

**ORIGINAL RESEARCH**

# Functional outcome of Arthroscopic ACL Reconstruction with Tripled Hamstring Tendon Autograft

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Received: 12-02-2023

Accepted: Between 01-03-2023

**ABSTRACT**

**Background:** Arthroscopic ACL reconstruction is done with different type of autografts, and with different surgical and fixation techniques. This study aimed to evaluate the functional results and patient satisfaction after arthroscopic ACL reconstruction with tripled hamstring tendon autograft.

**Methods:** The diagnosis was done on the basis of clinical examination and MRI findings. Preoperative Lysholm scores were evaluated, and patient satisfaction was assessed postoperatively. All patients underwent arthroscopic single-bundle ACL reconstruction using tripled hamstring tendon autografts. Meniscectomy was done for degenerative changes and irreparable meniscal injuries.

**Results:** The mean preoperative Lysholm score was  $40.5 \pm 19.8$ . More than 90 % of the patients achieved well to excellent Lysholm scores. None of the patient was dissatisfied postoperatively.

**Conclusion:** Arthroscopic reconstruction of chronic ACL tear with single-bundle tripled hamstring tendon autografts, along with comprehensive rehabilitation, leads to positive knee function outcomes and high levels of patient satisfaction, with minimal occurrence of failure and complications.

**Key words:** Anterior Cruciate Ligament, ACL Reconstruction, Tripled Hamstring Tendons, Meniscectomy.

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**Introduction**

The anterior cruciate ligament (ACL) can be described as a compact and fibrous tendon structure, spanning from the posteromedial region of the lateral femoral condyle to the anterior intercondylar area of the tibia (1). Its primary function involves the prevention of anterior translation and internal rotation of the tibia, thereby serving as a crucial stabilizer to restrain excessive motion within the knee joint. Notably, the occurrence of ACL rupture has been reported at a higher rate in the Germany and the United States (2, 3). After ACL injury, a very high prevalence of posttraumatic knee osteoarthritis (OA), life-long knee joint pain, and functional limitations is a reality for young and athletically active patients,

which can severely impair quality of life (4). The main goals in managing chronic ACL tear revolve around attaining a knee joint that is both pain-free and capable of optimal mobility with stability [3]. Nonoperative interventions have limited success, especially in instances of complete tear where patients are not ready to modify their active lifestyle [5]. Surgical techniques for ACL reconstruction can differ, and the decision between an open or arthroscopic approach depend on availability of arthroscopy setup and expertise of the surgeon.

In India, delayed in diagnosis and management of ACL injuries are frequently observed, with patients often expressing a preference for a cosmetic procedure that offers favorable outcomes.

Arthroscopic ACL reconstruction is increasingly becoming popular in India due to its excellent results, which include decreased postoperative pain, reduced morbidity, less surgical scars, and better rehabilitation compared to the open technique [6, 7]. While research studies conducted have demonstrated good to excellent outcomes with same procedures [8, 9-12], there is less data available in the Indian context. To assess the functional outcomes and patient satisfaction regarding the treatment of chronic ACL tear, our study aimed to evaluate the use of single-bundle tripled hamstring tendon autografts in patients from central India. Considering the chronic nature of these ACL injuries, it is crucial to investigate the functional outcomes to better understand the efficacy of arthroscopic reconstruction in this specific patient population.

### Materials & Methods

This prospective study was conducted at a tertiary care hospital after taking clearance from ethical committee [13]. Eligible patients were recruited upon presentation with complaint of pain and instability. Exclusion criteria were patients aged less than 18 or more than 45 years, those with partial ACL tear, chronic ACL avulsion fracture, associated PCL tear, bilateral ACL tear, ACL tear with advanced knee osteoarthritis, revision ACL reconstruction, ACL reconstruction with meniscus repair and ACL tear with associated tibia or femur fractures. The recruitment of patient was done on the basis of clinical examinations utilizing Lachman's test, anterior drawer test, and Lelli's test to assess knee instability. The range of knee motion was recorded and compared with the normal contralateral knee. Preoperative evaluations included magnetic resonance imaging findings (MRI), and all preoperative Lysholm score was determined in all the patients [14].

All surgeries were performed with the patient in a supine position, under spinal/Epidural anesthesia by the same surgeon. Prior to the diagnostic arthroscopy, an clinical examination under anesthesia was done, which included Lachman's test, anterior and posterior drawer tests, Lelli's test, and Pivot shift. The diagnostic arthroscopy was performed through standard anterolateral and anteromedial portals, confirmed the presence of ACL tear and assessed the meniscus and chondral injuries. The grafts were harvested after 5 cm oblique incision on proximal anteromedial tibia without tourniquet (Fig. 1a-d). Subsequently, the graft was prepared and tripled under tension. Length and diameter of the graft was taken, with the smaller diameter ends tagged as the lead-end for the femoral tunnel. Debridement using a 4.5mm shaver blade and removal of loose body was carried out whenever required. Partial meniscectomy was performed for irreparable meniscus tear.

The femoral tunnel was created using the free hand anteromedial anatomic tunnel placement technique. The femoral tunnel drilled with 4mm drill bit, to facilitate the passage of shuttle sutures. Subsequently, the femoral tunnel was drilled to a depth ranging from 20 to 30mm, depending upon the size of femoral endobutton. The tibial tunnel was established to exit in the posteromedial region of the ACL footprint, specifically on the lateral surface of the medial tibial spine. The tibial jig was positioned externally on the upper part of the oblique posteromedial incision of the graft harvesting site. During the procedure, the tibial tunnel was drilled first with 4mm drill and then completely through big size reamer to match the size of the graft. Shuttle sutures were affixed to the sutures pulling on the graft to facilitate its transportation through the tunnels. All patients underwent arthroscopic ACL reconstruction utilizing a single-bundle tripled semitendinosus graft. Graft was fixed with endobutton on the femur side and with bioabsorbable interference screw on the tibial side. Following the surgery, patients were provided with long leg knee brace permitting only close chain exercises. Isometric exercises were initiated from the first postoperative day. A gradual increase in the range of motion exercises was implemented, with a 30-40° increment every two weeks. Partial weight-bearing was initially allowed for the first two weeks, followed by full weight-bearing as tolerated with long leg knee brace and crutches.

Postoperatively, regular follow-up was done at 3, 6, 12, 24, and 48 months to evaluate the progress of the patients. Crutches were discontinued at 6-8 weeks after the surgery. The long leg knee brace was discontinued at approximately 12 weeks after the surgery.

During the follow-ups, clinical evaluations were conducted, which included Lachman's test, anterior drawer test, and Lelli's tests to assess the knee stability. The functional outcome was assessed using the Lysholm score, which provided a detailed evaluation of various factors related to knee function. Additionally, patient satisfaction was evaluated using the Likert scale for subjective assessment of the patient's gratification after ACL reconstruction. Data collected during the study were recorded on Microsoft Excel sheet, and statistical analysis was performed using SPSS version 20.0 for Windows.

### Results

Out of the initial cohort of 51 patients who underwent ACL repair, only 43 patients successfully completed the 2-year follow-up period. Table 1 provides an overview of the demographic characteristics of the patients. The age group between 31 and 40 years constituted the highest proportion (39.53%) of the affected individuals. The male to female ratio was 2.07:1.

**Table 1: Demographic details of study participants**

Variable	Number	%
<b>Age group</b>		
18-30	16	37.21
31-40	17	39.53
41-50	10	23.26
<b>Gender</b>		
Male	29	67.44
Female	14	32.56
<b>Occupation</b>		
Sportsperson	3	6.98
Serviceman	9	20.93
Military/paramilitary personnel	12	27.91
Student	13	30.23
Teacher	5	11.63
Businessman	1	2.33

According to the data presented in Table 2, over half of the patients (54.3%) experienced their injury while playing football. The majority of patients sought medical attention more than 6 months after

the initial injury. Approximately 70% of the patients had concomitant meniscal injuries. Furthermore, the right knee was more frequently affected than the left knee

**Table 2: Clinical presentation of study participants**

Cause of injury	Number	%
Falling from height	3	6.98
Road traffic accident	7	16.28
Football injury	23	53.49
Foot slip	2	4.65
Military training related injury	8	18.60
<b>Other injury associated</b>		
Medial meniscus	22	51.16
Lateral meniscus	7	16.28
Medial + Lateral meniscus	2	4.65
None	12	27.91
<b>Time lapse before presentation</b>		
< 6 months	7	16.28
6 – 12 months	23	53.49
12 – 24 months	5	11.63
24 – 36 months	4	9.30
> 36 months	4	9.30
<b>Laterality</b>		
Right	28	65.12
Left	15	34.88

The mean preoperative Lysholm score was  $40.5 \pm 19.8$ . Following the surgery, there was a gradual improvement in Lysholm scores over time, as shown in Table 3. Even at 3 months

postoperatively, there was a significant statistical difference ( $p < 0.05$ ) between the preoperative and postoperative scores.

**Table 3: Pre and post-operative Lysholm scores**

	Mean score $\pm$ S.D	Grade
Pre-operative	$40.5 \pm 19.8$	Poor
3 months post-operative	$84.6 \pm 3.6$	Good
6 months post-operative	$91.7 \pm 4.6$	Excellent
1 year post-operative	$95.9 \pm 3.1$	Excellent
2 years post-operative	$99.1 \pm 1.1$	Excellent

One patient in the study experienced postoperative knee stiffness, which was successfully resolved with physiotherapy. Another patient had transient tourniquet palsy, which resolved on its own. Two patients developed superficial surgical site infections, which were treated appropriately (see

Table 4 for details). At the final follow-up, which occurred 2 years after the surgery, 38 out of the total 43 patients (88.37%) expressed satisfaction with the outcome of the surgery based on the Likert scale assessment (refer to Table 5).

**Table 4: Post-operative Complications in study participants**

Complication	Number	%
None	39	90.70
Superficial infection at Surgical site	2	4.65
Knee Stiffness	1	2.33
Tourniquet palsy	1	2.33

**Table 5: Two years' post-operative patient satisfaction**

	Number	%
Very much satisfied	26	60.47
Satisfied	12	27.91
Neutral	4	9.30
Dissatisfied	1	2.33
Very much dissatisfied	0	0.00

## Discussion

The success of ACL reconstruction depends primarily on crucial factors including precise graft placement, appropriate fixation techniques, and effective postoperative rehabilitation, rather than the specific choice of graft utilized [15, 16]. Taking into account the demonstrated low morbidity associated with harvesting and the preference of our main surgeon, the hamstring graft was the most commonly utilized graft for arthroscopic reconstruction in our hospital, and it was employed for all patients included in this study. The graft sizes used in our study ranged from 8mm to 10mm in thickness. In our study, a standardized technique was employed for all patients undergoing ACL reconstruction, as well as a uniform approach to postoperative rehabilitation. Notably, more than 90% of the patients achieved favourable outcomes ranging from good to excellent. In our study, a significant improvement in functional knee outcomes, as measured by Lysholm scores, was observed following the surgical intervention. These findings are consistent with the study conducted by Umar et al. [7], where a different graft type, specifically the bone-patellar tendon-bone (BPTB) graft, was utilized. Umar et al. reported a mean preoperative Lysholm score of  $58.19 \pm 20.0$ , which increased to  $88.23 \pm 12.17$  at 6 months postoperatively. Similarly, other studies, such as those conducted by Bhati et al. [17] and Chodavarapu et al. [18], have also reported positive results in terms of postoperative knee function based on Lysholm scores.

In our study, we utilized a tripled hamstring graft for ACL reconstruction. However, other studies conducted by Bhati et al. and Chodavarapu et al. utilized quadruple-weaved semitendinosus and gracilis grafts, yet achieved similar outcomes in terms of knee function [17, 18]. Furthermore, there

have been studies that compared horizontal hamstring grafts with patellar tendon grafts, and all of them demonstrated similar good to excellent outcomes [18-21]. These findings further support the notion that the choice of graft may not significantly impact the outcome of the reconstruction. Instead, the technique of the procedure and the effectiveness of the postoperative rehabilitation play crucial roles in determining the success of the surgery.

At the final follow-up assessment conducted two years after the surgery, no instances of graft failure were observed, aligning with findings reported in other studies [7, 17, 22]. Patient-reported outcomes were evaluated using the Likert scale in our study, revealing that 38 out of the total patients (88.37%) expressed satisfaction with the surgical outcome, with none reporting dissatisfaction. Furthermore, no instances of revision surgery have been recorded thus far. These findings indicate a high success rate and positive patient experiences following the ACL reconstruction procedure.

## Conclusion

The utilization of arthroscopic reconstruction with single-bundle tripled hamstring autografts in cases of chronic ACL tear, combined with effective rehabilitation, results in favorable knee stability and functions. Most of the patients achieved high level of satisfaction with minimal occurrence of complications after the surgery. High levels of patient satisfaction.

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