

## Original Research Article

# Evaluation of functional outcome of arthroscopic anterior cruciate ligament reconstruction by modified AMP technique

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## ABSTRACT

**Background:** In anterior cruciate ligament (ACL) reconstruction, transtibial (TT) drilling of the femoral tunnel has been criticized for its vertical and less anatomical tunnel, which accompanied rotational instability of knee. Antero medial portal (AMP) drilling technique creates more oblique and anatomic femoral tunnel. However, recent researches show that oblique tunnel is related to risks of too short femoral tunnel, blowout of back wall, and posterolateral structures injury. Modified AMP technique creates vertical tunnel with anatomical FSP (femoral starting point).

**Methods:** In our study we have functionally evaluated 30 patients of ACL tear who underwent reconstruction by modified AMP technique. Modified AMP technique creates vertical tunnel with anatomical FSP.

**Results:** Mean postoperative Lysholm score is  $94.4 \pm 1.22$  and mean postoperative subjective IKDC score is 93.308. All the cases of ACL tear reported their knees as normal or near normal according to objective IKDC score after reconstruction. Mean coronal angle is  $51.112 \pm 6.3$  and mean femoral tunnel length is  $41.8 \pm 3.55$  mm while posterior wall blowout of lateral femoral condyle and postero lateral structure injury has not been observed.

**Conclusions:** The modified AMP technique provides an anatomic and safe mode with vertical tunnel and oblique graft, by reduces the risks involved in the AMP technique.

**Keywords:** Arthroscopy, Anatomic anterior cruciate ligament reconstruction, Single-bundle, Femoral tunnel, Anteromedial portal drilling, Coronal angle

## INTRODUCTION

Optimal femoral tunnel placement has been intensively concerned in anterior cruciate ligament (ACL) reconstruction, yet tunnel misplacement may compromise the restoration of knee stability. For the preparation of the femoral tunnel, transtibial (TT) technique and AMP technique are most widely used methods. TT technique provides vertical and non-anatomical tunnel which will lead to rotatory instability but vertical tunnel provides longer femoral tunnel lengths and shortcomings of too short femoral tunnel like injury to LCL ligament,

peroneal nerve and blowout of backwall of posterolateral structures of lateral femoral condyle does not occur in TT technique. The TT drilling method was adopted to obviate the necessity for the lateral incision to reduce operative time and surgical morbidity.<sup>1,2</sup> However, recently it has been postulated that the single bundle (SB) TT ACL reconstruction places the graft in a non-anatomical femoral insertion site which has been blamed to be the cause of non-reproducible results and poor pivot control in the knee.<sup>2-4</sup>

Anteromedial portal technique (AMP) provides oblique and anatomical tunnel which no doubt gives better rotational stability and good pivot control in the knee which in turn gives better functional scores (Lysholm and IKDC) and better patient satisfaction.<sup>6,7</sup> Single bundle AMP ACL reconstruction avoids complexity of double bundle (DB) ACL reconstruction and provides the surgeon with a greater freedom to place the graft in the anatomical position on femoral side. But AMP technique leads to too short femoral tunnel and injury to LCL ligament, peroneal neurovascular structures, lateral gastrocnemius tendon and popliteus tendon are more.<sup>8-10</sup> To overcome shortcomings of AMP technique and TT technique, and to include benefits of both the techniques, modification in SB AMP technique has been made and modified AMP technique has been introduced. The fundamental of new technique is that oblique graft but not oblique tunnel is essential for rotational stability of knee with same anatomical femoral starting point as traditional AMP technique, vertical tunnel can be made with this new technique. Thus modified AMP technique provides oblique graft and vertical tunnel. It not only preserves anatomic reconstruction as the superiority of AM technique but also avoids pitfalls which have been listed in recent studies.

## METHODS

This study conducted in the Department of Orthopaedics, Pt. B.D. Sharma Medical College, Rohtak from May 2014- May 2015. In this study 30 patients of both sex and age above 18 years with clinical symptoms of ACL rupture like knee instability will be admitted and MRI was done. Clinically and radiologically proven cases will be included and will undergo arthroscopic SB ACL reconstruction with four strand semitendinosus and gracilis tendon autografts.

### *Operative procedure*

The patient was positioned supine on the operating table under anesthesia with tourniquet applied to the operative extremity. After cleaning and draping, both the semitendinosus and gracilis tendons were harvested with a tendon stripper. After harvesting the tendons, the graft was prepared by stitching with non-absorbable sturdy suture (polyester no. 5); the graft was sized and then tensioned and conditioned. Using the standard anterolateral and AMPs, routine diagnostic arthroscopy and debridement of ruptured ACL will be performed. Notchplasty was done in cases of narrow notch whenever required. At 90° of flexion, the anatomic FSP was marked on the center of the lateral bifurcate ridge, which was located between the native AM and posterolateral (PL) bundle insertion sites and followed the clock-face reference (at the 10 o'clock position for the right knee or the 2 o'clock the left knee). In this step, both bony landmarks and clock-face reference were considered. Then, at 100° of knee flexion, with the assistance of the femoral aimer, a guide pin and a thin cannulated reamer

(5.0 mm in diameter), a shallow pit (3 mm depth) was made at the center of the mark and then, the reamer and guide pin was removed out of the joint. This 3 mm depth pit at insertion of native ACL was created as FSP of graft. Then through AM portal, the guide pin was placed on the bottom of the shallow pit and drilled in relatively vertical direction by freehand (usually equal to the direction of 1 o'clock for the right knee or the 10 o'clock the left knee). The far cortex was breached by a 4.5 mm reamer and the tunnel length was assessed with the depth gauge and recorded. After that guide pin was over drilled with a cannulated reamer of the size of the graft (usually between 7 and 10 mm) upto the depth of difference between tunnel length and size of EndoButton and adding 7 mm (required for flipping of the EndoButton) to the length. Femoral graft fixation was performed by EndoButton continuous loop which was usually between 15 and 25 mm, whereas the tendinous portion on tibial side was fixed by interference screw at 30° of knee flexion and knee again observed arthroscopically to exclude graft impingement on anterior side.

### *Method of evaluation*

All the patients were followed up for six months. Two follow up of 15 days each, 30 days each and next 45 days each. Final follow up at six month. In each follow up visit clinical examination will be done and calculate the Lysholm score and IKDC scale for functional evaluation.

### *Statistical analysis*

Collected data were entered in the MS Excel spreadsheet, coded appropriately and later cleaned for any possible errors in Prism 5 (data analysis software). Categorical data were presented as percentage (%). Normally distributed data were presented as mean and standard deviation. For comparing pre IKDC and Lysholm scores with post IKDC and Lysholm scores paired student t-test was used. Pearson's correlation was used for measuring correlation coefficient between coronal angle and femoral tunnel length. All tests were performed at a 5% level significance, thus the difference was significant if the value was less than 0.05 ( $p < 0.05$ ).

## RESULTS

In our study 30 patients underwent ACL reconstruction by modified AMP technique. Mean age of study group is  $26.28 \pm 9.29$  (18-55) yrs. Most of the patients confined to male sex i.e. 26 (86.6%) cases and 4 (13.3%) case was of female sex (Table 1). In 22 (73.3%) cases right knee was involved and in 8 (26.6%) cases left knee was involved (Table 2).

Mean pre-operative Lysholm score was  $56.48 \pm 7.5$ . Mean postoperative Lysholm score was  $94.4 \pm 1.22$ . 18 (60%) cases of ACL tear had excellent results i.e.  $\geq 95\%$  Lysholm score and 12 (40%) cases had good result i.e. between 84-94% Lysholm score. Thus there were 100%

(excellent+good) results in cases of ACL tear in the series (Table 3).

**Table 1: Sex wise distribution of study subjects.**

Sex	Percentage (%)
Male	26 (86.6)
Female	4 (13.3)

**Table 2: Knee affected wise distribution of study subjects.**

Side affected	Male	Female
Left	6	2
Right	20	2

**Table 3: Pre and postoperative Lysholm scores.**

Group	Pre-op Lysholm score	Post-op Lysholm score
Mean	56.48	94.4
SD	7.539	1.225
N	30	30

**Table 4: Pre and postoperative subjective IKDC scores.**

Group	Pre-op subjective IKDC	Post-op subjective IKDC
Mean	47.056	93.308
SD	8.602	1.685
N	30	30

On evaluation of patients on objective IKDC score with ACL tear before operation, 20 (66.6%) cases were in group C (abnormal), 4 (13.3%) in group B (nearly normal) and 6 (20%) cases were in group D (severely abnormal). 29 cases reported their knees as normal after ACL reconstruction. 1 case described his knee as near normal. Thus all cases (100%) come under normal and nearly normal grade on objective IKDC score after ACL reconstruction. Mean preoperative subjective IKDC score was 47.056±8.6 and the mean postoperative subjective IKDC was 93.3±1.68% (Table 4).

## DISCUSSION

Transtibial technique usually results in vertical graft orientation which can be rotational instability in despite of its excellent anteroposterior stability. The AM technique outperforms TT technique because of its easy creation of more oblique femoral tunnel for anatomic reproduction of ACL. However, pitfalls of unsafe surgical procedures compromised AM technique to be ideal method. In our study, the modified AMP technique abandons the popular oblique tunnel but provides a vertical femoral tunnel with an anatomic starting point. The postoperative 3D-CT showed that the center of FSP

was very close to the midpoint between the native insertion sites of AM and PL bundles. Under arthroscopic view, it was found that the aperture of completed femoral tunnel was quite low (distal) on the lateral wall of the intercondylar notch, and the guide rope connected femoral tunnel and tibial tunnel indicated the orientation of the coming ACL graft was quite oblique. The 3D-CT, arthroscopic view, and postoperative X-ray proved that even with a vertical femoral tunnel, the ACL graft could be oblique and with an anatomic FSP. Moreover, the exit of femoral tunnel on the lateral facet of femur approximately located on the midpoint of anterior-to-posterior axis, and the mean femoral tunnel length was 41.8 mm (range 34–49 mm). It implies that the modified AMP technique can avoid risks as a result of oblique tunnel drilling through AM portal. The fundamental of the modified AMP is that oblique graft but not oblique tunnel is essential for restoration of normal rotational laxity.

The mean postoperative Lysholm score in cases of isolated ACL tear was in accordance with the 90% of Siebold et al, 94.5% of Sung et al, 92% of Jarvela et al and 93.13% of Devgan et al.<sup>11-14</sup> In the present study the subjective IKDC score was in accordance with the other studies in literature i.e. 88% of Siebold et al, 84.3±11% of Asagumo et al and 92.87±2.78 of Devgan et al.<sup>11,14,15</sup> All the cases of ACL tear i.e. 100% reported their knees as normal or near normal after reconstruction which is in accordance with the 92% of Siebold et al, 91% of Sung et al and 100% of Jarvela et al.<sup>11-13</sup>

Single bundle arthroscopic reconstruction of ACL tear by modified AMP technique using semitendinosus and gracilis autograft fixed with EndoButton and interference screw is a reliable, effective and reproducible technique. The femoral tunnel length can be adjusted while drilling from FSP on medial surface of lateral femoral condyle by changing the coronal angle. The modified AMP technique provides an anatomic and safe mode with vertical tunnel and oblique graft, which avoids the risks of AMP technique, such as short tunnel, blowout along back wall of lateral femoral condyle, danger to peroneal neurovascular structures and LCL. Randomized control trials comparing this modified technique with traditional AMP technique with larger number of cases and longer period of follow up needed to validate its superiority in future.

## CONCLUSION

We concluded that, the modified AMP technique provides an anatomic and safe mode with vertical tunnel and oblique graft, which avoids the risks of AMP technique, such as short tunnel, blowout along back wall of lateral femoral condyle, danger to peroneal neurovascular structures and Lateral cruciate ligament.

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