

# FEMORAL TUNNEL LENGTH IN LOW ANTERO-MEDIAL PORTAL ANATOMIC ACL RECONSTRUCTION

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## ABSTRACT

**Introduction:** Injury to the anterior cruciate ligament (ACL) is the commonest cause of knee instability. Arthroscopic intra articular ACL reconstruction with soft tissue graft is the standard treatment for symptomatic ACL deficient individuals. Non anatomical ACL reconstruction results in loss of range of movement, residual laxity and graft failure. This study aims to make an assessment of femoral tunnel length through a precise low anteromedial portal for the femoral tunnel.

**Materials and Methods:** A prospective study was conducted on fifty patients who presented with acute or chronic ACL insufficiency to the Orthopaedics Department at Baby Memorial Hospital, Calicut, during the period April 2013 to April 2014. Males aged 18 to 45 were included. Females, revisions, associated fractures, and flexion less than 110 degrees were the exclusion criteria. All patients underwent pre-operative clinical and MRI assessment. Low anteromedial portal was used in all patients for the femoral tunnel.

**Results:** The mean age of patients was 29.42 years. Most common mode of injury was sports injuries. Femoral tunnel length was between 50 mm and 36 mm with mean length of 42.80 mm and standard deviation of 3.938. Condyle AP diameter and tunnel measurement correlation coefficient value was 0.347 and condyle width and tunnel measurement correlation coefficient value was 0.538.

**Conclusion:** Low anteromedial portal, placed 5mm medial to the medial border of patellar tendon just above the medial meniscus, can overcome the drawback of short femoral tunnel in anatomical ACL reconstruction. Hyper flexion of the knee is recommended for femoral tunnel drilling. Femoral tunnel length is positively correlated with the lateral condyle width and AP measurement.

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## INTRODUCTION

The anterior cruciate ligament (ACL) is an important stabiliser of the knee.<sup>1</sup> ACL injury more commonly causes knee instability than does injury to other knee ligaments. Development of arthroscopic techniques and improvements in technology and research has allowed ACL reconstruction to become one of the most successful

surgical procedures in orthopaedic sports medicine.<sup>2</sup> Arthroscopic intra articular ACL reconstruction with soft tissue graft has become the standard treatment for symptomatic ACL deficient individuals.

Success of ACL reconstructions depend primarily on achieving

1. Proper tunnel placement
2. Graft fixation technique



### 3. Rehabilitation protocols<sup>2</sup>

ACL reconstruction technique requires drilling of femoral and tibial tunnels for the passage of the graft with their aperture over footprint of native ACL attachment. The ACL is composed of the anteromedial bundle (AMB) and the posterolateral bundle (PLB). The previous concept of placing the femoral tunnel at the 11 o'clock position for the right knee and 1 'O' clock for the left knee, and as far posterior as possible, is no longer considered ideal. As per the current recommendations, the position of the femoral tunnel should overlap the site of attachment of both the AMB and PLB.<sup>2</sup>

For the past 15 years, the most common technique was to create the femoral tunnel through the tibial tunnel. This often resulted in a high anterior femoral tunnel which resulted in a vertically placed graft providing less rotational stability.<sup>3</sup>

The position of the femoral tunnel was improved by drilling through the anteromedial portal. This results in a more horizontally and anatomically placed graft which is likely to provide more rotational stability in addition to antero posterior stability. Non anatomical ACL reconstruction results in loss of range of movement, residual laxity and graft failure.<sup>3</sup>

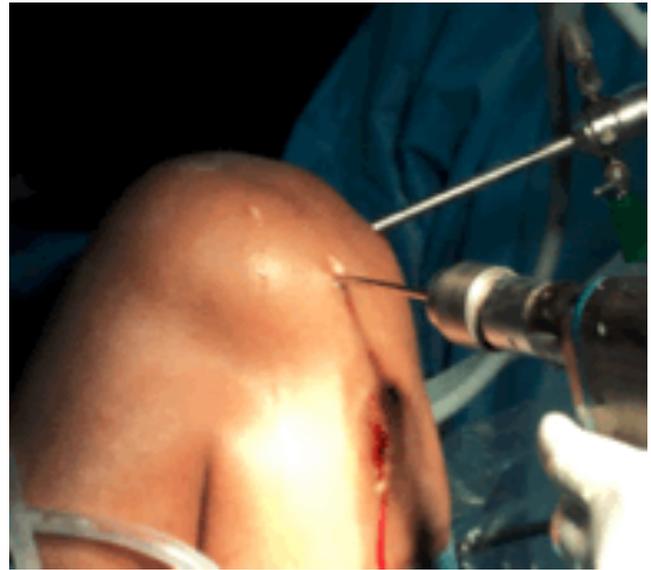
Anteromedial portal drilling of the femoral socket may allow for improved restoration of anatomy and stability with ACL reconstruction compared with conventional transtibial drilling technique. One of the disadvantage of the trans portal technique is a short femoral tunnel.<sup>4</sup> Though many studies have been done on anatomic and biomechanical outcomes of (ACL) reconstruction with transtibial and anteromedial portal drilling of the femoral tunnel on cadaveric knees, there are not many publications on assessment of femoral tunnel length through a precise low antero medial portal.

## MATERIALS AND METHODS

A prospective observation study was conducted on a group of fifty patients with acute or chronic anterior cruciate ligament insufficiency who presented to the Orthopaedics department at Baby Memorial Hospital, during the period April 2013 to April 2014.

The inclusion criteria was male patients in the age group of 18 to 45. Exclusion criteria were female patients, revision ACL surgeries, post-traumatic fractures of tibia/patella/femur, and patients with pre-operative flexion less than 110 degrees.

After receiving the institutional research committee approval and written informed consent, the patients underwent routine clinical evaluation and MRI evaluation of the knee. Pre operative knee flexion was assessed and further clinical assessments were done by Anterior drawer, Lachman and Pivot shift test at outpatient department, and under anaesthesia



**FIGURE 1.** Showing hyperflexion of knee while drilling the femoral tunnel.

at the operating table. In MRI, clinical diagnosis was confirmed and width of the femoral condyle at trans epicondylar cut and maximum antero-posterior condyle length were measured. This enabled pre-operative assessment of the femoral condyle size so that only comparable femoral condyles were studied.

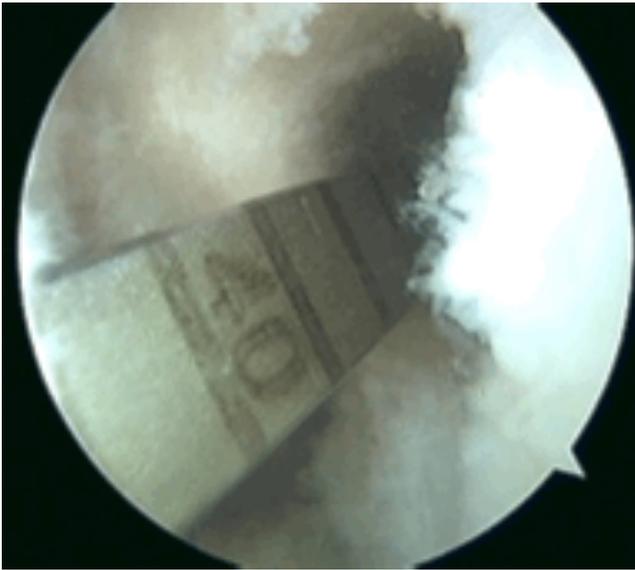
After attaining stable general condition, vital parameters and normal systemic status, they underwent arthroscopic ACL reconstruction using semitendinous graft by low anteromedial transportal technique. Low anteromedial portal is placed 5mm medial to the medial border of patellar tendon just above the medial meniscus. Intra-operatively femoral tunnel is drilled through a low antero medial portal. Intra operatively length of the femoral tunnel is measured with the help of guage. Tibial tunnel is made through standard method using tibial guide. Graft is placed in the tunnel and fixed with endobutton in femur and interference screw in tibia.

All the procedures were done under spinal anaesthesia unless general anaesthesia was specifically indicated.

## RESULTS

50 male patients of anatomical low anteromedial transportal ACL reconstruction were studied. Age group was between 18 and 45 years, with mean age of 29.42 years and standard deviation 8.846. 29 left knees were operated and 21 right knees. Most common mode of injury was sports injuries.

Low antero-medial portal was placed 5 mm medial to the medial border of the patellar tendon just



**FIGURE 2.** Showing tunnel length is measured with gauge.

above the medial meniscus. Femoral tunnel length was measured in all patients intra operatively with gauge. It was found to be between 50 mm and 36 mm with mean length of 42.80 mm and standard deviation of 3.938.

Lateral condyle femur AP measurement and width were measured in pre operative MRI in all 50 patients and its correlation with femoral tunnel length studied. Condyle AP diameter and tunnel measurement correlation coefficient value was 0.347 and condyle width and tunnel measurement correlation coefficient value was 0.538. So width is more positively correlated with tunnel measurement i.e. a smaller increase in width will increase the tunnel value or a smaller decrease in width will decrease the tunnel value when compared to the change in AP measurement of condyle.

## DISCUSSION

In our study femoral tunnel drilling through a low antero medial accessory portal creates femoral tunnel with mean length of 42.8 mm, longest length being 50 and shortest length 36 mm. Standard deviation was 3.938.

In a study Bedi *et al.* reported that critically short femoral tunnel length is 25 mm.<sup>4</sup> Hensler *et al.* reported that as little as 15 mm is sufficient for graft bone healing.<sup>5</sup> So in our study mean femoral tunnel length of 42.8mm is long enough comparing these two statements.<sup>4</sup>

There are not many studies measuring the femoral tunnel length in low antero medial portal technique. Wang J H *et al.* in a CT evaluation of the femoral tunnel reported that 34.3 mm  $\pm$  3.2 mm tunnel length was obtained<sup>6</sup>. Hensler *et al.* in accessory portal drilling for

femoral tunnel in ACL reconstruction reported 31.0  $\pm$  6.3 mm.<sup>3</sup>

So it is clear that even though the short femoral tunnels are one drawback of anatomical reconstruction of ACL, it is highly variable according to the site of accessory portal. Two of the above mentioned studies used an accessory low portal compared to the normal medial portal. None of the studies described in the review of literature also clearly mentioned the anatomical site of this accessory portal.

We recommend low antero medial portal 5 mm medial to medial border of patellar tendon just above the medial meniscus. In our study it is observed that drilling the femoral tunnel using this portal gives a tunnel length of around 42 mm.

## CONCLUSION

On the basis of the present study, following conclusions can be drawn.

Low anteromedial portal femoral tunnel drilling can overcome the drawback of short femoral tunnel in anatomical ACL reconstruction.

Low anteromedial portal can be placed 5 mm medial to medial border of patellar tendon just above the medial meniscus.

Hyper flexion of the knee is recommended for femoral tunnel drilling for anatomical placement of graft and for avoiding injury to medial femoral condyle.

Femoral tunnel length is positively correlated with the lateral condyle width and AP measurement, width being more positively correlated than AP measurement, i.e. a smaller increase in width will increase the tunnel value or a smaller decrease in width will decrease the tunnel value when compared to the change in AP measurement of condyle.

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