ARIPEX - INDIAN JOURNAL OF RESEARCH   Volume-8   Issue-11   November - 2019   PRINT ISSN No. 2250 - 1991   DOI:10.36106/paripex								
Journal or A OR	IGINAL RESEARCH PAPER	Orthopaedics						
ANTI PARIPET	IPARATIVE STUDY OF ARTHROSCOPIC ERIOR CRUCIATE LIGAMENT ONSTRUCTION USING BONE PATELLAR DON BONE GRAFT AND HAMSTRING GRAFT.	<b>KEY WORDS:</b> Anterior Cruciate Deficient Knee, Bone Patella Bone Graft, Hamstring Graft.						
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INTRODUCTION: ACL reconstruction is probably the most common procedure of the knee in adults in recent times, and the choice of graft to be used for it is the most important decision to be made during the surgery. Although several methods of ACL reconstruction exist, the 2 most common procedures done are BTB reconstruction using an autograft of the middle third of the patellar tendon and reconstruction using a (HT) graft.

PURPOSE: The purpose of this study was to evaluate the midterm functional outcome of ACL reconstruction using the bone-patellar tendon-bone graft and hamstring graft.

MATERIALS AND METHODS: The study was conducted in the Department of Orthopaedics, Kempegowda institute of medical science and research centre. A total of 40 cases were operated out of whom 20 were operated using arthroscopic ACL reconstruction using Hamstring graft and other 20 underwent ACLR using Patellar tendon graft. Patients in our study were assessed by IKDC, Tegners and Lysholm operative scores.

RESULTS- The mean age of the patients in our study was around 29 years. Around 70% of our patients were operated within 6 months from the time of injury after achieving complete flexion. Evaluation using IKDC, Lyshom and tegner scoring system showed hamstring graft having statistical significance when compared with BPTB graft, but the difference between the groups was not clinically appreciable.

CONCLUSIONS: ACL reconstruction by either hamstring tendon graft or bone patellar tendon graft gives equally satisfactory results. But complications in the form of anterior knee pain were noted in BPTB group.

### INTRODUCTION

ABSTRACT

Anterior cruciate ligament (ACL) is one of the most serious and commonly injured ligaments of the knee. It can lead to recurrent instability, chronic pain and degenerative changes in knee joint. ACL injury is quite common among the young active population especially in athletes, contact sports and with high velocity accidents on the road. Since ACL is the primary stabilizer against anterior translation of the tibia on the femur, it is important in counteracting rotatory and valgus stress. ACL deficiency may lead to knee instability, which results in recurrent injuries and increased risk of intraarticular damage, especially the meniscus. The goals of the ACL reconstruction are to restore stability to the knee; allow the patient to return to normal activities, including sports; and to delay the onset of osteoarthritis with associated recurrent injuries to the articular cartilage and loss of meniscal functions.

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The need for surgical reconstruction of the ACL is justified by its anatomical characteristics. The branch of the genicular artery responsible for the vascularisation gives rise to terminal branches, which precludes potential repair of the ligament. Ideally, a graft for anterior cruciate ligament reconstruction (ACLR) should be one that recreates the anatomical and biochemical properties of the native ligament, ensures safe fixation and that provides rapid biological integration and neurophysiological activities of

ACL. There are several options when considering anterior cruciate ligament reconstruction (ACLR), including graft choice. Regarding autografts, the decision between using a bone-patellar tendon-bone (BPTB) and hamstring tendon (HT) autograft remains controversial. Both BPTB and HT have been widely accepted and studies have shown little difference between the two graft types. A BPTB graft remains the gold standard as far as mechanical stability is concerned <sup>[29]</sup>, early return to high level sports and hamstring is an attractive and good all round graft choice with easier harvesting. Potential drawbacks of a BPTB autograft include the risk of patellar fractures, patellar tendon ruptures, quadriceps weakness, and donor site morbidity,  $^{[3,4,5]}$  while disadvantages of an HT autograft include decreased hamstring strength, increased joint laxity, and delayed grafttunnel healing.<sup>[6]</sup>Reconstruction with BPTB autografts might be superior in getting back rotation stability of the knee joint and allow patients to return to better levels of activity in comparison with SHT autografts. Whereas, postoperative complications of the knee joint were lesser for SHT autografts than for BPTB autografts. There was insufficient evidence to identify which of the two types of grafts was significantly better for ACL reconstruction

In our retrospective study, we selected our patients into two groups, depending on the type of graft used for reconstruction. Our aim of the study was to compare both

Submitted : 24 <sup>th</sup> July,2019	Accepted : 19 <sup>th</sup> September,2019	Publication : 15 <sup>th</sup> November, 2019

(bone-patella-bone with hamstring semitendinosus (HS) auto graft) groups in terms of subjective and objective outcome.

#### Materials and Methodology

In this retrospective clinical study, 40 patients who underwent ACLR, were allocated to two equal groups based on type of graft used: the BPTB group or the HT group. All of the participants were operated in department of Orthopaedics, Kempegowda institute of Medical Science and research Centre, Bangalore. Patients who were admitted with ACL injury confirmed by clinical records and MRI scan during the period 2016 to 2018 were included in the study based on inclusion criterion.

Indications for surgery were clinically and radiologically confirmed cases of anterior cruciate ligament deficient knees.

#### THE INCLUSION CRITERION WERE

- Age between 18 to 55 years
- Clinically ACL deficient knee
- Radiological ACL deficient knee confirmed by MRI
- Associated menisci injuries

#### THE EXCLUSION CRITERIONWERE

- Infection
- Patients who were lost in the follow up
- Associated tibial plateau fractures
- Patients not willing to involve in the study
- Bilateral knee injuries

Using the Orthopaedic departmental trauma database patients were identified for inclusion in the study. The 40 patients were followed up by means of case note and operative record analysis, radiographic assessment and functional questionnaire.

Case notes were used to establish all demographic details including age, sex, mechanism of injury, time to surgery, intraoperative details. Complications were also recorded and confirmed with the patients.

The questionnaire done was both telephone based and inperson format methods. The functional scoring system used was IKDC subjective functional scoring system. The Lysholm score and Tegner prep and post-operative scoring system were also considered.

All patients underwent spinal anesthesia. All single-bundle reconstructions were performed with ACL reconstruction according to the standard protocol used by the department. All patients underwent standard postoperative rehabilitation. The rehabilitation protocol started the day after the operation and consisted of partial weight bearing with support by crutches and simple muscle-strengthening exercises. Postoperatively, the patients were put on a knee brace for 4-6 weeks but range of motion exercises were started immediately after surgery. Full weight bearing was allowed as per patients' tolerance. Usually, by 6 months postoperative period, return to full activity level was allowed.

The patients underwent physiotherapy three times a week for the first 6 weeks after surgery. The primary focus was on strengthening of the quadriceps and hamstring muscles and achieving full extension. Jogging was allowed after 4 months, but return to competitive sports was restricted till 6 months after surgery.

#### RESULTS

Male predominance was noted in our study; 23 (57.5%) patients were males and 17 (42.5%) were females. The mean age of patients was around 29 years in both the groups. In our study, the most common mode of injury was self-fall and

twisting injury.

70% of patients among BPTB group and 60% among hamstring underwent ACL reconstruction 1 month(4 weeks) to 6 months after injury which was in coherence with other studies.

The most common symptom at presentation was anterior knee pain, 25% in BPTB group and 10% in hamstring group. The mean range of motions in BPTB graft was 112 degrees and 126 degrees in hamstring group, at the end of 6 months. No instability was noted in our study at 6 months follow up. (table 5)

In our study the mean age of patients was 28.9 and 29.3 in the hamstring and BPTB groups and there was a slight male predominance in both groups.(table 1) and the most common mode of injury was twisting injury with righ sided predominance.(table 2).

The mean flexion achieved in the 2 groups were 126.5 and 112.0 in hamstring and BPTB grafts(table 6).

The pre operative and post operative lysholm, Tegner and IKDC are mentioned in the tables below. (table 7,8,9 and 10)

#### DISCUSSION

There are currently multiple meta-analyses evaluating BPTB versus HT autografts. A recent meta analysis by Xei et al compared 931 patients in the BPTB group and 999 patients in the 4SHT group in which the results of the meta-analysis showed that there were no significant differences between BPTB and 4SHT

The choice of graft is a topic of great debate in recent years. The goal of treatment of ACL deficient knee is to provide stable knee which prevents secondary injury to knee and potential early onset of osteoarthritis associated with ACL deficient knee. The most accepted method of surgical management at present for ACL deficient knee is ACL reconstruction. The various options include bone patellar tendon bone graft, hamstring autograft, 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. But the hamstring graft has been increasingly used in recent times. The advantages of arthroscopic ACL reconstruction using hamstring graft include decreased surgical site morbidity, decreased occurrence of patellofemoral adhesions and reduced incidence of anterior knee pain.

And result of the present study was compared with the studies of D Choudhary et al. 2005, Jomha et al. 1999, Riley et al. 2004 and Mahir et al. 2005 and Kumar et al  $2016^{[31]}$ .

Average age of patients at the time of surgery in the present study was 29 years whereas that of Jomha et.al<sup>[2]</sup>, D Chaudhary et al<sup>[30]</sup>, Railey et al., Mahir et al and Kumar et al were 26, 27, 33, 24 and 27 years respectively<sup>[31]</sup>.

Early studies by Gobbi et al. also showed that gender couldn't be a factor in the use of PT grafts or HS grafts  $^{[21]}$ . Kartus et al. furthermore reported that age and gender did not influence the postoperative complications of ACL reconstruction, such as anterior pain or problems related to ROM  $^{[22]}$ .

Various authors suggest that ACL reconstruction be performed at least 3 weeks after injury in order to avoid arthrofibrosis.<sup>[10,11,12,13]</sup> More important than the time of surgery

alone, objective criteria including perioperative swelling, edema, hyperthermia, and ROM are important indicators of when surgery should be performed.  $^{\rm [14]}$ 

Preoperative quadriceps strength has also been suggested to influence outcomes following ACL recomstruction. Eitzen et al<sup>[23]</sup> found that patients with quadriceps strength deficits greater than 20% prior to surgery had significantly greater deficits in strength two years following surgical intervention. Thus, these authors suggest that surgery should be performed only when involved quadriceps muscle strength is 80% of the uninvolved lower extremity.

The average Lysholm score at the end of the study of D Chaudhary et al was 92 <sup>[30]</sup>., Jomha et al. was  $94^{[2]}$ , Railey et al. was 91, Mahir et al. was 93.5 and Kumar et al was 90 and in our study average Lysholm score at last follow up was 91.9 which was comparable with the above studies<sup>[31]</sup>.

The most common symptom at presentation was anterior knee pain, 25% in BPTB group and 10% in hamstring group. The mean range of motions in BPTB graft was 112 degrees and 126 degrees in hamstring group, at the end of 6 months. No instability was noted in our study at 6 months follow up. The results of the study were compared with other studies.

The comparison of pivot shift test in our study with other studies is comparable, in our study all patients of both groups had negative pivot shift test after 6 months.

Similar postoperative effects were seen with ACL reconst ructions with BPTB or HT autograft, in terms of restoring knee joint function. While the HT autografts were associated with fewer postoperative complications, there was increased anterior knee pain and kneeling pain with ACL reconstruction with BPTB autograft when compared to HT autografts, according to Li S, Chen Y, Lin Z, et al<sup>[22]</sup>.

The results of the study by Shaieb et al.<sup>[17]</sup> found no significant difference overall between the two groups in terms of return to sports, reduction in activity, jumping, etc. An important consideration in the study by Shaieb et al. is that the evaluation was performed with a minimum follow-up of 6 months, and it was impossible to assess common complications, such as osteoarthritis or long-term pain, after surgery. The pooled data showed statistically significant differences between PT and HS autograft choices for functional assessment, return to activity, Tegner and Lysholm scores, subjective outcome measures or IKDC scores but the clinical variation in spectrum of different parameters were not significant.

Our investigation was also performed with a follow-up of 6 months, which was consistent with recent studies. Relatively small sample size was one of the limitations of the study. Another limitation was the short-term follow-up period. Since many trials have found significant differences in long-term follow-up, increasing the duration of follow-up may result in such differences.

#### **CONCLUSION**

Use of a BTB autograft appears to be a better strategy for patients taking part in light athletic disciplines, while the STG tendon graft is better for patients with a lower activity level. In summary, the results of the present and other well-structured studies do not reveal clear differences in effectiveness between the two surgical techniques. Hence, the surgeon and patient's preference should be the basis of choosing the graft site.

Relatively short follow-up periodic yet another main limitation to the study however, the main aim of the study was to compare the early results of ACL reconstruction, and the follow-up duration in both analyzed groups was the same; thus, the groups were comparable.

#### ACKNOWLEDGEMENTS

We would like to thank our patients for their cooperation

## DECLARATIONS

*Funding:*None

Conflict of interest: None

**Ethical approval:** Institutional Ethical Committee approval taken

#### **Tables**

# Table 1- Distribution of Sociodemographic charac teristics among study subjects

Distribut	Distribution of Sociodemographic characteristics among study subjects									
Variables	Group	Hams (n=	tring 20)	BP' (n=	P-Value					
		Mean	SD	Mean	SD					
Age	Mean&SD	28.9	6.9	29.3	5.7	0.94ª				
	Range	16 -	43	21 -	39					
		Ν	%	n	%					
Gender	Males	11	55%	12	60%	0.75 <sup>b</sup>				
	Females	9	45%	8	40%					

\*statistically significant

#### Table 2 - comparison of mode of injury and side Hamstring BPTB

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Variables	Category	n	%	n	%	$\chi^2$ Value	P-Value
Mode of njury Self Fall		9	45%	11	55%		
	Slip & Fall	1	5%	4	20%	3.667	0.16
	Twist Injury	10	50%	5	25%		
Side	Right	11	55%	10	50%	0.100	0.75
	Left	9	45%	10	50%		

# Table 4- Comparison of Pre Operative characteristics between 02 groups using Chi Square Test

Variables	Category	Ham	string	g BPTB		$c^2$ Value	P-Value
		n	%	n	%		
Mode of	Self Fall	9	45%	11	55%	3.667	0.16
Injury	Slip & Fall	1	5%	4	20%		
	Twist	10	50%	5	25%		
	Injury						
Side	Right	11	55%	10	50%	0.100	0.75
	Left	9	45%	10	50%		
Other	Normal	20	100%	20	100%		
Lig.							
Time of	< 1	3	15%	7	35%	5.993	0.20
Injury to	month						
Surgery	2-6	9	45%	7	35%		
	Months						
	6m - 1	4	20%	3	15%		
	year						
	2 - 5	1	5%	3	15%		
	years						
	6 - 10	3	15%	0	0%		
	years						

#### Table 5 - Comparison of Intra Operative and Post Operative Characteristics between 02 groups using Chi Square Test

Variables	Category	Hamstring		BPTB		C <sup>2</sup>	P-Value
		n	%	n	%	Value	
Implant Used	Endobutton	20	100%	0	0%	40.000	< 0.001*
	Ti. Screws	0	0%	20	100%		
Lachman's Test	Negative	20	100%	20	100%	:	
Follow-up	6 Months	20	100%	20	100%		

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Complications	Ant. Knee	2	10%	5	25%	1.558	0.21
	Pain						
	None	18	90%	15	75%		

\*statistically significant

## Table 6 - Comparison of mean Flexion and Extension values between 02 groups using MannWhitney Test

Variables	Group	Ν	Mean	SD	Mean Diff	P-Value
Flexion	Hamstring	20	126.5	15.3	14.5	0.04*
	BPTB	20	112.0	21.7		
Extension	Hamstring	20	126.5	15.3	14.5	0.04*
	BPTB	20	112.0	21.7		

\*statistically significant

# Table 7 – Comparison of mean values of study charac teristics b/w Pre-Op & Post-Op in Hamstring Group using Wilcoxon Signed Rank Test

Variables	Time	Ν	Mean	SD	Mean Diff	P-Value
Lysholm	Pre-Op	20	69.70	10.07	-21.90	<0.001*
	Post-Op	20	91.60	3.65		
Tegner	Pre-Op	20	7.45	1.00	1.25	0.006*
	Post-Op	20	6.20	1.28		
IKDC	Pre-Op	20	58.95	6.78	-17.64	<0.001*
	Post-Op	20	76.59	8.18		

\*statistically significant

# Table 8- Comparison of mean values of study characteristics b/w Pre-Op & Post-Op in BPTB Group usingWilcoxon Signed Rank Test

Variables	Time	N	Mean	SD	Mean Diff	P-Value
Lysholm	Pre-Op	20	68.95	10.40	-17.05	< 0.001*
	Post-Op	20	86.00	5.07		
Tegner	Pre-Op	20	7.35	1.35	2.40	< 0.001*
	Post-Op	20	4.95	1.36		
IKDC	Pre-Op	20	54.51	9.13	-9.89	< 0.001*
	Post-Op	20	64.40	7.37		

\*statistically significant

### Table 9 – Comparison of mean values of Pre-Op study characteristics between 02 Groups using Mann Whitney Test

	Variables	Group	Ν	Mean	SD	Mean Diff	P-Value
I	Lysholm	Hamstring	20	69.70	10.07	0.75	0.64
		BPTB	20	68.95	10.40		
I	Tegner	Hamstring	20	7.45	1.00	0.10	0.93
		BPTB	20	7.35	1.35		
I	IKDC	Hamstring	20	58.95	6.78	4.43	0.21
		BPTB	20	54.51	9.13		

#### Table 10 – Comparison of mean values of Post-Op study characteristics between the two Groups using Mann WhitneyTest

Variables	Group	Ν	Mean	SD	Mean Diff	P-Value
Lysholm	Hamstring	20	91.60	3.65	5.60	0.001*
	BPTB	20	86.00	5.07		
Tegner	Hamstring	20	6.20	1.28	1.25	0.007*
	BPTB	20	4.95	1.36		
IKDC	Hamstring	20	76.59	8.18	12.19	< 0.001*
	BPTB	20	64.40	7.37		

\*statistically significant

# Chart 1 – Post op charecteristics between 2 groups on various scorings



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