Femoral Tunnel Drilling From the Anteromedial Portal Using the Figure-4 Position in ACL Reconstruction

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Abstract: Creation of the femoral tunnel in anterior cruciate ligament (ACL) reconstruction via the anteromedial portal can reproducibly achieve femoral tunnel positioning at the center of the femoral ACL footprint. Anteromedial portal drilling requires knee hyperflexion, which is awkward to perform. Knee hyperflexion to 120° can easily be achieved in the figure-4 position for femoral tunnel drilling via the anteromedial portal. The leg is hyperflexed in the figure-4 position on a Mayo stand. The offset femoral guide, guidewire, and drill are placed at the femoral ACL footprint via the anteromedial portal to create the femoral tunnel.

The femoral tunnel in anterior cruciate ligament (ACL) reconstruction can be created using transtibial, anteromedial portal, or outside-to-in techniques. The outside-to-in technique is less commonly performed because it requires an additional incision on the distal lateral aspect of the femur. In the transtibial technique, the femoral tunnel is drilled through the tibial tunnel and through the anteromedial portal in the anteromedial portal technique. The anteromedial portal technique allows femoral tunnel drilling independent of the placement of the tibial tunnel.

Recent studies have shown the superiority of the anteromedial portal technique over the transtibial technique. Anteromedial portal drilling requires knee hyperflexion during use of the drill guide, guidewire, and cannulated drill, which is awkward and requires an additional assistant to stabilize the knee in hyperflexion during this critical surgical step.

The figure-4 position is a standard knee arthroscopy position most knee arthroscopists are comfortable with that can be used to easily obtain the necessary hyperflexion for femoral tunnel creation via the anteromedial portal. To the author’s knowledge, anteromedial portal femoral tunnel drilling in the figure-4 position has not been previously described.

Materials and Methods
Twenty consecutive patients underwent ACL reconstruction with patellar tendon autograft using the anteromedial technique in the figure-4 position. Mean patient age was 22.5 years (range, 15-34 years). Eleven patients were women, and 9 were men. All patients were followed for a minimum of 4 months postoperatively.

Surgical Technique
The patient is positioned supine in slight Trendelenburg with the lower portion of the operating table in full flexion. The knee is flexed at the bend of the operating table (Figure 1).1-5 Anteromedial portal drilling may lead to improved Lachman and anterior drawer tests, although clinical results have not been shown to be significantly different.1

Although the popularity of the anteromedial portal technique is growing, many surgeons are uncomfortable changing from the transtibial technique. Anteromedial portal drilling requires knee hyperflexion, which is awkward to perform. Knee hyperflexion to 120° can easily be achieved in the figure-4 position for femoral tunnel drilling via the anteromedial portal. The leg is hyperflexed in the figure-4 position on a Mayo stand. The offset femoral guide, guidewire, and drill are placed at the femoral ACL footprint via the anteromedial portal to create the femoral tunnel.

Figure 1: Femoral tunnel location via the medial portal technique (M) compared with the transtibial technique (T).
A curved lateral knee post is used. A thigh tourniquet is placed. The anteromedial portal is placed 1 cm medial to the patellar tendon and 1 cm superior to the joint line. The anterolateral portal is placed immediately lateral to the patellar tendon and 1 cm superior to the joint line.

Treatment of meniscal or chondral pathology and an assessment of the ACL are first performed arthroscopically. The tourniquet is raised after exsanguination, typically to 350 mm Hg. Harvest of the central one-third of the bone–patellar tendon–bone autograft is then performed. The ACL stump is debrided, and a lateral notchplasty is performed as needed. The tibial tunnel is drilled from outside-to-in with the knee at 90° of flexion. The tibial tunnel is placed 7 mm anterior to the posterior cruciate ligament at the center of the tibial ACL footprint.

The femoral tunnel position is marked with a curet at the 10-o’clock position on the wall of the femoral notch at the center of the femoral ACL footprint with the knee at 90° of flexion. The knee is then flexed to 120° in the figure-4 position. A well-padded Mayo stand is used to stabilize the leg in the figure-4 position. The foot is inverted by an assistant to stabilize the knee in hyperflexion (Figure 3). The 7-mm offset femoral aimer is placed through the anteromedial portal with the knee hyperflexed in the figure-4 position (A). Arthroscopic image of the 7-mm offset guide positioned at the femoral anterior cruciate ligament footprint (B). Diagram of the 7-mm offset guide positioned at the femoral anterior cruciate ligament footprint (C).

The passing beath pin is placed through the femoral tunnel via the anteromedial portal and retrieved on the distal lateral aspect of the thigh. A #2 nonabsorbable passing suture is looped in the eyelet of the beath pin and brought through the femoral tunnel via the anteromedial portal (Figure 7). A guidewire for the femoral interference screw is placed through the anteromedial portal into the femoral tunnel. The passing suture is retrieved through the tibial tunnel with the knee flexed to 90° (Figure 8). The suture is used to pass the graft through both tunnels at 90° of flexion (Figure 9). The knee is again placed in the figure-4 position for placement of the cannulated femoral interference screw through the anteromedial portal. The tibial interference screw is placed with the knee flexed to 30° and with a posterior drawer force applied to the knee (Figure 10).

RESULTS

In all 20 cases, the femoral tunnel was consistently placed at the 2-o’clock position on the wall of the femoral notch. No patient had significant intra- or postoperative complications. No cases were complicated by femoral wall blowout. All patients reported excellent results at final follow-up.

DISCUSSION

Femoral tunnel creation via the anteromedial portal requires knee hyperflexion to achieve the proper drilling angle. Knee hyperflexion in the axial plane during ACL reconstruction is awkward and difficult to
achieve. The lower portion of the standard operating table typically blocks knee flexion past 100°. Therefore, knee hyperflexion requires flexion at the hip, which necessitates removal of knee holders or other obstructions to hip flexion. An assistant is required to hold the knee in hyperflexion, and the operating table must be lowered to allow the surgeon to be properly oriented to the knee. Therefore, many surgeons are uncomfortable with the technical difficulty associated with anteromedial portal drilling and the necessary knee hyperflexion.

The figure-4 position is commonly used in routine knee arthroscopy to gain access to the lateral compartment of the knee. This position is simple to obtain and highly reproducible. Hyperflexion of the knee up to 120° can be easily achieved in the figure-4 position. The Mayo stand is used to stabilize the leg in this position and can be raised or lowered to adjust knee flexion and varus stress on the knee. The foot is stabilized in inversion by the assistant to maintain stable knee hyperflexion.

The femoral tunnel can be created through the anteromedial portal using the figure-4 position. Most knee arthroscopists are comfortable with the figure-4 position and do not need to make adjustments to the operating table setup to accommodate this technique. Anteromedial portal femoral tunnel drilling in the figure-4 position is a useful alternative in ACL reconstruction.

**CONCLUSION**

Knee hyperflexion in the figure-4 position allows simple, reproducible femoral tunnel drilling through the anteromedial portal.

**REFERENCES**