



E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2020; 6(4): 295-300  
© 2020 IJOS  
[www.orthopaper.com](http://www.orthopaper.com)  
Received: 09-07-2020  
Accepted: 21-08-2020

**Hameed Saber**  
M.S Ortho- Postgraduate  
Student, Department of  
Orthopaedics, Rajah Muthiah  
Medical College and Hospital,  
Annamalai University, Tamil  
Nadu, India

**Senthilnathan Arumugam**  
Professor of Orthopaedics, Rajah  
Muthiah Medical College and  
Hospital, Annamalai University,  
Tamil Nadu, India

**Prabhakar Ramabdran**  
Lecturer, Department of  
Orthopaedics, Rajah Muthiah  
Medical College and Hospital,  
Annamalai University, Tamil  
Nadu, India

**Vijayashankar Kaliyaperumal**  
Assistant Professor, Department  
of Orthopaedics, Rajah Muthiah  
Medical College and Hospital,  
Annamalai University, Tamil  
Nadu, India

**Raghul Raj**  
Senior Resident, Department of  
Orthopaedics, Rajah Muthiah  
Medical College and Hospital,  
Annamalai University, Tamil  
Nadu, India

**Corresponding Author:**  
**Senthilnathan Arumugam**  
Professor of Orthopaedics, Rajah  
Muthiah Medical College and  
Hospital, Annamalai University,  
Tamil Nadu, India

## Comparative study on the functional outcome of arthroscopic reconstruction of anterior cruciate ligament using patellar tendon bone graft versus hamstrings graft

**Hameed Saber, Senthilnathan Arumugam, Prabhakar Ramabdran, Vijayashankar Kaliyaperumal and Raghul Raj**

DOI: <https://doi.org/10.22271/ortho.2020.v6.i4e.2354>

### Abstract

**Introduction:** The anterior cruciate ligament (ACL) is truly a "CRUCIAL" ligament of the knee. It prevents anterior translation of tibia over femur and has definite role in providing rotational stability of knee. Out of all the ligaments in the knee joint, the ACL is injured the most. The aim is to restore ligamentous stability while preserving a functional pain free range of motion of knee.

**Material and Methods:** This study was done in the department of orthopaedics of Rajah Muthiah Medical College and hospital. 30 cases with "Tear/Rupture" anterior cruciate ligament were treated with arthroscopic reconstruction, of which 15 were reconstructed using the patellar tendon bone graft and 15 using the hamstrings graft. Patients were assessed for the functional outcome using International knee documentation score (IKDC) score

**Results:** Functional outcomes were comparable for both Patellar tendon bone graft and hamstrings graft.

**Conclusion:** Arthroscopic anterior cruciate ligament reconstruction "using patellar bone tendon graft or hamstring graft" is an effective method and gives stable fixation with excellent results.

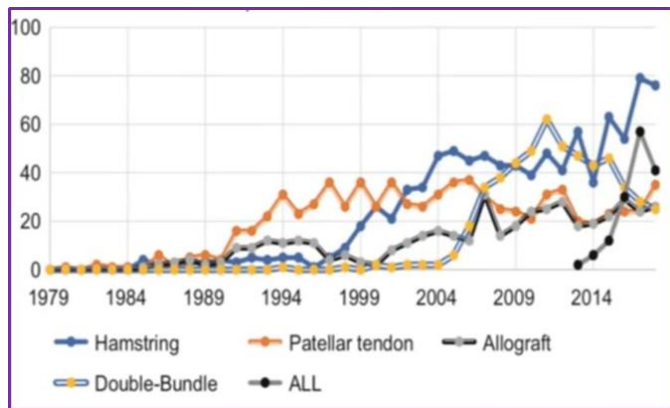
**Keywords:** ACL Reconstruction, Complications, Fixation Method, Functional Outcome, Quadrupled Semitendinosus Autograft

### Introduction

The knee is a complex multi-ligamentous joint. Of the various ligaments in the knee, the most commonly injured is the ACL. Any tear/rupture of the ACL has to be treated surgically. The reason for this is that the branch of genicular artery supplying the ACL is an end artery. As a result, any injury to the ACL cannot be repaired, rather it has to be replaced <sup>[1]</sup>.

However, unfortunately, no ligament construction can recreate the exact biomechanical and neurophysiological properties of the ACL <sup>[2]</sup>. Thereby, a graft that is to be used should mimic the biomechanical, anatomical and physiological properties of the native ACL as close as possible.

The aim of this study is to analyse and evaluate the clinical and radiological outcomes of patients with anterior cruciate ligament injury treated by using patellar tendon bone graft versus those treated with hamstrings auto graft. The graph depicts the changes in trends of ACL reconstruction over the past four decades. <sup>[3]</sup>



Graph 1: Techniques of ACLR over past 40 years

**Material and Methods:**

This study was overseen in department of orthopaedics of Rajah Muthiah Medical College and hospital. 30 cases with "Tear/Rupture" anterior cruciate ligament were treated with arthroscopic reconstruction with patellar tendon bone graft for 15 cases and hamstring graft for 15 cases. Patients were assessed for the functional outcome using International knee documentation score (IKDC) score

**Surgical procedure**

All patients underwent an arthroscopically assisted ACL reconstruction with either a BPTB auto graft or a hamstrings auto graft in a transtibial approach for drilling of the femoral tunnel. The central-third patellar tendon graft was harvested through a longitudinal incision. The grafts were fixed with a titanium or bio absorbable interference screw both on the femoral side and tibial side. The hamstring graft was harvested using tendon strippers and fixed with an interference screw on the tibial side and an end button on the femoral side. All patients received the same standardized post-operative rehabilitation program. The rehabilitation program included full pain adapted weight bearing after the surgery under flexion limitation until the 21st day after surgery. The return to sports was as follows: (1) jogging on plane sole 12 weeks post-surgery (2) re-integration to athletic activity post 6 months. For non-athletic patients, an early return to physical activity was considered.



Fig 2: Harvesting the Patellar Tendon Bone Graft

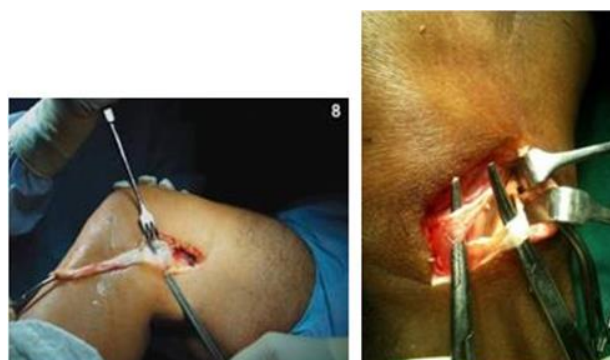


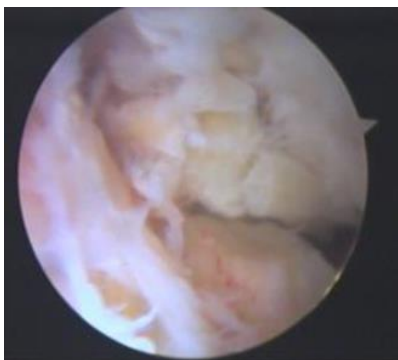
Fig 3: Harvesting the Hamstring Tendon Graft



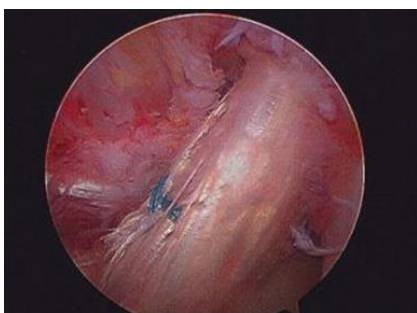
Fig 4: Graft Preparation



Fig 1: Positioning the patient



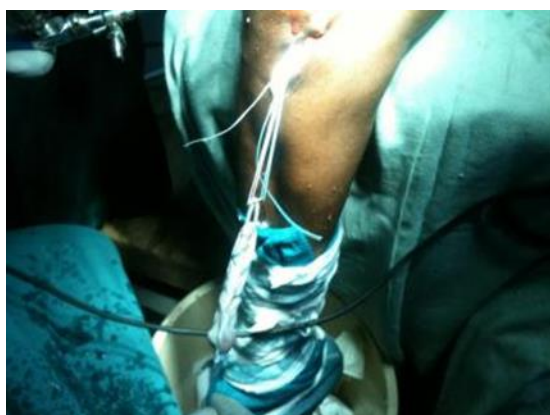
**Fig 5:** Arthroscopic Picture of Torn ACL



**Fig 6:** Graft Fixation



**Fig 7:** Bio-Absorbable Screw Fixation



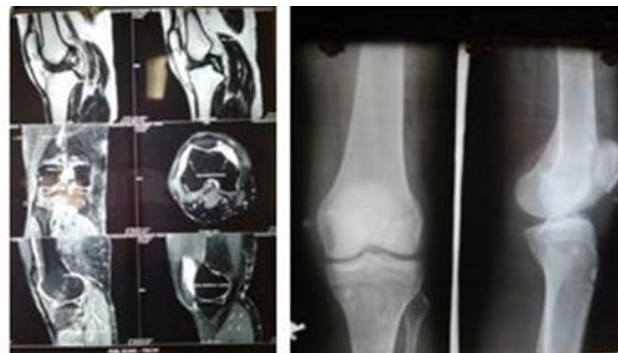
**Fig 8:** Hamstring Graft Fixation

**Outcome measures**

The IKDC clinical examination form 10 was completed preoperatively and subsequent follow-up visits. The KT-1000 Arthrometer was utilized for the evaluation of the anterior-

posterior stability [4]. Other measures of outcome included the Lysholm score, 12 Tenger activity scale and rating of satisfaction (1 = poor, 2 = moderate, 3 = good, 4 = excellent) with the treatment outcomes at the time of follow-up. Radiographic assessment included AP and lateral standing X rays which were studied and evaluated based on the Kellgren-Lawrence classification.

**Case Study-1**



**Pre Op MRI**

**Post Op X- ray**



**1 Week Post Op**



**1 Month Post Op**



**At 6 Months Follow Up**

**Case study-2 – Hamstring graft fixation**



**Pre Op MRI Pre-Op Photo**



Post Op X ray



6 Months Follow Up

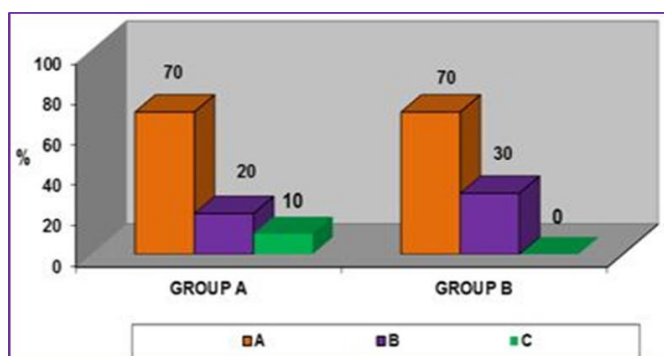
**Results**

According to the inclusion and exclusion criteria, 30 patients were considered for inclusion in the study. The mean follow-up was 6 months. The mean age at the initial date of surgery was 24 years. The post-operative functional outcome of bone patellar tendon and hamstring graft is measured by IKDC knee scoring. In this scoring we take various factors like Effusion, Passive motion deficit, Ligament examination which includes Lachmann, Pivot shift, AP translation and also

took considerations of the morbidity in the harvest site and X-ray findings. Functional outcomes were “normal” in 11 cases of hamstring graft and “nearly normal” in about 3 cases and “abnormal” in 1 case. In bone patellar tendon, 11 cases were normal” and 4 cases were “nearly normal”. There were no cases under the grading of “severely abnormal” in our study and there were no significant differences between the 2 groups.

**Table 1:** Functional outcome of the two types of graft fixation

Final grade	GROUP		Total
	Group HAM	Group BPT	
A	Count	11	11
	% within GROUP	70.0%	70.0%
B	Count	3	4
	% within GROUP	20.0%	30.0%
C	Count	1	0
	% within GROUP	10.0%	.0%
Total	Count	15	15
	% within GROUP	100.0%	100.0%



**Graph 2:** Comparison between group A and group B in final grade

**Advantages of bone patellar tendon graft**

- Closest resemblance to torn are the length of both ACL and BPT are equal.
- Bone to bone healing is always better and considered to be strongest.

**Advantages of hamstring graft**

- Small incision (less chances of infection)
- Less anterior knee pain
- Range of motion returns faster.

**The common complications encountered in Arthroscopic ACL reconstruction are**

- Persistent pain (most common)
- Instability
- Joint swelling
- Infection
- Stiff knee
- Deep venous thrombosis

In our study, superficial wound infection was seen in 1 case of bone patellar tendon which was treated with intra venous antibiotics and got settled. In 1 case of hamstring graft, implant got infected leading to screw pull out and the patient lost follow up. In a study conducted by David N. Garras<sup>[5]</sup> stated that any infection post-operatively must be identified early and should be treated adequately to prevent cartilage damage and Arthrofibrosis. Three cases of bone patellar tendon had an anterior knee pain with mild joint effusion which is 30%. In 2001, Eriksson *et al.* <sup>[5]</sup> published a comparison between two graft types and found no difference in incidents of anterior knee pain except on kneeling.

In one case of Hamstring graft, there is an extension lag of about 5 degrees. Out of 6 sportsmen who were operated, 4 people have returned to their normal routine sports activity following ACL reconstruction.

**Conclusion**

30 patients of ACL injury were studied. There were 15 patients operated with hamstring graft and 15 patients operated by bone patellar tendon graft. In the study we compared the functional outcome of bone patellar tendon graft and the semitendinosus and gracilis graft.

1. The claimed advantage of hamstring graft is that it has less donor site morbidity than bone patellar tendon, it is therefore associated with less anterior knee pain and pain on kneeling.
2. The mechanical advantage rests with the bone patellar tendon as in previous studies the bone to bone integration is much better when compared to hamstring grafts. Micheal Hnues <sup>[6]</sup> stated in this study that the bone patellar tendon has higher post-operative activity levels than hamstring grafts.
3. In our study there were same post-operative protocol followed for both the sets of patients.
4. The p value between the two groups is not significant it is >0.05, and therefore the final outcome of these groups were similar in this study.
5. However a study with larger study group might yield a varying outcome

**Discussion**

Over the past few decades, reconstructing the ACL with the Patellar tendon bone graft was considered to be the gold

standard. However in view of complications like donor site morbidity and anterior knee pain, there has been a surge in the usage of hamstrings graft resulting in an array of comparative studies between the two. Some surgeons are of the opinion that there is a greater stability advantage when the PTB graft is used. Biau *et al.* <sup>[7]</sup> conducted a study which concluded that there was no evidence to suggest the superiority of one technique over the other.

Greater donor site morbidity rests with the PTB graft. Surprisingly, an early return to athletic sports activity also rests with the PTB graft. However, Pinczewski <sup>[8]</sup> noted no difference in final outcomes between the 2 groups in 10 years of follow up. However, as the hamstring graft is associated with lesser donor site morbidities and it is preferred as the first choice.

In our study, there was no significant difference in the functional outcomes between the two groups based on the pivot shift test, Lachman, IKDC, Lysholm, return to activity and patient satisfaction scales. Even though there was no randomisation or homogeneity in our study it was found to be in agreement with previous studies. There was a case for persistent anterior knee pain with the patellar tendon bone graft, but this association was not found in our study.

Our study was found to be in agreement with Shelbourne *et al.* <sup>[12]</sup> in that the cause of anterior knee pain was attributed to a loss of full extension, as one of our patients also presented with a loss of extension. The post-operative complication found in the Patellar tendon bone graft was that five patients were unable to kneel on hard surfaces.

The differences between the two graft types are well documented in the literature. Data from a fifteen year old randomised control study showed no difference in terms of subjective and objective results in the two groups and the differences that were earlier seen in the study were not present long term. Similarly, a double-blind randomized clinical trial by Mohtadi *et al.* <sup>[5]</sup> provided clinically valuable results: neither patient-reported nor clinical observations were significantly different among BTB, HT, and double-bundle HT ACL reconstruction techniques during a 2-year follow-up. Stolarczyk *et al.* <sup>[9]</sup> noted that in patients who would take part in strenuous athletic disciplines, the Patellar tendon bone graft was the preferred option whereas in those with a lower activity level the hamstring graft was preferred. Barenius *et al.* <sup>[11]</sup> claimed that the degenerative changes in the knee joint and the technique used for reconstruction had no co-relation.

To conclude, with respect to our study and other well-structured studies, there were no clear differences in the effectiveness of the two surgical techniques. Thus the choice of the graft should be based on the preference of the surgeon and the patient, the patient's requirements, tissue availability and prior surgeries. The drawback of our study was the relatively short follow up period. However based on early results of ACL reconstruction and follow up, it can be effectively concluded that, the groups are comparable.

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