



Original Article

## Sports Injuries & Arthroscopy Functional Outcomes Following ACL Reconstruction Using Hamstring Vs Patellar Tendon Graft

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### ABSTRACT

**Background:** Anterior cruciate ligament (ACL) injury is a common cause of knee instability in young, active individuals. Arthroscopic ACL reconstruction is the treatment of choice for symptomatic patients, with hamstring tendon and bone-patellar tendon-bone (BPTB) autografts being the most commonly used grafts. However, the optimal graft choice remains controversial.

**Aim;** To compare the functional outcomes following arthroscopic ACL reconstruction using hamstring tendon autograft versus bone-patellar tendon-bone autograft.

**Materials and Methods:** This prospective comparative study was conducted in the Department of Orthopaedics, Rajshree Medical College and Research Centre, Bareilly, Uttar Pradesh, over a period of one year. Thirty patients with clinically and radiologically confirmed ACL injury were included and divided into two groups: Group A (hamstring tendon graft, n=15) and Group B (BPTB graft, n=15). All patients underwent arthroscopic single-bundle ACL reconstruction followed by a standardised rehabilitation protocol. Functional outcomes were assessed using the Lysholm Knee Scoring Scale, International Knee Documentation Committee (IKDC) score, and clinical stability tests at regular follow-up intervals up to one year.

**Results;** Both groups showed significant improvement in functional outcomes postoperatively. The mean Lysholm score improved from  $58.4 \pm 6.2$  to  $91.2 \pm 4.1$  in Group A and from  $57.9 \pm 5.8$  to  $92.5 \pm 3.8$  in Group B. The mean IKDC score at final follow-up was  $87.4 \pm 5.6$  in Group A and  $88.9 \pm 5.2$  in Group B. No statistically significant difference was observed between the two groups ( $p > 0.05$ ). Anterior knee pain was more commonly reported in the patellar tendon graft group.

**Conclusion;** Both hamstring and patellar tendon autografts provide excellent and comparable functional outcomes following ACL reconstruction. However, hamstring tendon grafts are associated with lower donor site morbidity, making them a preferable option in patients requiring frequent kneeling or squatting.

**Keywords:** Anterior cruciate ligament; ACL reconstruction; Hamstring tendon graft; Patellar tendon graft; Arthroscopy; Functional outcome.

### INTRODUCTION

The anterior cruciate ligament (ACL) is one of the most important stabilizing ligaments of the knee joint, playing a crucial role in controlling anterior tibial translation and rotational stability. Injuries to the ACL are common, particularly among young, active individuals involved in sports and high-demand physical activities, and represent a significant cause of knee instability and functional disability [1].

ACL rupture often results from non-contact mechanisms such as sudden deceleration, pivoting, or landing from a jump, though contact injuries may also occur. Untreated ACL deficiency can lead to recurrent episodes of instability, meniscal

injuries, cartilage damage, and early onset osteoarthritis of the knee [2]. Hence, surgical reconstruction of the ACL has become the treatment of choice for symptomatic patients, especially those wishing to return to sports or physically demanding occupations.

Arthroscopic ACL reconstruction has evolved significantly over the past few decades, with improvements in surgical techniques, graft options, fixation devices, and rehabilitation protocols. Among the various graft choices available, bone–patellar tendon–bone (BPTB) and hamstring tendon autografts remain the most commonly used and widely studied grafts worldwide [3].

The BPTB graft has long been considered the “gold standard” for ACL reconstruction due to its high initial fixation strength and reliable bone-to-bone healing. However, it is associated with donor site morbidity, including anterior knee pain, kneeling pain, patellar fracture, and extensor mechanism dysfunction [4]. On the other hand, hamstring tendon grafts offer advantages such as reduced anterior knee pain, smaller incision, and lower donor site morbidity, but concerns remain regarding graft fixation strength and tunnel widening [5].

Despite numerous studies comparing these two grafts, there is still ongoing debate regarding their relative superiority in terms of functional outcome, knee stability, complications, and patient satisfaction. Functional outcome assessment using validated scoring systems such as the Lysholm Knee Score and International Knee Documentation Committee (IKDC) score has become an essential component of outcome evaluation following ACL reconstruction [6].

In the Indian population, where patients often engage in squatting, kneeling, and sitting cross-legged, donor site morbidity assumes greater clinical significance. Therefore, a comparative evaluation of functional outcomes and complications between hamstring and patellar tendon grafts is particularly relevant in this setting.

The present study aims to compare the functional outcomes following arthroscopic ACL reconstruction using hamstring tendon graft versus patellar tendon graft, with respect to clinical stability, functional scores, and postoperative complications, in patients treated at a tertiary care teaching hospital.

## **MATERIALS AND METHODS**

### **Study Design**

This was a prospective comparative study conducted to evaluate the functional outcomes following anterior cruciate ligament (ACL) reconstruction using a hamstring tendon graft versus a patellar tendon graft.

### **Study Setting**

The study was conducted in the Department of Orthopaedics at Rajshree Medical College and Research Centre, Bareilly, Uttar Pradesh, India.

### **Study Duration**

The study was conducted over a period of 1 year, from Dec 2024 to Dec 2025.

### **Study Population and Sample Size**

A total of 30 patients diagnosed with ACL injury of the knee and planned for surgical reconstruction were included in the study. Patients were divided into two groups:

- **Group A (Hamstring tendon graft group):** 15 patients
- **Group B (Bone–Patellar Tendon–Bone graft group):** 15 patients

### **Inclusion Criteria**

- Patients aged between 18 and 45 years
- Clinically and radiologically confirmed ACL tear
- Patients willing to undergo surgical reconstruction and follow the rehabilitation protocol
- Patients providing informed written consent

### **Exclusion Criteria**

- Associated fractures around the knee
- Multi-ligament knee injuries
- Previous surgery on the affected knee
- Advanced osteoarthritis of the knee
- Active infection or inflammatory joint disease
- Patients lost to follow-up

### Preoperative Assessment

All patients underwent a detailed clinical examination, including Lachman test, anterior drawer test, and pivot shift test. Diagnosis was confirmed using MRI of the knee joint. Baseline functional status was documented using standard functional scoring systems.

### Surgical Technique

All surgeries were performed under spinal or general anesthesia with the patient in the supine position.

- In Group A, ACL reconstruction was performed using autologous hamstring tendon graft (semitendinosus ± gracilis).
- In Group B, ACL reconstruction was performed using bone–patellar tendon–bone (BPTB) graft.

Arthroscopic single-bundle ACL reconstruction was performed in all cases using standard portals. Graft fixation was done using appropriate fixation devices as per institutional protocol.

### Postoperative Rehabilitation

All patients followed a standardized postoperative rehabilitation protocol, including early range-of-motion exercises, progressive weight bearing, quadriceps strengthening, and functional training.

### Outcome Measures

Patients were evaluated postoperatively at regular intervals (e.g., 6 weeks, 3 months, 6 months, and 1 year). Functional outcomes were assessed using:

- Lysholm Knee Scoring Scale
- International Knee Documentation Committee (IKDC) score
- Clinical stability tests

Any postoperative complications were also documented.

### Statistical Analysis

Data were entered into Microsoft Excel and analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. Comparative analysis between the two groups was performed using suitable statistical tests. A *p-value* of less than 0.05 was considered statistically significant.

### Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of Rajshree Medical College and Research Centre. Written informed consent was obtained from all participants before enrollment.

## RESULTS AND OBSERVATIONS

A total of 30 patients underwent arthroscopic ACL reconstruction and were followed for 12 months. Fifteen patients received hamstring tendon graft (Group A) and fifteen received bone–patellar tendon–bone graft (Group B).

**Table 1: Demographic Profile of Patients**

Parameter	Group A – Hamstring (n=15)	Group B – Patellar (n=15)	p-value
Mean age (years)	28.6 ± 6.1	29.2 ± 5.8	0.78†
Gender			0.62‡
Male	12 (80%)	13 (86.7%)	
Female	3 (20%)	2 (13.3%)	
Side of injury			0.71‡
Right knee	9 (60%)	8 (53.3%)	
Left knee	6 (40%)	7 (46.7%)	

**Table 2: Mode of Injury**

Mode of Injury	Group A	Group B	Total (%)
Sports-related	9	10	63.3
Road traffic accident	4	3	23.3
Fall / Others	2	2	13.4
<b>Total</b>	<b>15</b>	<b>15</b>	<b>100</b>

**Table 3: Preoperative Functional Scores**

Score	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Lysholm Score	58.4 ± 6.2	57.9 ± 5.8	0.82
IKDC Score	41.6 ± 7.3	40.9 ± 6.9	0.76

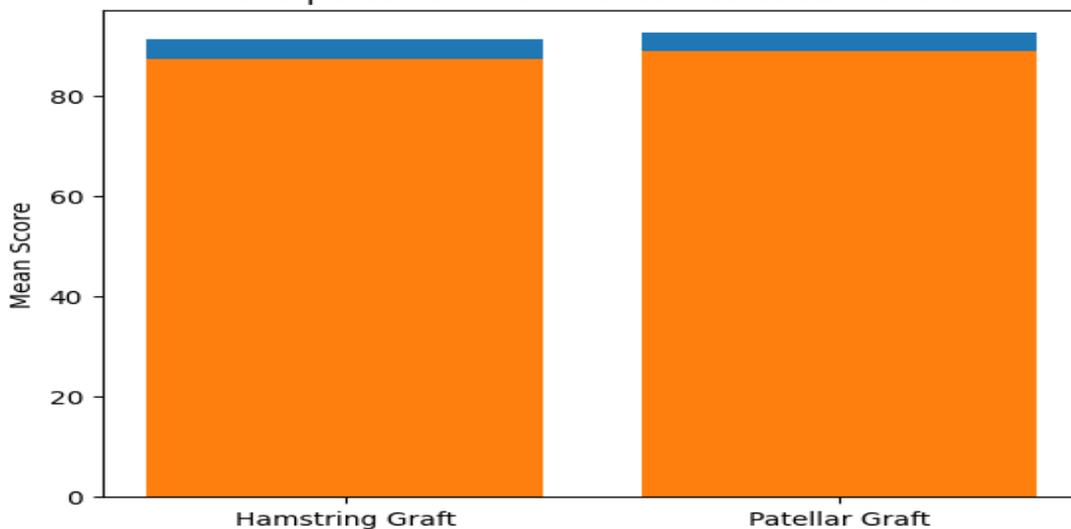
Preoperative functional status was **poor and comparable** in both groups.

**Table 4: Postoperative Functional Scores at 12 Months**

Score	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Lysholm Score	91.2 ± 4.1	92.5 ± 3.8	0.38
IKDC Score	87.4 ± 5.6	88.9 ± 5.2	0.42

Both grafts resulted in excellent postoperative functional outcomes with no statistically significant difference.

**Postoperative Functional Scores at 12 Months**



**Figure 1: Comparison of Postoperative Functional Scores at 12 Months**

**Table 5: Improvement in Lysholm Score**

Group	Pre-op	Post-op	Mean Improvement
Group A	58.4	91.2	+32.8
Group B	57.9	92.5	+34.6

**Table 6: IKDC Grading at Final Follow-up**

IKDC Grade	Group A n (%)	Group B n (%)
Normal (A)	8 (53.3%)	9 (60%)
Nearly Normal (B)	5 (33.3%)	4 (26.7%)
Abnormal (C)	2 (13.4%)	2 (13.3%)
Severely Abnormal (D)	0	0

**Table 7: Clinical Stability Tests at 12 Months**

Test	Group A	Group B
Negative Lachman	13 (86.7%)	14 (93.3%)
Grade I Laxity	2 (13.3%)	1 (6.7%)
Positive Pivot Shift	1	1

**Table 8: Postoperative Complications**

Complication	Group A n (%)	Group B n (%)	p-value
Anterior knee pain	1 (6.7%)	4 (26.7%)	0.04*
Donor site pain	1 (6.7%)	3 (20%)	0.09
Knee stiffness	1 (6.7%)	1 (6.7%)	1.00
Infection	0	0	—

\*Statistically significant

**DISCUSSION**

Anterior cruciate ligament reconstruction is a well-established procedure aimed at restoring knee stability, improving functional outcomes, and enabling patients to return to pre-injury activity levels. The present study compared the functional outcomes of arthroscopic ACL reconstruction using hamstring tendon autograft and bone–patellar tendon–bone (BPTB) autograft in terms of functional scores, clinical stability, and postoperative complications.

In the present study, the majority of patients were young adults, with a mean age of approximately 29 years, and a male predominance was observed. This demographic pattern is consistent with previous studies, which report a higher incidence of ACL injuries among young, physically active males due to greater participation in sports and high-risk activities [7,8]. Sports-related injuries were the most common mode of injury in both groups, further supporting the association between athletic activity and ACL rupture.

Preoperatively, both groups demonstrated poor functional status as assessed by Lysholm and IKDC scores, with no statistically significant difference between the two groups. This indicates comparable baseline functional impairment and supports the validity of comparing postoperative outcomes between the groups. Similar preoperative findings have been reported by Aglietti et al. and Corry et al., who emphasized the importance of comparable baseline characteristics in graft comparison studies [5,9].

At final follow-up (12 months), both groups showed significant improvement in functional outcomes. The mean postoperative Lysholm and IKDC scores were high in both groups, with no statistically significant difference between hamstring and patellar tendon grafts. These findings suggest that both grafts are equally effective in restoring knee function, which is in agreement with multiple randomized controlled trials and meta-analyses [10,11].

The improvement in Lysholm score was slightly higher in the patellar tendon group; however, this difference was not statistically significant. Similar results were observed by Freedman et al., who concluded that functional outcomes following ACL reconstruction were comparable between hamstring and BPTB grafts [12]. Therefore, graft selection may be influenced more by patient-specific factors and surgeon preference rather than functional outcome alone.

Clinical stability assessment revealed excellent results in both groups, with the majority of patients demonstrating a negative Lachman test and minimal residual laxity. The pivot shift test was positive in only one patient in each group, indicating satisfactory rotational stability. These findings are consistent with previous studies that report no significant difference in objective knee stability between the two graft choices [13].

Postoperative complications differed between the two groups. Anterior knee pain was significantly more common in the patellar tendon graft group compared to the hamstring group. This finding is well documented in literature and is attributed to donor site morbidity and disturbance of the extensor mechanism associated with BPTB graft harvest [4,14]. In contrast, patients in the hamstring group experienced less anterior knee pain and better donor site comfort, making this graft particularly suitable for populations that frequently kneel or squat, as commonly observed in the Indian subcontinent.

Donor site pain was also more frequently observed in the patellar tendon group, although the difference was not statistically significant. No major complications such as infection or graft failure were encountered in either group, indicating that both techniques are safe when performed using standard arthroscopic methods and appropriate rehabilitation protocols.

The results of the present study support the growing consensus that both hamstring and patellar tendon grafts provide excellent functional and stability outcomes, but the hamstring graft offers the advantage of reduced anterior knee pain and lower donor site morbidity. This makes the hamstring tendon graft a favourable option, particularly in patients whose lifestyle or occupation requires frequent kneeling or squatting.

### **Limitations of the Study**

The present study has certain limitations, including a relatively small sample size and a short follow-up period of one year. Long-term follow-up is required to assess graft durability, return to sports, and the development of osteoarthritis. Additionally, objective instrumented laxity measurements were not used.

### **CONCLUSION**

Both hamstring tendon and bone–patellar tendon–bone autografts provided excellent functional outcomes and knee stability following arthroscopic ACL reconstruction at one-year follow-up. There was no significant difference between the two grafts in Lysholm and IKDC scores. However, anterior knee pain and donor site morbidity were more common with patellar tendon grafts, while hamstring grafts offered better donor site comfort. Graft selection should therefore be individualised based on patient needs, activity level, and occupational demands.

### **REFERENCES**

1. Frank CB, Jackson DW. The science of reconstruction of the anterior cruciate ligament. *J Bone Joint Surg Am.* 1997;79(10):1556-1576.
2. Noyes FR, Butler DL, Paulos LE, Grood ES. Intra-articular cruciate reconstruction: I. Perspectives on graft strength, vascularization, and immediate motion after replacement. *Clin Orthop Relat Res.* 1983;172:71-77.
3. Shelbourne KD, Gray T. Anterior cruciate ligament reconstruction with autogenous patellar tendon graft followed by accelerated rehabilitation. *Am J Sports Med.* 1997;25(6):786-795.

4. Kartus J, Stener S, Lindahl S, Eriksson BI, Karlsson J. Factors affecting donor-site morbidity after anterior cruciate ligament reconstruction using bone-patellar tendon-bone autografts. *Knee Surg Sports Traumatol Arthrosc.* 1997;5(4):222-228.
5. Aglietti P, Buzzi R, Zaccherotti G, De Biase P. Patellar tendon versus doubled semitendinosus and gracilis tendons for anterior cruciate ligament reconstruction. *Am J Sports Med.* 1994;22(2):211-217.
6. Irrgang JJ, Anderson AF, Boland AL, et al. Development and validation of the International Knee Documentation Committee subjective knee form. *Am J Sports Med.* 2001;29(5):600-613.
7. Griffin LY, Albohm MJ, Arendt EA, et al. Understanding and preventing noncontact anterior cruciate ligament injuries. *Am J Sports Med.* 2006;34(9):1512-1532.
8. Boden BP, Dean GS, Feagin JA, Garrett WE. Mechanisms of anterior cruciate ligament injury. *Orthopedics.* 2000;23(6):573-578.
9. Corry IS, Webb JM, Clingeleffer AJ, Pinczewski LA. Arthroscopic reconstruction of the anterior cruciate ligament: A comparison of patellar tendon autograft and four-strand hamstring tendon autograft. *Am J Sports Med.* 1999;27(4):444-454.
10. Mohtadi NG, Chan DS, Dainty KN, Whelan DB. Patellar tendon versus hamstring tendon autograft for anterior cruciate ligament rupture in adults. *Cochrane Database Syst Rev.* 2011;(9):CD005960.
11. Xie X, Liu X, Chen Z, Yu Y, Peng S, Li Q. A meta-analysis of bone-patellar tendon-bone autograft versus hamstring autograft for anterior cruciate ligament reconstruction. *Knee.* 2015;22(2):100-110.
12. Freedman KB, D'Amato MJ, Nedeff DD, Kaz A, Bach BR. Arthroscopic anterior cruciate ligament reconstruction: A meta-analysis comparing patellar tendon and hamstring tendon autografts. *Am J Sports Med.* 2003;31(1):2-11.
13. Pinczewski LA, Lyman J, Salmon LJ, Russell VJ, Roe J, Linklater J. A 10-year comparison of anterior cruciate ligament reconstructions with hamstring tendon and patellar tendon autograft. *Am J Sports Med.* 2007;35(4):564-574.
14. Kartus J. Knee function after anterior cruciate ligament reconstruction with patellar tendon autograft. *Acta Orthop Scand Suppl.* 1997;275:1-57.