



Comparison of short term clinical outcomes between transtibial and transportal TransFix® femoral fixation in hamstring ACL reconstruction

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Objective: The aim of this study was to compare the clinical results of transtibial and transportal TransFix® methods in ACL reconstruction.

Methods: One hundred and sixty-eight patients were randomized into either transtibial TransFix® (n=88) or transportal TransFix® (n=80) femoral fixation groups for hamstring ACL reconstruction. Patients were clinically evaluated through history and physical examination as well as the International Knee Documentation Committee (IKDC) and Lysholm scores and a rolimeter over an 18-month time frame.

Results: According to the IKDC score, there were more normal knees in the transportal group than the transtibial group (37 vs. 25). Mean Lysholm score was 78.32 ± 10.7 in the transtibial group and 81.41 ± 8.2 in the transportal group ($p=0.037$). Mean rolimeter value was 2.2 ± 1.13 mm in the transtibial group and 1.73 ± 0.85 mm in the transportal group ($p=0.002$). At the final follow-up, 20 patients in the transtibial group and 10 in the transportal group had a Lachman test grade of 2 or 3. More intra-operative complications in terms of graft passage difficulties and posterior wall blow-up were seen in the transportal group.

Conclusion: Transportal TransFix® technique appears to produce better clinical results than the traditional transtibial technique.

Key words: Anterior cruciate ligament; reconstruction; TransFix®

Cross-pin fixation using a TransFix® (Arthrex Inc., Naples, FL, USA) pin has become increasingly common in anterior cruciate ligament (ACL) reconstruction and is a technique that has yielded acceptable results in the literature.^[1,2] In addition, *in vitro* studies have shown that the TransFix® suspension fixation system offers the best and most predictable results in terms of elongation, fixation strength, and stiffness.^[3]

Traditionally, surgeons were trained to use the transtibial technique for drilling the femoral tunnel.^[4,5]

However, several studies have suggested that the transtibial technique might not be able to center the graft near the anatomic center of the ACL, owing to constraints imposed by the tibial tunnel.^[6,7] Anatomical ACL graft positioning is considered a key factor for proper postoperative knee function and restoration of the physiological kinematics of the femorotibial joint in ACL reconstruction.^[8-10]

The transportal TransFix® technique has recently been introduced in the literature but there are still some

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concerns regarding the feasibility and reproducibility of this technique. Furthermore, safety in terms of neurovascular injuries and achieving adequate length of the femoral tunnel are subjects to be investigated.^[11,12]

The purpose of this study was to compare the short-term results of transportal TransFix[®] with the more popular transtibial TransFix[®] ACL reconstruction method.

Patients and methods

Anterior cruciate ligament reconstruction using either the transtibial or transportal TransFix[®] technique was performed in 223 consecutive patients between January 2007 and February 2009. Ethical approval was granted by the Ethics Committee of Urmia University of Medical Sciences. All participants received oral and written information about the purpose and procedures of the study and provided with written informed consent. All surgeries were performed by the same surgeon with extensive experience in ACL reconstruction.

Inclusion criteria included young active patients who had an ACL tear with signs of knee instability and the completion of two years of follow-up. Patients with concomitant meniscal injury and osteochondral lesions were also included. Patients with infection, previous surgery, bilateral injuries or other ligament injuries needing reconstruction, and patients over the age of 40 were excluded.

Of the 223 patients who met the inclusion criteria, the clinical results of the 168 patients that completed the minimum 18 months of postoperative follow-up were statistically analyzed. Eighty-eight patients underwent transtibial TransFix[®] and 80 transportal TransFix[®] reconstruction. Patients were assessed using the International Knee Documentation Committee (IKDC) rating, the Lysholm scoring, and Tegner activity scales for two years postoperatively. Knee stability was checked by physical examination. Instrumental measurement of anterior laxity was performed using a rolimeter and compared with the normal side. Standard AP notch and lateral radiography of the knee was obtained before and after the operation for all patients. The position of the tunnels was assessed using the Sommer's radiological parameters method^[13] and ruler

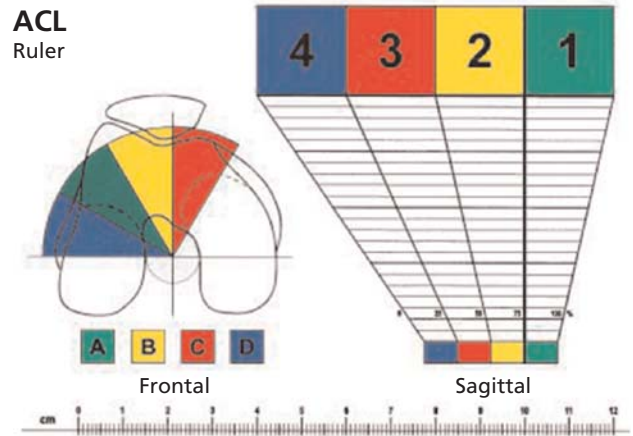


Fig. 1. The ACL ruler for determining the femoral ACL graft positioning on plain radiographs. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

in the AP view (Fig. 1). All measurements were performed by two orthopedic residents not related to the study. In cases where there was disagreement between observers, another senior resident performed the measurements and interobserver reliability was recorded. Any changes in range of motion of the knee were measured by a protractor and recorded. Patients answered questions based on the scaling systems and a nurse was available to explain the concepts behind the questions.

The transportal TransFix[®] technique was performed according to Hantes et al. (Fig. 2).^[14] The transtibial technique was performed according to the original manufacture instructions. The same postoperative rehabilitation was used in both treatment groups.

SPSS software was used for statistical analysis. Means and standard deviations of different scaling systems were compared with nonparametric methods using the Mann-Whitney U test. A p value of less than 0.05 was considered significant.

Results

Table 1 shows the demographic data of both groups. Of 36 cases with concomitant meniscal tears, 16 were bucket-handle tears located in the medial meniscus. Of the remaining 20 tears, 8 were in the posterior horn of

Table 1. Preoperative demographic data of the patients.

	Age	Sex	Meniscus injury	MR osteochondral lesion	Arthroscopic osteochondral lesion	Mean Tegner activity level
Transtibial	26.8	84 M, 4 F	22	40	6	5.1±0.99
Transportal	26.6	79 M, 1 F	14	32	6	5.08±1.12



Fig. 2. U-guide is inserted through the anteromedial portal. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

the medial meniscus and 12 in the lateral meniscus. There were no significant statistical differences between the two groups ($p=0.16$).

There were 3 saphenous nerve injuries with resultant dysesthesia over the anteromedial aspect of the leg in the transtibial group and 2 in the transportal group. No other major neurovascular complication occurred. One case of septic arthritis occurred in the transtibial group. This infection resulted in the removal of the implant and the graft. Significant laxity and pain were present in the final follow-up in this case. Twelve patients complained of mild pain and tenderness over the insertion site of the TransFix® pin in the transportal group. The pin was palpable after 2 months and reoperation for reinsertion of pin was performed in one. Intraoperative complications are listed in Table 2. Complications were managed during the surgery with repeated attempts and no further complications occurred. Mean operation time was 20 minutes longer for the transportal technique (100 min; range: 70 to 150 min.) than the transtibial technique (80 min.; range: 60 to 120 min.).

Twenty patients in the transtibial group and 10 patients in the transportal group had a Lachman test grade of 2 or 3 positive at the first postoperative year. For patients with a positive Lachman test, an MRI was carried out. A complete rupture of the graft was seen in only one patient in the transportal group who underwent revision of the ACL reconstruction. MRI showed a lax graft in the remaining patients with a positive Lachman test. Eighteen patients in the transtibial group and 10 patients in the transportal group had a positive pivot shift test. Instrumented laxity measurement testing using a rolimeter showed a mean differ-

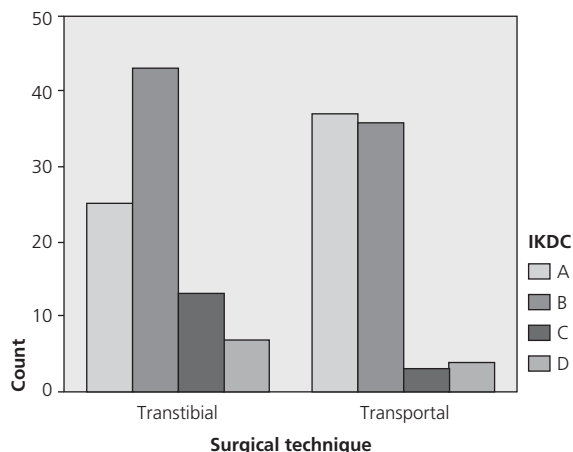


Fig. 3. Distribution of IKDC scores based on the surgical technique. A: normal knee, B: near normal knee, C: abnormal knee, D: severely abnormal knee.

ence between the normal side and the affected side of 2.2 ± 1.13 mm in the transtibial group and 1.73 ± 0.85 mm in the transportal group ($p=0.002$).

Qualitative evaluation of the results based on the IKDC rating showed a significant difference for subjective criteria between the two groups. Thirty-seven percent of knees in the transportal group were normal, compared to 21% in the transtibial group. There were fewer abnormal (Class C) and severely abnormal (Class D) knees in the transportal group (Fig. 3). With further scrutinizing of the IKDC scoring system, it appeared that there were more soft-end points in the transtibial group (Table 3). The pain profile deduced from the IKDC score showed no significant difference between the two groups.

Table 2. Intraoperative complications of ACL reconstruction in transtibial and transportal techniques.

	Twisted wire leading to graft passing failure	Posterior cortex blow-up
Transtibial group	5	0
Transportal group	8	5

Table 3. Distribution of soft and rigid-end points in two groups based on IKDC scores.

	Soft-end points	Rigid-end points
Transtibial group	47	41
Transportal group	22	58

Table 4. Tunnel position at femoral side in AP notch view according to Sommer’s radiological parameters.

		Intervention		Total
		Transtibial	Transportal	
Tunnel position	Zone A	39	28	67
	Zone B	8	20	28
	Zone D		10	10
Total	47	58	105	

Modified Lysholm daily activity score indicated better results in the transportal technique (mean: 81.41) than then the transtibial technique (mean: 78.32) ($p=0.037$). The Tegner activity level showed a greater increase in activity levels in the transportal group, although this was not statistically significant (Fig. 4).

The position of the femoral tunnel was determined in 47 of the transtibial patients and 58 of the transportal patients (Table 4). In the remaining cases, the lucency of the femoral tunnel was not enough to be predicted in the AP notch view of the femur. Using the Sommer’s ruler technique (Fig. 1), 90% of femoral tunnels in the transtibial group were found to be in Zone B (between 11 and 12 o'clock). Eighty percent of tunnels in the transportal group were in Zone A (10 to 11 o'clock of the intercondylar notch) and the remaining tunnels were in Zone B and Zone D (9 o'clock) (Fig. 5). None of the cases in the transtibial group had a tunnel position less than 10 o'clock on the femoral notch. Interobserver reliability was 85%.

Discussion

Markolf et al. reported no significant difference between femoral tunnels lying in the 11 o'clock position versus those that were more oblique in a cadaveric study.^[15] Other in vitro studies indicated an increase in rotational instability when the graft is positioned more vertically.^[16-18] Piasecki et al.^[19] attempted to position the graft in a more oblique location through the tibial tunnel. Although they succeeded in the laboratory, a meticulous and exact starting point on the tibia was necessary to achieve this. We believe that this may not be achievable in clinical scenarios, especially in obese patients. In a clinical study, Alentorn-Geli et al. concluded that the use of the anteromedial portal (AMP) resulted in greater knee stability and range of motion values and an earlier return to running compared to the transtibial technique.^[20] These results are in line with our study.

A review of the literature indicates that a rate between 75 and 95% of good and excellent results for single-strand ACL reconstruction using current tech-

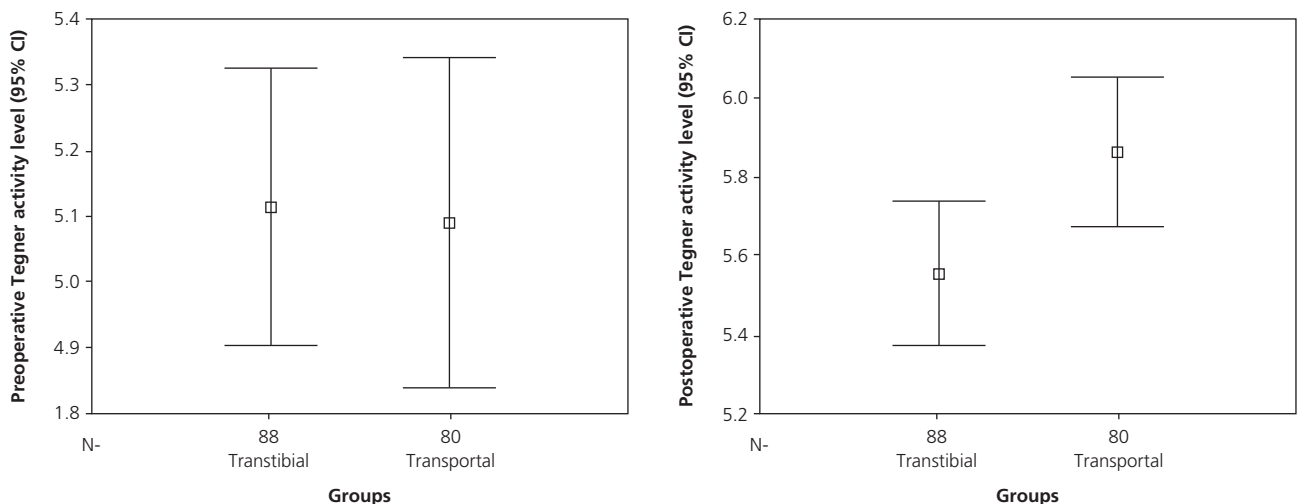


Fig. 4. Tegner activity levels before and after the operation.

niques.^[21-24] Normal and near-normal IKDC results in our study for the transportal and transtibial groups was 91% and 77%, respectively. Our IKDC results in the transportal group are amongst the best outcomes of ACL reconstruction in the literature to date.

The rate of reoperation 24 months post-surgery in the transportal group was 2.5% (n=2). The reason for surgery in one of the cases was lateral slippage of the TransFix® pin. This was easily resolved by hammering the pin into a deeper position. Lateral slippage of the pin is a well-characterized complication of the TransFix® system.^[11,12] Although troublesome for the patient, it is not in itself a devastating complication. However, it may cause friction of the iliotibial band and localized edema, which may result in pin removal.^[5,25] The other reoperation was an ACL revision performed due to graft failure which had arisen without specific trauma. In the transtibial group, there was only one reoperation necessary due to septic arthritis.

One of the most important challenges when using the transportal technique is the risk of damage to lateral and posterolateral structures. Pujol et al. demonstrated in cadavers that the origin of the lateral collateral ligament is at real risk of being damaged during lateral pin insertion and that this risk is increased when using the transportal technique.^[11] We did not experience this complication in our clinical study.

The blow-out of the posterior femoral cortex by improper pin placement and subsequent absence of sufficient medial bony buttress for the implant has also been reported in the TransFix® technique.^[26,27] We had five such complications, all occurring in the transportal group. Complications were managed with retraction of the TransFix® U-guide backward 5 mm and changing the TransFix® guide position to a more vertically rotated one. These patients passed a normal postoperative period without graft failure.

Tunnel position is one of the most important factors determining the outcome of ACL reconstruction. It has been shown that failed ACL reconstructive surgery with persistent knee laxity or constrained knee motion correlated with improper graft placement; and placement of the femoral bone tunnel more towards the medial wall of the lateral condyle in a 10 o'clock position more effectively resists rotator loads when compared with tunnel placement close to the roof of the intercondylar notch.^[28] We attribute our better clinical results in the transportal group to the more distal positions of the femoral tunnels in this group.

This study had some limitations. First, while there are some concerns in the literature that graft re-rup-



Fig. 5. Black line depicting Position B (10 o'clock) in the transportal technique.

ture may occur in the long-term when patients return to their full sporting activities, our study does not address the long-term clinical results. Second, we suffered a loss of radiological data concerning the position of the femoral tunnels. An additional study using CT scans may reveal the exact position of the tunnels in each of the two groups. Finally, we assumed that we would be unable to achieve uniform femoral tunnel position in both the transtibial and transportal techniques, which resulted in patients having different tunnel positions according to the Sommer criteria.

In conclusion, the use of the transportal method of TransFix® fixation demonstrated better short-term clinical results than the transtibial technique in ACL reconstruction. Despite an increased complication rate in the transportal technique, patients' overall satisfaction rate was better in terms of subjective assessment of normal knees.

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Conflicts of Interest: No conflicts declared.

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