

## Study of Functional Outcome of Arthroscopic ACL Reconstruction by Various Grafts

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### Abstract

**Introduction:** Anterior knee instability associated with rupture of the ACL is a disabling clinical problem. The ACL has a poor capacity for intrinsic repair. Thus, ligament reconstruction as a means of stabilizing the tibio-femoral joint and restoring high level function of the knee joint becomes destined. Therefore, present study was aimed to study the functional outcome of arthroscopic ACL reconstruction by various grafts.

**Materials and methods:** The present Study was carried out in patients coming to a tertiary care hospital considering a total of 24 patients. Arthroscopically assisted Anterior Cruciate Ligament Reconstruction surgery was performed in patients concluding inclusion criteria. ACL repair was done by Bone patellar tendon bone (BTBP), hamstrings and Peroneus grafts were used as and when required.

**Results:** In present study patients average age was  $29.8 \pm 7.6$  years with 3 females and 21 males. Considering the mode of injury majority patients were having sports playing. Considering the mechanism of injury most of the patients reported the “valgus” posture to be the mode of injury to the knee joint. Majority of the patients were treated using hamstring and peroneus grafts (41.7%). During pre-operative evaluation, majority of the patients showed grade 3 results upon Lachman test. During post-operative evaluation, majority of the patients were observed to be at grade 0 on Lachman evaluation similar results were observed by Lysholm scoring.

**Conclusion:** We found that all three methods had shown equal potential however, majority of the patients were benefited by hamstring and peroneus grafts with optimistic Lachman and Lysholm scorings.

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## Introduction

Anterior Cruciate Ligament (ACL) injury is the most controversial ligamentous injury and has been studied extensively all over the world in the past 20yrs. The Anterior Cruciate Ligament is the weaker of the two cruciate ligaments and therefore may be it torn easier than the Posterior Cruciate Ligament. [1]

Anterior knee instability associated with rupture of the ACL is a disabling clinical problem. The ACL has a poor capacity for intrinsic repair. Thus, patients who have knee symptoms related to ACL deficiency, may consider ligament reconstruction as a means of stabilizing the tibio-femoral joint and restoring high level function of the knee joint. [2]

The need for surgical reconstruction of the ACL is justified by its anatomical characteristics. The branch of the genicular artery responsible for the vascularization of the ACL gives rise to terminal branches; this precludes potential repair of this ligament. Unfortunately, ligament reconstruction cannot recreate the anatomical, biological, biomechanical and neurophysiological properties of a native ACL. [3]

In 1954, the development of successful arthroscope brought new possibilities to the field of knee surgery. Since 1982, the Anterior Cruciate Ligament Reconstruction has often been performed arthroscopically. [4]

Arthroscopically assisted Anterior Cruciate Ligament Reconstruction has the advantage of being minimally invasive, accurate graft placement, less disturbance of normal tissue resulting in quicker recovery and rehabilitation, minimal hospital stay and very less infection rate.

Numerous authors have described successful reconstruction of the ACL with use of a donor autograft (patellar tendon, hamstring tendon or quadriceps tendon) and allograft (Achilles, patellar tendon, hamstring tendon or tibialis anterior)

tendons. Anterior Cruciate Ligament Reconstruction has been attempted using Silver wire [5] Fascia lata [6] and Iliotibial band. Till date more than 400 different techniques have been described for Anterior Cruciate Ligament Reconstruction from open to arthroscopic technique [7]. The bone- patellar tendon- bone is the most commonly used graft in ACL reconstruction. However, concerns regarding problems with the extensor mechanism of the knee, loss of motion, patella infra, patellar fracture and the development of chronic anterior knee pain have promoted surgeons to seek.

Therefore, present study was aimed to study the functional outcome of arthroscopic ACL reconstruction by various grafts with the follow-up up to 6 months to evaluate improvements.

### Material and methods:

The present Study was carried out in patients coming to a tertiary care hospital of Bhopal city with having history of acute knee pain due to any knee pathology. Present study was a prospective observational hospital-based study considering a total of 24 patients coming to dept. Of Orthopaedics.

Age group greater than 18 years and either gender were considered for this study. After obtaining informed consent, demographic information was noted. An elaborate history was taken from all the patients which was followed by a thorough clinical evaluation, in which duration of symptoms, affected side, dominant knee, and range of movement was noted.

A thorough medical history, nature of complaints, symptoms, and signs were noted. In case of an injury being the cause of knee pain, cause of injury was also noted. Patients were subjected to X-ray, MRI and axial as initial investigation. On viewing, the X-ray and MRI next modality was decided.

**Inclusion criteria:**

- All skeletally mature patients with anterior cruciate ligament tear confirmed by Lachman test with concomitant meniscal injury that required repair were included in the study, provided that they were permitted to undergo rehabilitation after Anterior Cruciate Ligament reconstruction involving full weight – bearing gait and unrestricted non-weight bearing range of motion.

**Exclusion criteria:**

- Patients with Anterior Cruciate (ACL) Ligament avulsion injury.
- Anterior cruciate ligament tear with Concomitant posterior cruciate ligament, collateral ligament injuries requiring surgery or posterolateral corner injury.
- Anterior cruciate ligament tear associated with the bony injury around the knee.
- Patients undergoing revision anterior cruciate ligament reconstruction.

In the selected cases grafting of ACL repair was done by Bone patellar tendon bone (BTBP), hamstrings and Peroneus grafts were used as and when required as per appropriateness of the cases. Pre and post-

operative effectiveness of the procedure was graded by standard tests and scoring systems.

**Statistical analysis**

The data analysis was performed using IBM SPSS ver. 20 software. Age and other quantitative data were expressed as mean and standard deviation whereas categorical data were expressed as numbers and percentages. Mean was compared using independent sample t test one way ANOVA. Categorical data was compared using the Chi-Square test. P-value of <0.05 was considered significant.

**Results:**

The current study enrolled a total of 24 patients to study the functional outcome of arthroscopic ACL reconstruction by various grafts with the follow-up up to 6 months to evaluate improvements. In present study average age of the patients under consideration was  $29.8 \pm 7.6$  years with 3 females and 21 males were considered.

Considering the mode of injury majority of the patients were having history of accidents or long standing sports playing history details are depicted in table 1:

**Table 1: Distribution according to Mode of Injury**

Mode of Injury	Frequency	Percent
RTA	5	20.8
Sports	19	79.2
Total	24	100.0

Considering the mechanism of injury most of the patients reported the “valgus” posture to be the mode of injury to the knee joint. Whereas other mechanisms reported in the present study were hyperextension, locking

of the knee joint, varus posture and internal rotation. External rotation of the knee joint happened to be the least common mechanism associated details are depicted in table 2:

**Table 2: Distribution according to Mechanism of injury**

Mechanism of injury	Frequency	Percent
Hyperextension	4	16.67
Locking	4	16.67
Valgus	17	70.83

External Rotation	3	12.50
Varus	4	16.67
Internal Rotation	4	16.67

While considering the site of tenderness around the knee joint. Majority of the patients reported the tenderness around the whole knee. Lateral side knee joint

tenderness was present in 29.2% of the patients. There was one patients who presented with the tenderness at the front of the knee joint as depicted in table 3:

**Table 3: Distribution according to Tenderness**

Tenderness	Frequency	Percent
Back of the knee	2	8.3
Front of knee	1	4.2
Lateral side of knee	7	29.2
Medial side	5	20.8
Whole knee	9	37.5
Total	24	100.0

When patients were operated grafting was done using various graft types. Majority of the patients were treated using hamstring and peroneus grafts (41.7%). 16.7% patients were treated with Bone patellar tendon bone (BPTB) graft as depicted in table 4:

**Table 4: Distribution according to Graft Type**

Graft Type	Frequency	Percent
BPTB	4	16.7
Hamstring	10	41.7
Peroneus	10	41.7
Total	24	100.0

During pre-operative evaluation, majority of the patients showed grade 3 results upon Lachman test. Out of these 15 patients, 7 received hamstring graft, 5 received peroneus graft and 3 received BPTB graft. 9 patients showed grade 2 Lachman result. During post-operative evaluation, majority

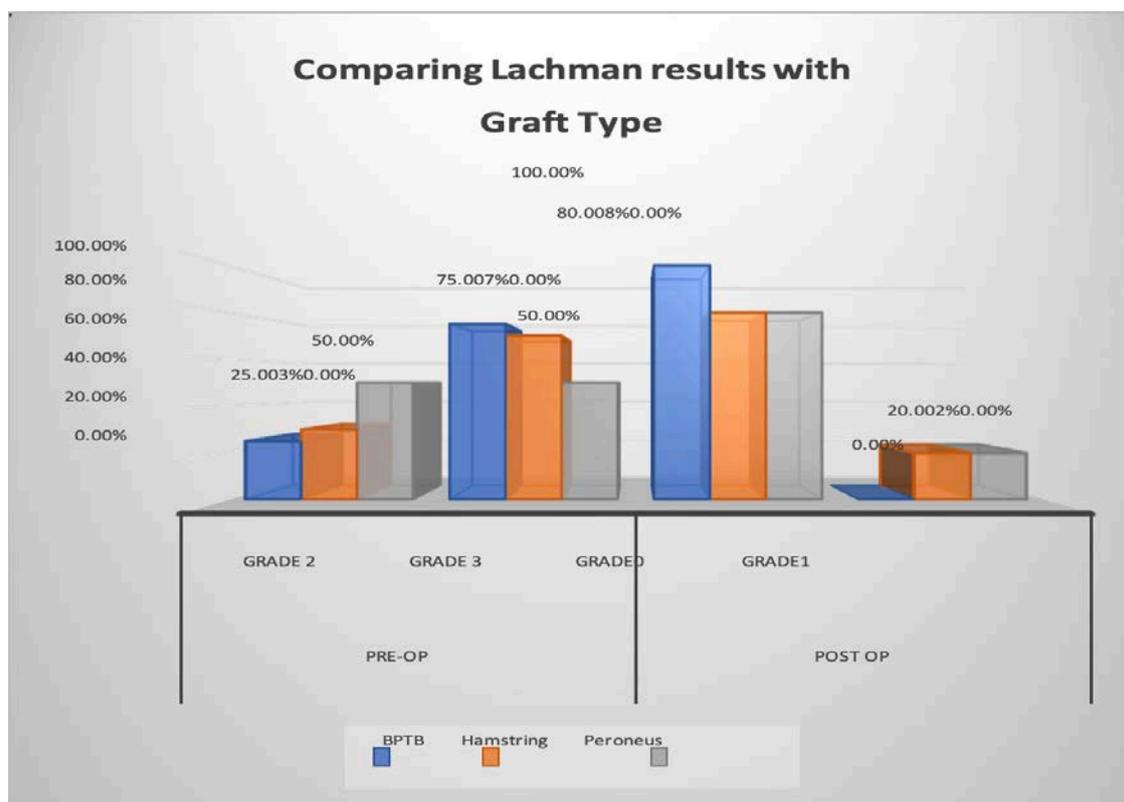
of the patients were observed to be at grade 0 on Lachman evaluation.

Status of the patients depending upon Lachman evaluation is depicted in table 5 and figure 1:

**Table 5: Comparing Lachman results with Graft Type**

Lachman			Graft Type			Total
			BPTB	Hamstring	Peroneus	
Pre- op	Grade2	Count	1	3	5	9
		% Within Graft Type	25.0%	30.0%	50.0%	37.5%
	Grade3	Count	3	7	5	15
		% Within Graft Type	75.0%	70.0%	50.0%	62.5%
Post- op	Grade0	Count	4	8	8	20
		% Within Graft Type	100.0%	80.0%	80.0%	83.3%
	Grade1	Count	0	2	2	4

		% Within Graft Type	0.0%	20.0%	20.0%	16.7%
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**Figure 1: Comparing Lachman results with Graft Type**

During preoperative evaluation, the mean Lysholm score in patients who received BPTB, Hamstring and peroneus grafts were 44, 38.8 and 32 respectively which mean score of 36.83. Whereas, after operation,

the same scores for these grafts were 84, 84.3 and 85 respectively with the means scoring of 84.54. This difference in all three types of graft was statistically significant as depicted in table 6

**Table 6: Comparing Lysholm Score with graft types.**

Graft Type	Pre op		Post op		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
BPTB	44.00	10.033	84.00	11.431	<0.001
Hamstring	38.80	8.929	84.30	8.111	<0.001
Peroneus	32.00	9.226	85.00	7.040	<0.001
Total	36.83	9.920	84.54	7.896	<0.001
P value	0.083		0.972		

**Discussion:**

Due to the increased occurrence of Road Traffic Accidents and increased number of persons participating in sports activities, the number of ACL reconstructions being done has been increased. Arthroscopic reconstruction of the injured ACL has

become the gold standard and is one of the most common procedures done in orthopaedics and thus it has been extensively studied and outcomes of ACL reconstruction have gained considerable attention.

The present study recruited a total of 24 patient with the history of knee injury and requirement of various grafts. In our study, the most common mode of injury was sports injuries followed by Road Traffic Accident injuries. Male predominance was found in our study. 87.5% patients were males and 12.5% were females. Most of the patients were in the age group of > 25 years (54.2%). There was not much difference in lateralization of injury.

The choice of graft is a topic of great debate in recent years. The various options include bone patellar tendon bone graft, hamstring auto graft, quadriceps tendon, various synthetic grafts and allograft.

Among these, the most commonly used are the Bone patellar tendon bone graft and hamstring graft. The advantages of Bone patellar tendon bone graft include high ultimate tensile load (approximately 2300 N) and a rigid fixation due to its bony ends.

ACL reconstruction is a commonly performed procedure. However, bone-patellar tendon-bone complex, hamstring tendon auto grafts, and allografts are commonly used as the graft sources, which graft is the most suitable has still been controversial. The BPTB graft is considered as a gold standard for ACL reconstruction because of its strength, consistency of the size of the graft, ease of harvesting and most importantly because of bone to bone healing within the tibial and femoral tunnel.<sup>8</sup>

Complications of bone patella tendon bone graft include patellar tendon rupture, patellar/tibial fracture, quadriceps weakness, loss of full extension, anterior knee pain, difficulty in kneeling and numbness due to injury to the infra-patellar branch of saphenous nerve. Hence it is to be avoided in patients whose occupation or lifestyle requires frequent kneeling [9]. The hamstring tendon grafts have greater mechanical strength than a bone-patellar tendon-bone graft.[10]

D.W Lewis et al. in their study on incidence of meniscal injuries at the time of ACL reconstruction found that 58% of patients had meniscal injuries and that medial meniscus was most commonly injured. They also concluded that meniscal repair or resection did not alter the final outcome. [11]

Average duration of follow-up of the present study was 18 months with a minimum follow-up period 7 months and maximum follow-up period was 27 months. Average duration of follow-up of D Choudhary et al. [12] was 12 months and that of Jomha et al. [13] was 84 months, Railey et al. [14] was 24 months, Mahir et al [15]. was 18 months and Ashok Kumar [16] et al.2016 was 17 months. The average Lysholm score at the end of the study of D Choudhary et al. was 92, Jomha et al. was 94, Railey et al. was 91, Mahir et al. was 93.5, Ashok Kumar et al.2016 was 90 and in our study average Lysholm score at last followup was 84.54 which was comparable with the above studies.

One of the primary goals of ACL reconstruction is to restore knee laxity and provide the patient with a stable knee without giving-way episodes to promote long-term knee health. The manual Lachman [17] test has been regarded as the gold standard in terms of evaluations of AP knee laxity. [18] Because of the subjective nature of the manual Lachman test, instrumented measurement systems, such as the KT-1000 arthrometer, were developed. We observed that during pre-operative evaluation, majority of the patients showed grade 3 results upon Lachman test. Out of these 15 patients, 7 received hamstring graft, 5 received peroneus graft and 3 received BPTB graft. 9 patients showed grade 2 Lachman result. During post-operative evaluation, majority of the patients were observed to be at grade 0 on Lachman evaluation.

The final outcome of the various grafts applied to the patients recruited in the present study. 59.3% of the patients

reported the surgical outcome to be good. 16.7% patients obtained fairly good outcome. There were 3 patients whose surgical outcome was observed to be poor. We observed the best outcomes with peroneus grafts.

### Conclusion:

We found that all the three methods had shown equal potential in present study however, majority of the patients were treated using hamstring and peroneus grafts and less with BPTB graft. Majority of the patients who turned out to be grade 0 after the operation. Similar pattern were observed during post-operative evaluation, where majority of the patients were observed to be at grade 0 on Lachman evaluation.

Majority of the patients showed pivotal shift of grade 2 severity during pre-operative evaluation. During pre op evaluation, the mean Lysholm score in patients who received BPTB, Hamstring and peroneus grafts were 44, 38.8 and 32 respectively which mean score of 36.83. Whereas, after operation, the same scores for these grafts were 84, 84.3 and 85 respectively with the means scoring of 84.54. This difference in all three types of graft was statistically significant.

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