technique for performing an extra-articular ALR.

### PHYSICAL EXAMINATION AND INDICATIONS

In our experience, there are 3 situations in which rotary instability should be suspected and an ALR considered. First, those who present with a failed isolated ACL reconstruction in which the tunnels, the graft, and the rehabilitation have all been done prop-

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0749-8063/00/1605-2007\$3.00/0  
doi:10.1053/jars.2000.7670

erly should be considered. In this situation, the surgeon should suspect a compromise of the lateral structures.

Second, patients who have had a previous lateral reconstruction in conjunction with an ACL reconstruction and are persistently unstable should be considered. All lateral reconstructions, including iliotibial band procedures, such as the Ellison,<sup>2</sup> the mini-Andrews,<sup>3</sup> and others,<sup>4,5</sup> have the potential of masking or contributing to lateral rotary instability. We believe lateral structures are more than likely compromised when a lateral reconstruction has been attempted and has failed.

Third, patients who have had a knee dislocation should be considered. In these patients, obvious rotary instability can be demonstrated with either the flexion-rotation drawer or internal/external dial test. Clearly, not every patient presenting with these histories will have rotary laxity and, obviously, there are several scenarios beyond those noted above where rotary instability should be suspected. However, in our experience, these 3 conditions encompass the majority of rotary instability cases.

Admittedly, defining all cases in which an ALR should be considered is difficult. Our attention was drawn to this problem by late failures in ACL reconstruction in which there was no identifiable explanation for the failure. In such cases, we found that the tunnels were correctly placed, graft fixation was secure, rehabilitation was effective, range of motion was restored, and initial stability was satisfactory. However, we noticed gradual deterioration of these initially satisfactory results. Often, this occurred without significant trauma. Eventually, these patients returned to high degrees of anteroposterior laxity (grade 2 or greater) and marked rotational instability (grade 2 or greater).

The Lachman and flexion-rotation drawer tests are used to assist in the diagnosis of severe lateral rotary instability. To date, all our patients who have undergone ALR have been grossly unstable, having positive Lachman and flexion-rotation drawer tests with grades of at least 2+ and frequently 3+. In addition to the Lachman and flexion-rotation drawer, the internal/external dial test can help identify rotary laxity. To perform the dial test, the patient is placed in a supine position with the knees raised and flexed to 90°. An external (Fig 1) and/or internal rotary load is applied to the knee at the foot. An increased amount of rotation when compared with the uninjured limb is an indication of rotary laxity.

The greater the degree of lateral rotary instability

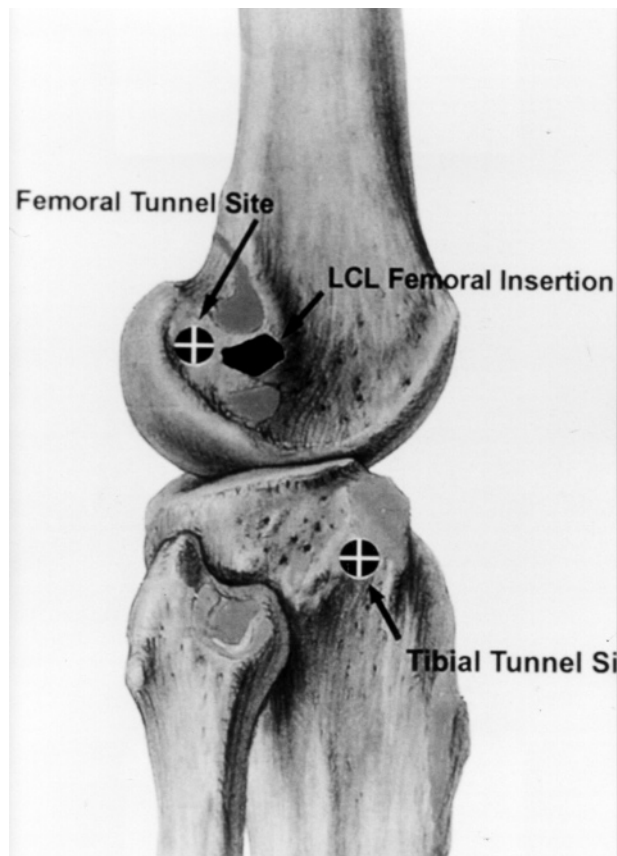


FIGURE 1. Severe posterolateral laxity can be demonstrated through the use of the external dial test.

and the more evidence of a compromise of the lateral supporting structures, the more likely it is that an isolated intra-articular ACL reconstruction will fail. Therefore, the greater the evidence of severe instability and the greater the evidence of compromise of the lateral structures, the more likely it is that the surgeon should add a lateral stabilizing procedure to the intra-articular procedure. If an ACL reconstruction is undertaken without the benefit of a lateral reconstruction in these instances, it will likely fail as well.

### ALR OPERATIVE TECHNIQUE

To minimize donor site morbidity, a semitendinosis or Achilles tendon allograft may be used. However, if allograft tissue is not available, autologous tissue may be substituted. A lateral incision is made through the subcutaneous tissue from the lateral femoral epicondyle to Gerdy's tubercle. The fascia lata is divided longitudinally. Gerdy's tubercle is identified along with the site just posterior to the insertion of the lateral collateral ligament on the femur (Fig 2). Slot-eyed Beath pins are then placed in these positions. Initially, the pins are drilled a short distance into the bone. A suitably strong suture material is then stretched between these 2 pins (Fig 3). The knee is then put through a full range of motion. Tension changes in the suture so placed should be less than 2 mm. This is a simple but useful approximation of isometry. If the tension in the suture is inadequate or the suture breaks because of nonisometric positioning, the pins are reinserted at a more suitable site until satisfactory isometry is established. The work of Sidles et al.<sup>6</sup> established that no truly isometric positions exist laterally and extra-articularly. However, this method



**FIGURE 2.** Anterolateral tunnel sites should be placed at Gerdy's tubercle and a site just posterior to the insertion of the lateral collateral ligament on the femur.

establishes a useful approximation that will protect the ACL graft in these instances of severe anterolateral instability.

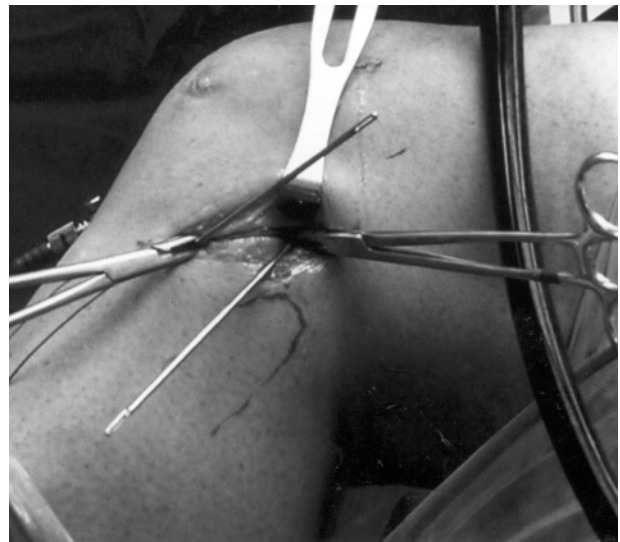
Once this relatively isometric position is established, the femoral pin is drilled through the femoral cortex so as to exit medially and sufficiently proximal to avoid the femoral tunnel of the previously reconstructed ACL (Fig 4). To avoid the tibial tunnel, the tibial pin is advanced distally and medially. Once adequate pin position is achieved, a 7-mm cannulated reamer is advanced over the Beath pins and both tunnels are drilled to a depth of at least 25 mm. A wire suture is placed at both ends of the graft, which is then advanced into the tunnels with the aid of the slot-eyed Beath pins. With the knee held in 20° of flexion, the graft is tensioned to approximately 5 kg, and direct tendon-to-bone fixation is accomplished with 7- × 20-mm bioabsorbable interference screws placed over a guide wire (Fig 5). The femoral insertion is fixed first, followed by the tibial insertion. Stability is then

checked. The pivot-shift phenomenon should be completely eliminated. The wound is then closed with subcuticular absorbable sutures.

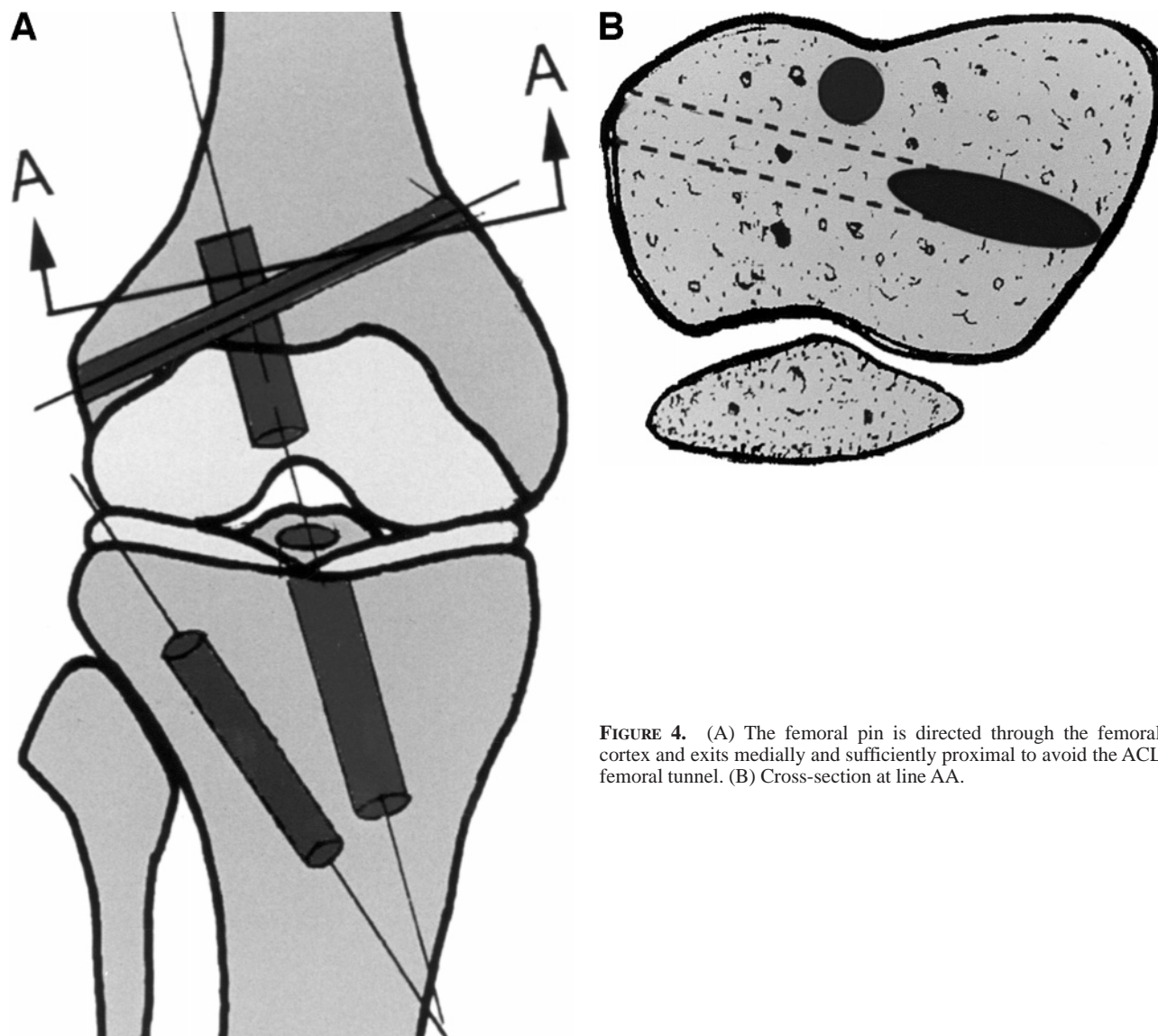
## REHABILITATION

The postoperative program is similar to that initiated after an isolated ACL reconstruction. Postoperative pain may be slightly greater after ALR. Proper pain management is crucial so that early rehabilitation can be initiated. Rehabilitation emphasizes range of motion with heel slides and continuous passive motion, quadriceps strengthening with straight leg raises, and patellofemoral joint protection. Patients are allowed weight bearing as tolerated, with the majority of patients returning to full weight bearing by the seventh postoperative day. The postoperative range of motion protocol includes continuous passive motion and heel slides, with the goal of full range of motion (0° through 135°) by the sixth postoperative week. Cold therapy is used to reduce postoperative pain and swelling.<sup>7</sup>

The postoperative exercise program emphasizes quadriceps strengthening and avoids all extension against resistance. Immediately after surgery, all patients begin a strengthening program that consists initially of straight leg raises. Patients progress to nonimpact sliding/gliding exercises as tolerated. Specifically, patients begin a program consisting of swimming, cross-country ski machine, and stationary bicy-



**FIGURE 3.** A suitably strong suture material stretched between the 2 pins is a simple but useful approximation of isometry.



**FIGURE 4.** (A) The femoral pin is directed through the femoral cortex and exits medially and sufficiently proximal to avoid the ACL femoral tunnel. (B) Cross-section at line AA.

cling beginning usually by the end of the second postoperative week. If any activity produces pain, patients are instructed to discontinue or limit the extent of that exercise.

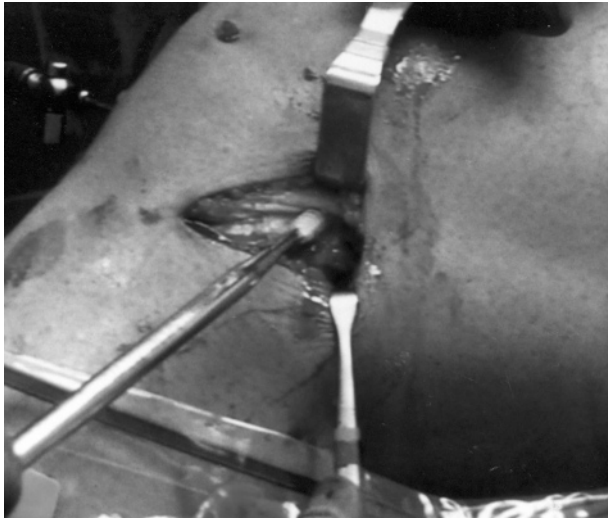
### DISCUSSION

We currently recommend performing a combined intra-articular ACL reconstruction and extra-articular ALR in those patients with severe rotary instability. In these patients, an isolated reconstruction of the ACL may not be sufficient to restore and maintain stability and function. Typically, this group includes patients with a failed ACL reconstruction in which the tunnels, the graft, and the rehabilitation all seem to have been

done properly, patients with previous lateral procedures, or patients with knee dislocations.

The excellent work of Sidles et al.<sup>6</sup> showed that there are no truly isometric points extra-articularly and laterally. However, we believe there are sites that are nearly isometric. We reasoned that the construction of a sling between these points would act as a check-rein in the extremes of rotary motion, thereby shielding the ACL graft from the extreme forces placed on it as a result of deficient lateral structures.

Initially, the only way for such a patient to be recognized as a candidate for ALR was to have had at least 1 surgical failure. Accordingly, we began an effort to identify those patients who would likely be failures if they did not undergo ALR. Such an ap-



**FIGURE 5.** With the knee held in 20° of flexion, the graft is tensioned to approximately 5 kg, and direct tendon-to-bone fixation is accomplished with 7- × 20-mm bioabsorbable interference screws.

proach carries with it the implicit risk of overprescribing the need for extra-articular ALR. Undoubtedly, the equation is multifactorial. The patient's age and activity level could play a role. The presence of associated ligamentous laxity can adversely affect the forces on the ACL graft. Meniscal and articular surface injuries can all play a role. Certainly, it is well established that most ACL reconstructions are successful without the need for lateral side reinforcement. In our practice, an ALR has been incorporated in 7% of the ACL reconstructions.

Although autograft tissue can certainly be used, we believe that using allogenic tissue is beneficial in this group of patients. Many of these rotary-unstable patients have had prior surgical procedures and, therefore, the additional morbidity associated with auto-

graft harvest may prove counterproductive or, in some cases, impossible. Additionally, many of these rotary-unstable patients present after a knee dislocation, which may require a multiligament reconstruction (ACL, posterior cruciate ligament, and medial collateral ligament). Without allograft tissue, there may not be sufficient autograft tissue to properly reconstruct every ligament.

The added morbidity of a secondary procedure certainly influences the surgeon's decision. If the associated morbidity and the risk to otherwise normal structures is small, one is more inclined to use such a technique. We believe this surgical technique has minimal additional morbidity and requires minimal disturbance of normal structures, thereby making it a safe and efficacious procedure for treating rotational instability.

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