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Three-portal technique for anterior cruciate ligament reconstruction: Use of a central medial portal

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19 **The Three Portal Technique for ACL Reconstruction: Use of an**
20 **Accessory Medial Portal**

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22 **Technical Note**

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Introduction

Traditional endoscopic anterior cruciate ligament (ACL) reconstruction is performed using two standard portals. The anterolateral portal is used as the viewing portal and the anteromedial portal is used as the working portal. When performing ACL reconstruction however the posterior aspect of the lateral intercondylar notch may be difficult to view entirely through the lateral portal. There have been numerous descriptions for portal locations for knee arthroscopy, but no article has noted optimal locations for specific portals relating to ACL reconstruction.[1-6] In fact, Kurosaka has used a similar multiple portal technique for ACL reconstruction for several years [personal communication, 2002].

Conventionally, the anterolateral portal is positioned above the joint line just lateral to the lateral border of the patella tendon. Likewise, the anteromedial portal can be created by direct visualization using a spinal needle but is located slightly above the joint line and just off or nearly 1 cm medial to the medial border of the patella tendon. From our experience these portals limit anatomic placement of both the tibial and femoral tunnels during ACL reconstruction by preventing proper visualization of both the tibial plateau and lateral wall of the intercondylar notch. Our current technique for endoscopic anatomic double bundle ACL reconstruction, a modification from Kurosaka, has been well described and involves the use of three portals [7, 8], which are used interchangeably as viewing and working portals based on the specific task being performed, much like that of arthroscopy of the shoulder.(**Table 1**)

Portal Location

“High” Anterolateral Portal

The anterolateral portal is initially used as the viewing portal. It is located just lateral to the patella tendon with the most inferior portion of the portal at the level of the inferior pole of the patella when the knee is flexed to 60 degrees (**Figure 1**). The portal is created with an 11-scalpel blade taking care to avoid damage to the articular cartilage when penetrating the capsule. This portal avoids penetration into the fat pad and is used for the diagnostic arthroscopy, as it allows complete viewing of the patellafemoral, medial, and lateral compartments of the knee without significant resection of the fat pad. Additionally, the anterolateral portal is used to determine the precise position of the anteromedial (AM) and posterolateral (PL) bundles of the ACL at its insertion on the tibia. These sites are marked in preparation for drilling the two tibial tunnels for ACL reconstruction (**table 2**). The superior position of the portal allows a wider view of the tibial insertion of the ACL.

Anteromedial Portal (Central Portal)

The anteromedial or “central” portal is used as a working and a viewing portal. It is placed nearly 1 cm lateral to the medial border of the patella tendon (intratendinous) just inferior from the inferior pole of the patella when the knee is flexed to 60 degrees (**Figure 1**). Again, the portal is created with an 11-scalpel blade taking care to avoid the articular cartilage of the trochlea. This portal is specifically used for viewing the wall of the lateral intercondylar notch and marking the insertion sites of the AM and PL bundles of the ACL (**Table 2**). While viewing through this portal, the accessory medial portal becomes the working portal. By working in this fashion, no “notchplasty” or

“wallplasty” is required because there is no obstruction to viewing the notch, and each bundle is placed in its anatomic insertion while avoiding impingement of the posterior cruciate ligament (PCL). Additionally, the anteromedial portal is used to place the guide (which is set on 45 degrees) for drilling the AM tibial tunnel.

Accessory Medial Portal

The accessory medial portal is used mainly as the working portal for PL bundle femoral tunnel placement. Nearly 30% of the time it is also used for AM bundle femoral tunnel placement when the transtibial technique does not allow for anatomic AM femoral tunnel drilling. The portal is created using direct visualization with a 18-gauge spinal needle typically just superior to the medial joint line approximately 2 cm medial to the medial border of the patella tendon (**Figure 1 & 2**). This allows the proper angle to drill the PL (and if necessary the AM) femoral tunnel with avoidance of injury to the cartilage of the medial femoral condyle. It is also used to place the guide (which is set on 55 degrees) for the PL bundle tibial tunnel. By placing the guide in different portals for the AM and PL tunnels in the tibia, this allows for a larger bone bridge and the proper angle for tunnel placement (**Table 2**). In addition, the accessory medial portal may be used as a viewing portal to view the femoral insertion of the ACL in the notch.

Discussion

In shoulder arthroscopy, multiple portals are used to perform specific tasks. Similarly, arthroscopy of the knee and more specifically ACL reconstruction, portal placement is critical to successfully perform the intended procedure. Each of the three portals described above have specific roles during surgery (**Figure 3**). It is crucial to visualize the ACL footprint on the tibia to determine the precise anatomic location of the

AM and PL bundles of the ACL for tibial tunnel placement (**Figure 4**). Likewise, viewing the lateral aspect of the intercondylar notch through the standard lateral portal without a notchplasty to define the anatomic femoral insertion of the ACL can be quite limited (**Figure 5**). This may cause nonanatomic femoral tunnel placement during single or double bundle reconstruction. As a result, we recommend the use of the medial portal as the viewing portal for femoral tunnel drilling and the use of an accessory medial working portal. This prevents the need for removal of any bone from the notch.

During anatomic double bundle ACL reconstruction, it is helpful to use a variety of portals throughout the surgery. For marking the anatomic insertions of the ACL on the tibia and tibial tunnel drilling, we recommend using the “high” lateral portal for its greatest visualization of the tibial footprint. Contrary to traditional ACL reconstruction, we advocate using the anteromedial (middle) viewing portal to determine the femoral origin of the AM and PL bundles of the ACL on the femur. In order to do this, the accessory medial portal is used as a working portal for drilling the PL femoral tunnel and if necessary the AM femoral tunnel. Most commonly, the AM femoral tunnel can be placed with the transtibial technique, however if the transtibial technique places the AM tunnel too vertical or non-anatomic, the accessory medial portal is used to drill the AM femoral tunnel.

The most common complication associated with ACL reconstruction is erroneous tunnel placement.[9] There are a variety of causes of this, but poor visualization of the anatomic landmarks is will likely cause inaccurate tunnel placement. We propose the solution to poor intercondylar notch visualization is not notchplasty or wallplasty but rather altering the viewing location and adding an accessory medial working portal. This

137 will allow improved visualization of both tibial and femoral anatomic insertions of the
138 ACL and may prevent improper tunnel position during ACL reconstruction.

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Figures

Figure 1: Portal locations marked on skin for ACL reconstruction

Figure 2: External view of arthroscopic instruments during ACL reconstruction. A) Scope in the anterolateral portal and a spinal needle used to identify location of the accessory medial portal in a right knee, B) Scope in anteromedial portal and guide-pin placed in the accessory medial portal for placement of the posterolateral bundle tunnel in the femur of the left knee

Figure 3: Arthroscopic view of the intercondylar notch of a right knee from the anterolateral portal (ALP), anteromedial portal (AMP), and accessory medial portal (MP)

Scope in ALP

**Scope in
CAMP**

**Scope in
accessory AMP**

Figure 4: Arthroscopic view of the tibial plateau of a right knee through the anterolateral portal after placement of the anteromedial and posterolateral bundle tunnels in the tibia

Figure 5: Arthroscopic view of the intercondylar notch of a right knee from the anterolateral portal (A) and the anteromedial portal (B) after placement of the 2 femoral tunnels during ACL reconstruction

Table 1: Use of portals in anatomic double bundle ACL reconstruction

Portal	Viewing Advantage	Surgical Purpose	Working Portal
Anterolateral	Anatomic insertion of ACL on Tibia	Viewing tibia for tibial tunnel placement	Inside-out medial meniscal repair
Anteromedial	Anatomic insertion of ACL in Intercondylar Notch	Viewing intercondylar notch for femoral tunnel placement	Tibial guide placement for drilling AM tunnel
Accessory Medial	Anatomic insertion of ACL in Intercondylar Notch	Placement of PL and if necessary AM tunnels in femur	Tibial guide placement for drilling PL tunnel

Table 2: Specific portal use for anatomic double bundle ACL reconstruction

Tunnel for ACL Reconstruction	Viewing Portal	Instrument Portal
Tibia – Anteromedial Bundle	Anterolateral	Anteromedial
Tibia – Posterolateral Bundle	Anterolateral	Accessory Medial
Femur – Anteromedial Bundle	Anteromedial	Transtibial or Accessory Medial
Femur – Posterolateral Bundle	Anteromedial	Accessory Medial