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Original Research

Comparison of functional outcome of anteromedial vs transtibial drilling technique in arthroscopic ACL reconstruction

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***ABSTRACT*:**
Background: Among the many factors that determine the outcome following anterior cruciate ligament (ACL) reconstruction, the position of the femoral tunnel is known to be critically important and is still the subject of extensive research. **Objective:** We aimed to retrospectively compare the outcomes of arthroscopic ACL reconstruction using transtibial (TT) or anteromedial (AMP) drilling techniques for femoral tunnel placement. **Methods:** ACL reconstruction was performed using the TT technique in 49 patients and the AMP technique in 56 patients. Lachman and pivot- shift tests, the Lysholm Knee Scale, International Knee Documentation Committee (IKDC) score, Tegner activity scale and visual analog scale (VAS) were used for the clinical and functional evaluation of patients. Time to return to normal life and time to jogging were assessed in addition to the radiological evaluation of femoral tunnel placement. **Results:** In terms of the Lysholm, IKDC, Tegner score, and stability tests, no significant differences were found between the two groups ($p > 0.05$). Statistical analysis revealed reduced time to return to normal life and jogging in the AMP group ($p < 0.05$). The VAS score was also significantly reduced in the AMP group ($p < 0.05$). The position of the femoral tunnel was anatomically appropriate in 51 patients in the AMP group and 5 patients in the TT group. **Conclusion:** The AMP technique is superior to the TT technique in creating anatomical femoral tunnel placement during single-bundle ACL reconstruction and provides faster recovery in terms of return to normal life and jogging at short-term follow-up.
Key words: Anterior cruciate ligament, Anteromedial portal, Drilling, Femoral tunnel, Graft, Transtibial technique.

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INTRODUCTION

Various techniques for anterior cruciate ligament (ACL) reconstruction have been recently introduced. There are approaches to femoral tunnel placement in arthroscopic ACL reconstruction: the tibial tunnel-dependent approach (transtibial technique) and the tibial tunnel-independent approach (anteromedial [AM] and outside-in techniques). Femoral tunnel placement using the transtibial technique is a common and relatively easy procedure in single-bundle (SB) ACL reconstruction. However, recent reports and emphasis on anatomic tunnel placement have generated the need to reconsider the application of the transtibial approach. Some authors reported that the femoral tunnels created using the transtibial approach are non-anatomic. [1-3] So, there have been some efforts to modify the transtibial technique by positioning the starting point of the tibial tunnel more medial and proximal for a more oblique trajectory of the femoral tunnel.[2] However, this has led to other problems such

as a shorter tibial tunnel and widening of the intra-articular aperture of the tibial tunnel.[3,4] Therefore, a transition to creation of a femoral tunnel independent of the tibial tunnel is recommended to achieve anatomic femoral tunnel placement. [5] Techniques for creating anatomical femoral footprint in SB reconstruction have been reported, such as the trans-AM portal technique and the outside-in technique.[6-8] However, disadvantages such as insufficient femoral tunnel length, posterior wall breakage and a bent graft would limit the use of trans-AM portal technique. [9] Similarly, acute femoral tunnel angle, inadequate femoral fixation and additional lateral skin incisions upon surgery are major hindrances for the use of the outside-in technique. [10] To overcome the problems of the above-described modified transtibial technique and tibial tunnel independent technique, we devised a three-point freehand transtibial technique. We designed the three-point freehand trantibial technique for the purpose of anatomic femoral tunnel placement and evaluated the tunnel position with 3-dimensional computed tomography (3D CT) to determine clinical significance.

METHODOLOGY

Among the patients who underwent single-bundle ACL reconstruction using an autologous hamstring graft, 105 eligible patients were included in this retrospective study. ACL reconstruction was performed using the TT technique in 49 patients (4 female, 45 male; mean age, 26.8 years, range 18-40) and the AMP technique in 56 patients (4 female, 52 male; mean age, 25.5 years, range 17-35). The inclusion criteria for this study were as follows: less than 6 months between injury and surgery, at least 24 months of follow-up, a healthy contralateral knee, and patient age between 16 and 40 years. Patients who underwent concomitant surgery during ACL reconstruction for other combined injuries, such as collateral ligament injury, posterior cruciate ligament injury, or posterolateral corner injury were excluded from the study. study was approved by our institutional ethics committee and informed consent was obtained from all patients for the use of their demographic and radiological data.

Surgical Technique

Arthroscopic examination was performed and ACL rupture was confirmed before harvesting the graft. Quadruple- strand semitendinosus and gracilis autografts were used in all patients. The standard technique was performed to place the tibial tunnel in both the TT and AMP groups. [15] The tibial tunnel was prepared in the footprint of the ACL at an angle of 45° to the tibial shaft. In the TT group, the standard aiming guide with a 7-mm offset was placed through the tibial tunnel at the 11 o'clock position of the right knee and the 1 o'clock position of the left knee, and a pin was advanced to determine the femoral tunnel position. A cannulated reamer was then used transtibially to create the femoral tunnel. In the AMP group, a three-portal technique (anterolateral, central anteromedial, and low anteromedial) was used. [16] The midpoints of the remnants of the anteromedial and posterolateral bundles of the ACL were marked with a thermal device. The lateral intercondylar ridge and lateral bifurcate ridge served as the bony landmarks for the femoral attachments. [17] The knee was flexed to 120°-130°, and the guidewire was placed in the center of the two insertion areas via the low AMP. Femoral drills were selected according to the graft diameter, and the tunnel was drilled with a cannulated reamer using a freehand technique. An endobutton continuous loop device was used for femoral fixation of the graft. Pre-tensioning of the graft was performed by flexing and extending the knee through the range of motion. The absence of graft impingement was confirmed by arthroscopic examination. Tibial fixation was performed in 20° of flexion using a bioabsorbable screw and a U staple with a posterior drawer.

Postoperative Care

The same postoperative accelerated rehabilitation protocols were used for both groups. Knee braces or sleeves were not employed in any of the patients. All patients were allowed weight-bearing as tolerated with crutches on the day of surgery. After three weeks, weight-bearing without crutches was permitted.

Clinical and Radiological Assessment

At the last follow-up, all patients were examined by an orthopedic surgeon who was blinded to the relevant study details and who was not the operating surgeon. Lachman and pivot-shift tests were performed to evaluate the anterior- posterior and rotational stability, respectively.[20] Statistical analyses were conducted using SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL).

RESULTS

Statistically significant differences were not found between the groups with regard to age, sex, body mass index (BMI), mean follow-up period, and time from injury to surgery ($p > 0.05$) . The mean follow-up periods for the AMP and TT groups were 30.5 months (range, 24 - 42 months) and 28.6 months (range, 26-38 months), respectively. The mechanism of injury involved sports activities in 32 patients (65%) in the TT group and 41 patients (73%) in the AMP group.

Table 1: Physical examinations

Parameters	Anteromedial n (%)	Transtibial n (%)	p Value
Pivot-shift test			0.056
0	42 (75.0)	29 (59.2)	
1	14 (25.0)	19 (38.8)	
2	0	1 (2)	
3	0	0	
Lachman test			0.059
0	42 (75.0)	29 (59.2)	
1	14 (25.0)	17 (34.7)	
2	0	3 (6.1)	
3	0	0	

Table 2. VAS scores, time to normal life, and time to jogging for the AMP and TT groups.

	Anteromedial	Transtibial	p Value
VAS score (mean ± SD)	9.4 ± 0.8	8.9 ± 0.8	0.002
Time to normal life (mean ± SD, weeks)	7.5 ± 0.9 (8)	9.1 ± 1.3 (9)	< 0.001
Time to jogging (mean ± SD, weeks)	12.4 ± 1.6 (12)	14.4 ± 2.2 (14)	< 0.001

Assessment of the preoperative and postoperative IKDC and Lysholm scores showed a significant improvement in both groups ($p < 0.05$). Lachman and pivot-shift tests showed no significant differences between the groups ($p > 0.05$) (Table 1). Statistical analysis revealed that a reduced time was needed to return to normal life and jogging in the AMP group than in the TT group ($p < 0.05$), and a statistically significant difference was observed between the two groups ($p < 0.001$). Moreover, higher patient satisfaction was achieved for the AMP group following surgery according to analysis of VAS scores ($p < 0.05$) . AMP technique was found to be superior to the TT technique in creating femoral tunnels within anatomical range, according to the radiological evaluation method of Illingworth ($p < 0.001$). The reconstructed ACL fell within an anatomical range in 51 patients (91%) in the AMP group and 5 patients (10.2%) in the TT group (Table 2).

DISCUSSION

The principal finding of this comparative study is that the AMP technique is superior to the TT technique in achieving anatomical femoral tunnel placement. The patients in the AMP group began jogging and returned to normal life significantly earlier at short-term follow-up compared with patients in the TT group. The most frequent technical flaw resulting in the failure of ACL reconstruction is the non-anatomical placement of the femoral tunnel. [5-11] Creation of a femoral tunnel with the TT technique requires a relatively short operative time and has been commonly performed with successful results for a long time.[22] However, when using the TT technique, the femoral tunnel is typically placed anteriorly and higher in the intercondylar notch compared with the original ACL femoral footprint.[3,12] Only the anteromedial bundle of the ACL may be covered by the TT drilling technique, which results in better restoration of sagittal plane stability than rotational stability, which may remain inadequate. The abnormal femoral tunnel placement observed in the TT technique is attributed to the dependency of the femoral tunnel position on the antecedently drilled tibial tunnel.[13] Controversially, many authors have concluded that attempting to create an anatomical femoral tunnel position through a medial entry into the tibia would require a starting point too close to the tibial joint line, resulting in a relatively short medial tibial tunnel and a tunnel length-graft length mismatch.[14] Knee stability with respect to the ACL can be measured by the amount of anterior tibial translation identified using the Lachman and pivot-shift physical tests or using an arthrometer.[15] Although patients with TT ACL reconstruction obtain good anteroposterior stability, numerous biomechanical studies have demonstrated that the AMP technique restores the translational and rotational stability better and provides more anatomic graft placement .[16] In this study, anterior translation of the tibia was evaluated using both Lachman and pivot-shift tests, and no statistically significant difference was found between the groups. This finding may be due to the subjective nature of the tests. However, we performed stability tests at the last follow-up, which

was at least two years after surgery. Several clinical and biomechanical studies have demonstrated improved knee stability with the AMP technique, particularly during the first months.[17] This study has certain limitations. First, this was a retrospective study with no randomization. Second, it was a short-term study and thus could not assess the long-term results. Third, we did not assess knee stability objectively. Future randomized clinical trials directly comparing both techniques over long-term follow-up will help to clarify which technique provides the best clinical outcome.

CONCLUSION

In conclusion, the AMP technique is significantly superior to the TT technique in creating anatomical femoral tunnel placement during single-bundle ACL reconstruction. There is no evidence to support the superiority of either technique in terms of clinical outcomes. However, the AMP technique provides faster recovery in terms of return to normal life and return to jogging in the short-term.

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