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## Anatomic anterior cruciate ligament reconstruction with 70° arthroscope for better placement of Femoral and Tibial Tunnels

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### Abstract

The 70° arthroscope in knee surgery is frequently used in posterior cruciate ligament reconstruction. There are previous reports of its use in anterior cruciate ligament surgery, but it has not achieved routine use. With the move toward anatomic anterior cruciate ligament reconstruction (ACLR), it is recognized that accurate tunnel placement is vital for a good clinical outcome. The 70° arthroscope provides an excellent view of the femoral and tibial footprints and a view of the full length of the femoral and tibial tunnels through a single anterolateral viewing portal, which is very important for anatomic ACLR. This technique for creating femoral tunnel through AL portal is easy and avoids instrument overcrowding, particularly in patients with small knees in our country. To the best of our knowledge, we first started using 70° arthroscope regularly for ACLR in our country.

**Keywords:** Anatomic ACLR, 70° arthroscope, femoral footprint, femoral tunnel

### Introduction

The ACL functions as a primary stabilizer against anterior tibial translation and also acts as secondary restraint to rotation of the knee. Reconstruction of anterior cruciate ligament (ACL) can restore stability and function in ACL-deficient knees [1]. Among the various parameters for successful anatomic anterior cruciate ligament reconstruction, either double bundle or single bundle, tunnel placement is the most important aspects of successful anterior cruciate ligament reconstructions (ACLR). The most common cause of ACL reconstructions failure is incorrect tunnel placement, with the femoral tunnel more frequently misplaced than the tibial tunnel [2-4]. Most surgeons use a 30° arthroscope through a anterolateral portal (AL) for viewing the femoral footprint in ACLR and make femoral tunnel through accessory medial portal. Transtibial femoral tunnel placement has now largely been replaced by the transportal technique. It is often suggested to switch the arthroscope to anteromedial portal (AM) to allow accurate femoral tunnel placement through accessory medial portal by using a standard 30 arthroscope. However, increased surgical time is required in establishing and switching portals and viewing through AL portal gives a variable view of the femoral footprint [5]. In addition, instrument crowding occurs when two medial portals are used for viewing and making the femoral tunnel at the same time.

The use of 70° arthroscope is not a new concept. It is commonly used in for posterior cruciate ligament reconstruction and is the workhorse in hip and shoulder arthroscopy [6]. 70° arthroscope provides an excellent view of the femoral footprint through AL portal allowing accurate femoral tunnel placement and its use has also been reported in knee surgery [7, 8]. There is simulator evidence that using 45° arthroscope can increase visualization of the femoral footprint [9].

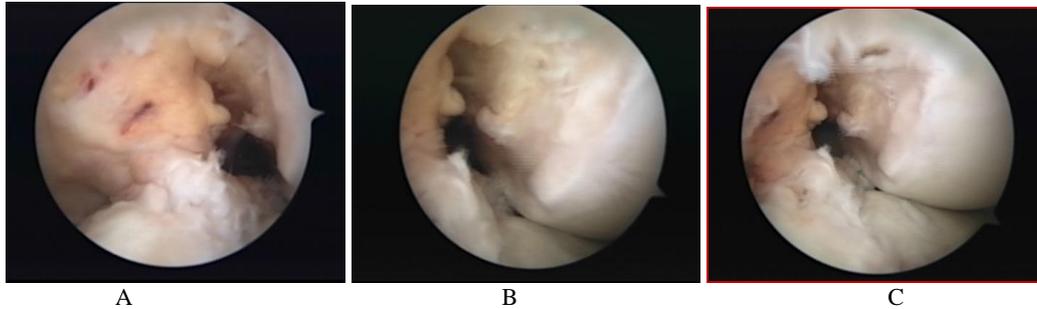
To the best of our knowledge, we first started using 70° arthroscope regularly for ACLR in our country. We believe that it provides an excellent view of both the femoral and tibial footprint which allows more accurate placement of femoral and tibial tunnel placement.

### Methods and Materials

After clinical examination and MRI, we properly select the patients for ACLR. After anesthesia we routinely do examination under anaesthesia (EUA). Then the lower limb is prepared and draped after application of a pneumatic tourniquet. Initially we make AL and AM portals. Diagnostic Arthroscopy is done through AL portal and assessed the nature of ACL tear and other pathologies. Then we treat the meniscal and other pathologies before doing ACLR. All these procedure are performed with a standard 30° arthroscope.

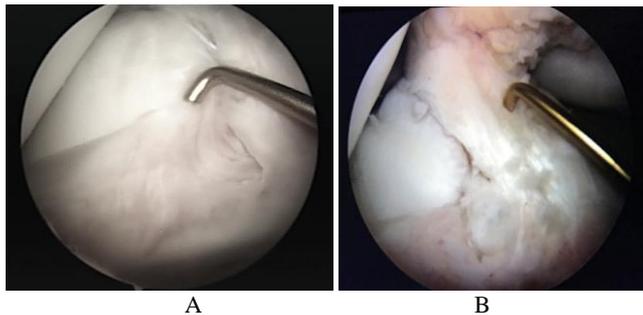
At this stage, the 30° arthroscope is exchanged for a 70°

arthroscope for viewing the femoral footprint through AL portal. After debridement of soft tissue on the medial surface of the lateral femoral condyle with a combination of a shaver and a curette, femoral footprint is identified. The important bony landmarks for femoral tunnels are lateral intercondylar and bifurcate ridges. The use of 70° arthroscope from the AL portal allows improved and clear view of these bony landmarks of femoral footprint (Figure 1). This facilitates accurate identification of the anatomic point for the femoral guide pin. After graft preparation and sizing, the femoral tunnel is reamed through accessory medial portal.



**Fig 1:** Inadequate visualization of femoral footprint with 30 arthroscope from AL portal. (B) Femoral footprint view with 30 arthroscope from AM portal. (C) Femoral footprint view with 70 arthroscope from AL portal. Excellent visualization of the femoral footprint is achieved.

Tibial tunnel is also made by using the 70° arthroscope because the tibial footprint is also well visualized by the 70° arthroscope. It gives a bird's eye view of the intercondylar area of the tibia and the tibial footprint of the ACL is also well visualized (Figure 2). The tibial footprint is inspected, and the center of the planned tunnel is marked with a radiofrequency ablation probe. We usually preserve the tibial stump because its preserve the mechanoreceptors and blood vessels within the stump which improves graft healing [10]. Soft tissue of the tibial stump covers the standard landmarks such as the tibial spine. We therefore use the landmark of the posterior border of the anterior horn of the lateral meniscus (PBAHLM) as the midpoint of the anterior cruciate ligament (ACL) origin [11].



**Fig 2:** Well visualization of PBAHLM (A) and Tibial footprint (B) with 70° arthroscope from AL portal.

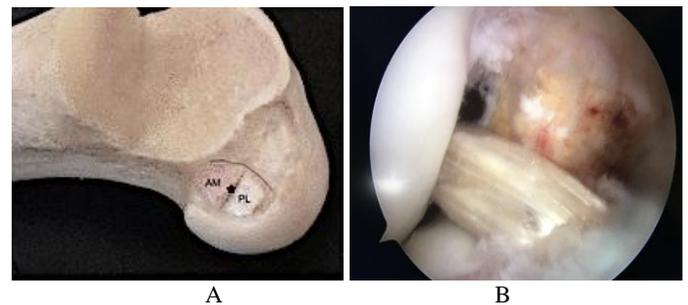
### Discussion

Success of ACL reconstruction depends on proper anatomic placement of the femoral and tibial tunnels. Regarding ACLR, consistent and accurate tunnel placement is crucial to avoid complications because small changes in tunnel position can affect the knee stability and outcomes [12, 13].

ACL anatomy has been well described by the use of radiographic and cadaveric measures [14, 15]. However, it is important to understand the anatomy of the ACL footprints with a arthroscope. [16, 17]. By using 70° arthroscope arthroscopic landmarks are easily visible. Although the use of

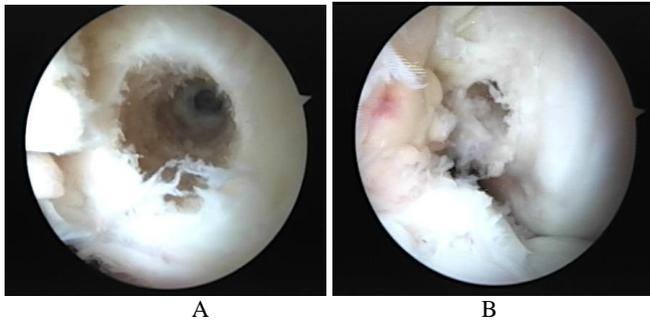
the 70° arthroscope has been described previously in PCL surgeries, it is routinely used in our facility for ACLR. To the best of our knowledge, this is the first description of its use in our country to visualize the femoral and tibial footprints and establish the tunnels.

It is essential to have a clear visualization of the ACL attachment site in its entirety for anatomic ACLR to find out the center of the footprint appropriately (Figure 3). Although it is possible to see the femoral footprint with a 30° arthroscope through AL portal, for better visualization arthroscope through AM portal is recommended [5]. However, it can be technically difficult to create femoral tunnel when two medial portals are used for visualization and working at the same time because of crowding of instruments on the medial side. In addition, viewing through AL portal with a 30° arthroscope gives a variable view of the femoral footprint.



**Fig 3:** Femoral footprint (A), anatomic ACLR (B).

The use of the 70° arthroscope from the AL portal gives an superb view of the femoral footprint, and there is no overcrowding of instruments. It is essential to place the AL portal very close to the patellar tendon at the level of the lower end of the patella to gain the maximum advantage of the 70° arthroscope through the AL portal. It is especially important to view the entire femoral tunnel in both primary and revision ACLR cases to make sure that the entire tunnel wall is healthy and there is no posterior blow out of the femoral cortex. (Figure 4).



**Fig 4:** Well visualization of Femoral tunnel (A) with 70° arthroscope from AL portal and with 30° showing inadequate visualization of Femoral tunnel.

In addition to femoral footprint, viewing from the AL portal with a 70° arthroscope also gives an excellent view of the tibial footprint. The landmarks for tibial tunnel placement, particularly posterior border of the anterior horn of the lateral meniscus (PBAHLM), should be easily identifiable arthroscopically for anatomic ACLR. Using the PBAHLM as a landmark for creating tibial tunnel allows preservation of the tibial stump, which maintains mechanoreceptor function. This can provide biomechanical benefit and promotes graft healing.<sup>10</sup> In the majority of the cases magnetic resonance imaging scans found that the PBAHLM correlates with the midpoint of the ACL tibial footprint<sup>[18]</sup> which usually allows accurate tibial tunnel placement without debridement of the tibial stump. It is also possible to obtain a good view of the tibial tunnel, which is particularly important in revision ACLR.

The described technique is quick and technically easy to learn. As a result, the surgeon is able to obtain a clear and superior view of the ACL footprints anatomy to facilitate accurate tunnel placement. There may be a short learning curve in adjusting to the routine use of the 70° arthroscope. However, a new equipment (70°arthroscope) is required and switching from a 30° arthroscope to a 70° arthroscope is needed after initial joint inspection has been performed and meniscal pathology has been treated.

### Conclusion

The 70° arthroscope provides an excellent view of the femoral and tibial footprints and a view of the full length of the femoral and tibial tunnels through a single anterolateral viewing portal, which is very important for anatomic ACLR. This technique for creating femoral tunnel through AL portal is easy and avoids instrument overcrowding, particularly in patients with small knees in our country.

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