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Functional Outcome of Bone Patellar Tendon Bone Graft in Anterior Cruciate Ligament Reconstruction

Nitin Wagh[1], Chinmay Salunkhe[2*], Sandip Pangavane[1], Brijbhushan Mahajan[3] and Sameer Shelar[2]

[1]Professor, Department of Orthopaedics, Dr. Vasantrao Pawar Medical College Hospital and Research Centre, Nashik – 422003, Maharashtra, India
[2]Former PG Student, Department of Orthopaedics, Dr. Vasantrao Pawar Medical College Hospital and Research Centre, Nashik – 422003, Maharashtra, India; chinsroyal@gmail.com
[3]Associate Professor, Department of Orthopaedics, Dr. Vasantrao Pawar Medical College Hospital and Research, Centre, Nashik – 422003, Maharashtra, India

Abstract

Background: Anterior Cruciate Ligament (ACL) tear is the one of the common among ligamentous injury to the knee joint. Various surgical methods have been advised for the anterior cruciate ligament reconstruction with different kinds of grafts which have own merits and demerits. Bone patellar tendon bone is one of the commonly used autograft for ACL reconstruction. Aim of this study was to analyze the functional outcome following arthroscopic ACL reconstruction using Bone patellar Tendon Bone graft (BTB). **Materials and Methods:** Between 2017 and 2019, 32 patients with an average age of 27 years (range: 19-51 years) participated in a prospective study. The patients were arthroscopically treated with a bone-patellar tendon-bone graft. Physiotherapy and appropriate post-operative care were provided. The patient's functional status was assessed at three-month, six-month, and one-year intervals. We assess knee joint stability and normal knee function using clinical tests. To evaluate the findings, we used the Tegner Lysholm knee score as well as the VAS score. **Results:** In terms of clinical outcomes, 93 percent of patients had normal or near-normal knee function. According to the Tegner-Lysholm knee rating system, 88 percent of the patients received an excellent score. At the end of one year, 27 out of 32 patients have no pain on the VAS score. Anterior knee discomfort (10%) and numbness above the graft donor site were the most common consequences (8 percent). **Conclusion:** Based on objective and subjective assessments, ACL reconstruction employing the bone-patellar tendon-bone approach could produce a very satisfactory functional outcome. Improved knee stability and function allow for a quicker return to everyday activities.

Keyword: Anterior Cruciate Ligament (ACL), Arthroscopic Repair, Bone Patellar Tendon Bone graft (BTB)

1. Introduction

The anterior cruciate ligament is the most commonly injured ligament in the knee and it is one of the most regularly injured joints in the human body. Anterior cruciate ligament injuries have increased as a result of high-speed vehicular damage, advanced lifestyles and sports. In conjunction with the other ligaments, knee capsule, muscles, and bone, the anterior cruciate ligament plays a critical function in maintaining knee alignment and stability. The Anterior Cruciate Ligament (ACL) is the primary knee stabiliser, preventing translation of the tibia over the femur anteriorly and contributing to rotatory stability[1]. In an ACL deficient knee, the kinematics of the joint are disrupted.

It is also important to counter valgus and rotational stress[2,3]. Most patients endure recurring episodes of instability, discomfort, and hypofunction after an ACL injury. The ACL reconstruction permits the patient to return to pre-traumatic levels of activity while also delaying leads to the onset of concomitant meniscal injuries and osteoarthritis[4]. Acute tears cause roughly 40% cartilage damage, but persistent tears cause 79 percent[5]. Reconstruction is essential to restore knee stability. ACLs have a very much low healing capacity and a very high failure rate after surgical repair with sutures[6].Open reconstruction was linked to increased post-operative morbidity[7]. Other issues that led to the creation of Arthroscopy assisted ACL restoration

*Author for correspondence

include post-surgical knee discomfort and a lengthy rehabilitation period. There is no damage to the capsule, minimal or no damage to the fat pad, and no articular cartilage desiccation, and a reduced incidence of post-operative knee discomfort with arthroscopically assisted anterior cruciate ligament replacement than with open reconstruction. Synthetic materials were employed for reconstructions in the 1980s, but they are no longer used due to synovitis[8]. The arthroscopic surgical method, which was introduced in the late 1980s, reduced surgical morbidity and improved results[7,9]. The gold standard for full ACL restoration is arthroscopic reconstruction[10]. The posterior aspect of knee joint can be better visualized through the arthroscope which was difficult in arthrotomy procedures. Different grafts were developed and were used for reconstructions[11]. Bone patellar tendon graft has been the ideal graft for ACL reconstruction. The reconstruction of the anterior cruciate ligament with Bone Patellar tendon Bone autograft primarily done for re-establishment of knee kinematics. It has the advantage direct bone to bone healing[12]. Objective is to find out functional outcome of Arthroscopic ACL Reconstruction using BTB tendon graft in terms of stability, function, pain, graft site morbidity, range of motions, clinical tests.

2. Aims and Objectives

Aim of this study is to assess the functional outcome of Arthroscopic assisted anterior cruciate ligament reconstruction using Bone patellar tendon Bone autograft.

3. Material and Methods

The prospective study includes 32 patients who had undergone Arthroscopic ACL reconstruction using Bone-patellar tendon-Bone autograft at the Department of Orthopedic Surgery, Dr. Vasantrao Pawar Medical College and Tertiary Health Care Centre.

3.1 Period of Study

August 2017 to December 2019

3.2 Study Design

Prospective study

3.2.1 Inclusion Criteria

1. Age group between 18 to 60 yrs.
2. ACL tear confirmed clinically and radiologically on MRI.
3. Incidental finding of Anterior Cruciate Ligament injury found during diagnostic arthroscopy.

3.2.2 Exclusion Criteria

1. Any other comorbid condition of the same knee joint such as osteoarthritis of knee, local infection etc.
2. Previous ligamentous injury in the same knee joint.
3. Associated lower limb fractures.
4. Neurovascular compromise of both lower limbs.

Between August 2017 and December 2019, all patients with ACL injuries were assessed. A thorough history was taken in terms of the type of the injury and the mechanism of harm. time since injury, ability to walk following injury, accompanying injury, treatment details, and history of any medical issue A thorough general and physical examination was performed, followed by a radiographic examination.

The patients having complaining of knee pain, limping, difficulty in walking downstairs, instability, restricted range of motion, and history of giving away are examined clinically.

Clinically diagnosis was made by Anterior Drawer Test, Lachman Test, Pivot Shift Test.

Local examination includes examination for the rotatitional instability and laxity of other ligaments to rule out Meniscal Injury by McMurray's Test, Apley's Grinding Test.

Radiological work up includes Xray and MRI

- X-rays including the antero-posterior and lateral view of the knee joint
  Rule out Avulsion Fracture, evidence of Segond's Fracture.

- MRI findings showing complete ACL tear.
  The surgical procedure, the goal of the study, and informed consent and approval from the IEC were all explained to all of the patients.

4. Surgical Techniques

The anterior cruciate ligament was arthroscopically repaired. Before the skin incision, a prophylactic antibiotic was given. A 5 cm longitudinal incision was made over the patellar tendon to harvest the BTB graft. With the leading suture made on the patellar side, the graft was

formed into a bone-patellar tendon-bone construct. The superomedial and inferomedial portals for tools and the high inferolateral portal for the arthroscope were employed for arthroscopy. Shaver was used to prepare the notch until femoral sided ACL footprint were visible. The tibial footprint was cleared. The tibial guide pin was placed into the posteriorly portion of the tibial remnant with the pointed tibial guide and the tibial tunnel reamed as per needed thickness of the graft. A guide pin was passed through the tibial tunnel to the femoral tunnel position with the knee flexed at 90 degrees. In Hyperflexion of knee as applicable to size of the graft, the femoral tunnel was reamed. Graft is rail roaded with help of ethibond.

The knee was put through 15-20 cycles of flexion and extension to pretension the graft. At 20 degrees knee flexion, the tibial site was fixed. Cannulated interference screws are used to secure the transplant to the tibia and femur.

A negative suction drain was put following the treatment and removed 48 hours later. To prevent joint movement, a crepe bandage is put to the knee and a lengthy knee brace is provided.

5. Evaluation

Postoperative X-rays Standard Antero-posterior and Lateral views were taken on the operated limb. All patients were reviewed periodically at 3 months, 6 months and 1 year for assessment. Range of motion, effusion, joint line discomfort and patellofemoral pain, instability, locking were all evaluated. They are also evaluated periodically by Tegner Lyshom score and VAS score. The Lachman test, Anterior drawer test and Pivot shift test were all used to assess stability. Measuring functional testing, a one legged hop for distance was used.

6. Results

32 cases of Arthroscopy ACL reconstruction with BTB Graft were followed up for 6 months to 1.5 years. The mean follows up period was 1 year.

Most of the patients are from young age group 21-30 about 62%, mean age was 27 years this shows that ACL injury more common in young age group.

Out of total 32 patients 28 were male and 4 were female.All patient having isolated ACL Injury.

Most common mechanism of injury is sports injuries (46%). In sports kabbadi being most common sports responsible for ACL tear it is followed by Road traffic accident (34%) followed by fall (6%).

6.1 Symptoms on Presentation

Most Patient with Instability only (46%), some have Pain and Instability at joint both (43%) very few are having Pain, instability plus locking at knee joint (3%)

On clinical examination most patients (69%) having Anterior Drawer test, Lachman test positive only 5% are having three positive tests.

We calculate Tegner Lysholm score for knee function preoperatively which was poor in 23 out of 32 patients.

Table 1. Age distribution

AGE	PATIENTS	PERCENTAGE
</=20	1	3.10%
21-30	20	62.50%
31-40	9	28.12%
41-50	2	6.25%
51-60	0	0.00%
TOTAL	32	100%

Table 2. Sex distribution

SEX	PATIENTS	PERCENTAGE
MALE	28	87.5%
FEMALE	4	12.5%
TOTAL	32	100%

Table 3. Mode of injury

MODE OF INJURY	PATIENTS	PERCENTAGE
SPORTS Injury	15	46.00%
Road Traffic Accidents	11	34.00%
FALL	6	20.00%
TOTAL	32	100%

Table 4. Clinical tests on presentation

Clinical tests positive	No. of patients	Percentage
Anterior drawer test	1	3%
Ant. drawer, Lachman's test	22	69%
Anterior drawer, Pivot shift test	4	13%
Ant. drawer, Lachman's, Pivot shift test	5	15%
Total	**32**	**100%**

Table 5. Tegner lysholm score

Tegner Lysholm Score	Preopr	3 month	6 month	1 year
Excellent >90	0	17	21	29
Good 84-90	0	9	6	2
Fair 65-83	9	6	5	1
Poor < 65	23	0	0	0
Total	**32**	32	32	32

Table 6. VAS score

VAS Score	Preopr	3 month	6 month	1 year
NONE (0)	0	3	20	27
MILD (1-5)	11	18	4	4
MODERATE (5-8)	13	6	7	1
SEVERE (9-10)	8	5	1	0
Total	**32**	32	32	32

Table 7. Anterior Drawer Test (ADT)

ADT examination	Number of patients at 3 month	Number of patients at 6 month	Number of patients at 12 month
NEGATIVE	28	30	31
1+	4	2	1

Table 8. Lachman's test

Lachman's examination	No.of patients at 3 month	No. of patients at 6 month	No. of patients at 12 month
NEGATIVE	26	29	32
1+	5	3	0
2+	1	0	0

Table 9. Lack of extension after 1 year

Lack of extension after 1 year	Number of patients	Percentage
< 4 degree	29	90.6 %
4 -6 degree	3	10.4 %
Total	32	100%

Table 10. Lack of flexion after 1 year

Lack of flexion after 1 year	Noumber of patients	Percentage
0-5 deg	28	87.5%
6-15 deg	4	9.3%
16-25 deg	1	3.1%
Total	32	100%

After 3 months 17 and after 6 months 21 patient having excellent result. Average tenger lysholm score was 95 in 32 patients at 12 months post operative follow up

VAS score used for pain associate with procedure. Preoperatively patient having moderate pain were 13 patients (40%) which decreased subsequent follow-up pain decreased at end of 1 year 27 out of 32 have no pain. About 5% patients came with effusion at level of knee after 6 months of surgery. No one developed joint effusion one year after surgery.

After 6 months, 75% of patients exhibited a 0–5-degree loss of flexion.

After 6 months, 20% of patients had lost 15 degrees of flexion. Only 9% of the PTB group exhibited no flexion between 6 and 15 degrees one year after surgery. The majority of 88 percent have a 0-5 degree of flexion deficiency. By anterior drawer test one year after surgery, only 7% of patients demonstrated laxity in ACL to the range of 3-5mm. Anterior drawer test translation was 0-2 mm in 29 patients.

By Lachman test, only 3% of patients demonstrated ACL laxity after about one year of surgery. 31 patients with a Lachman translation of 0-2mm. After six months, 30% of patients experienced patellofemoral discomfort. Two patients reported patellofemoral discomfort one year after surgery. After 6 months, 70% of patients were able to perform a 90% single leg functional hop test, and 85% of patients were doing the test 12 months after surgery.

7. Discussion

The results of the study were compared with the other studies of, Jomha *et al.,* 1999[13], D Choudhary *et al.,* 2005[14] and Ashok Kumar *et al.,* 2016[15].

The findings were compared to those of Jomha *et al.,* 1999[13], D Choudhary *et al.,* 2005[14], and Ashok Kumar *et al.,* 2016[15]. The average Lysholm score at the last follow-up in our study was 95, which was comparable to the previous investigations.

In a meta-analysis of articles published in 2005, Goldblat *et al.,* 16 concluded that the bone-patellar tendon-bone autograft was better in terms of stiffness and had normal knee ROM than the hamstring graft. In their study, Corry *et al.,*[17] found that patients who had hamstring tendon surgery had more laxity.

Table 11.

Author	No. of Patients	Age Mean	Follow up Interval in months	Gender
Jomha 1999[13]	59	26 yrs	84	73% Male
D Choudhary *et al.,* 2005[14]	100	27 yrs	12	93% Male
Ashok Kumar *et al.,* 2016[15]	34	27yrs	14	97.1% Male
Our Study	32	27 yrs	24	87.5% Male

Table 12. Comparison of Tegner Lysholm Knee score

Study	Average Lysholm Score	Follow up
Jomha 1999[13]	94	7 yrs
D Choudhary *et al.,* 2005[14]	92	1 yr
Ashok Kumar *et al.,* 2016[15]	90	14 months
Our study	95	1 yr

Table 13. Comparison of Pivot Shift Examination

Author and Year Published	Postoperative Grade (%)		
	0	1+	2+
Jomha 1999[13]	76	22	1
D Choudhary *et al.,* 2005[14]	95	4	1
Ashok Kumar *et al.,* 2016[15]	34	0	0
Our Study	32	0	0

Fu *et al.*,[18] BTB graft is considered the gold standard and first choice in ACL restoration. In addition, rigorous fixation of the bone transplant with interferential screws increases the graft's rigidity. In 1993, Otero *et al.*,[19] proposed that a BTB graft gives more prominent knee stability than a hamstring graft, and that the interference screw fixation method enhanced to the stability. In our research, there were no cases of graft failure.

Fox *et al.*,[20] discovered a prominent finding of greater activity in the BTB group in their comparative study of BTB *vs.* Hamstring tendon graft, showing that when the principles of ACL reconstruction are followed, consistent results with BTB autograft can be expected.

For postoperative pain assessment, we employed the Visual Analogue Score (VAS). VAS is simple to use. Pain intensity is measured on a scale of 1-10.

On further follow-up, there was a considerable reduction in post-operative pain.

We used an oblique incision during surgery to avoid knee pain when kneeling down later. According to Fox *et al.*,[20], anterior knee pain affects 15% of people. In three investigations, the percentage was greater than 20%. In 2005, Ibrahim *et al.*,[21] found that 24 percent of patients had anterior knee discomfort. Anterior knee discomfort was observed in 10% of the individuals in our study.

Morbidity at the donor site is a serious issue with the BTB graft. In our investigation, all of the patients in the bone-patellar tendon-bone group reported a disturbance of anterior knee feeling. However, within a year of the follow-up period, feelings returned to normal. Only one patient in our study had a superficial infection. Local debridement and an oral antibiotic course were used to treat the illness.

After 6 months, the wound had healed completely.

8. Conclusion

Based on physical and functional evaluations, ACL restoration using bone patellar tendon bone transplant produces excellent results. BTB's bone-to-bone healing has proven to be a gold standard, providing joint stability and a quick return to normal activities. It is difficult to achieve a natural knee like before due to the intricate biomechanics of the knee. Therefore, goal is to create a knee that is functionally stable. With bone patellar tendon bone graft reconstruction, we should expect consistent, trustworthy results if the principles of ACL reconstruction with BPTB graft are strictly followed.

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