



## Orthopaedics

# “STUDY OF ANATOMICAL ACL RECONSTRUCTION USING THREE PORTAL TECHNIQUE”

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**ABSTRACT** ACL is an intra-articular and extra synovial ligament of knee joint. ACL injury occurs as result of twisting force on semiflexed knee. (twisting extension. Lachman test and pivot shift test are used to diagnose the ACL tear. X-Ray, MRI and Arthroscopic evaluation are key for diagnosis. Lachman test is the most sensitive test for diagnosis of ACL tear even in acute injuries. Conservatively most cases of grade 1 and grade 2 injuries can be successfully treated. Newer technique of arthroscopic repair of ACL gives better results. Surgical treatment was far superior in producing functional results. Distribution of post-operative Lachman grading of study subjects. Grade 0 in 60.00% and Grade 1 in 40.00% Proportion of patients with lysolm score:- excellent, good, fair was significantly lower in pre-operative as compared to post-operative. (Excellent:- 0% vs 28% respectively, Good:- 0% vs 66% respectively, Fair:-0% vs 4% respectively). Our results are coinciding with the literature.

## KEYWORDS :

### INTRODUCTION

ACL is an intra-articular and extra synovial ligament of knee joint.<sup>[1]</sup> ACL prevents anterior translation of tibia on femur and also provides sagittal plane stability. It prevents hyperextension of knee. ACL injury occurs as result of twisting force on semiflexed knee. (twisting, extension. X-Ray, MRI and Arthroscopic evaluation are key for diagnosis. Lachman test is the most sensitive test for diagnosis of ACL tear even in acute injuries.

Conservatively most cases of grade 1 and grade 2 injuries can be successfully treated. After a few weeks the swelling subsides and adequate strength can be regained by physiotherapy. With availability of newer technique better results have been achieved by operative methods.

Operative Three Portal technique- First portal is High antero-lateral portal which is placed 1 cm lateral to the patellar tendon and most inferior portion of the portal at the level of inferior pole of patella. It permits a broad and unobstructed view of ACL Tibial attachment. Second portal is Central portal which is placed using a spinal needle under arthroscopic visualization following the orientation of previous ACL fibers. This allows a straight forward view of ACL femoral remnants and Bony landmarks in the intercondylar notch.

### Review Of Literature

Bony landmarks certainly play a prominent role. <sup>[2]</sup> Failure of ACL reconstruction commonly results from any combination of 3 factors: biological factors, new traumatic event, and errors of surgical technique. <sup>[3]</sup>

The major evolution in ACL surgery came with the emergence of double bundle reconstruction. Rehabilitation will continue to play a major factor in achieving optimal surgical outcomes. In 1988 MJ Freidman pioneered use of four stranded hamstring in arthroscopic assisted technique. In 1992 Tom Roseberg devised Endobutton as fixation device for ACL reconstruction.

Clancy, Ray et al in 1988 compared the conservative treatment of ACL injuries with surgical treatment and found that the surgical treatment was far superior in producing functional results.

The usefulness of knee braces and the use of knee braces post operatively for six months to protect the graft. Recent studies have proved endobutton and bone mulch screw have a very high yield load

than any other fixation device.

ACL reconstruction with hamstring autograft has its advantages of lesser donor site morbidity, absent anterior knee pain, less occurrence of patella fracture, easy harvesting of graft, reduced loss of extension postoperatively. It also has good biomechanical strength and stiffness near to bone patellar tendon graft.

### Functions Of Acl

Anterior cruciate ligament along with other intra articular and extra articular ligaments, functions in maintaining static and dynamic equilibrium of the knee joint and also control and limit the motion.

### Mechanism Of Injury

In isolated ACL injury the mechanism of injury was mostly deceleration, internal or external rotation and hyperextension.

### Principles Of Arthroscopy

Good visualization, palpation of the intra-articular structures to arrive at an accurate diagnosis, planning the treatment strategy and work on the target site without damaging the surrounding tissues are the cornerstone of arthroscopy.

### Anterolateral Portal:

This portal is located approximately 1cm above the lateral joint line and approximately 1 cm lateral to the margin of patellar tendon.

### Insertion Of Scope:

The portal sites should be infiltrated with 4 to 5ml of local anaesthetic agent mixed with epinephrine which reduces bleeding and postoperative pain.

### Clinical Evaluation

A twisting injury to the knee is usually the most common history. An audible pop during the injury, inability to walk after the injury and swelling of the knee joint over few hours are suggestive of anterior cruciate ligament tear. Non-contact injuries are commonly associated with ACL tear. In hyperextension injuries ACL is torn first.

The tests for cruciate ligaments, collateral ligaments and meniscus are done. The diagnosis is done followed by planning of treatment. The common tests performed are Anterior drawer test, Lachmann's test, Slocum test, Pivot shift test, Macmurrays test for meniscus, Valgus and varus stress test for collateral ligaments and Jerk test or reverse pivot shift test.

### Radiographic Evaluation

Radiographs which include anteroposterior and lateral views of the knee needed to look for fractures.

### Magnetic Resonance Imaging

The accuracy of MR imaging for evaluation of ACL pathology is high. Direct MR imaging signs of acute ACL tear include poor or non visualization of the ACL on sagittal images, an amorphous edematous mass with focally increased signal on T2-weighted images, irregular contour with wavy redundant fibers, or interruption of fibers with tears seen at mid substance or at the tibial or femoral attachments.

### Examination Under Anaesthesia And Patient Positioning

All patients are operated under spinal anesthesia. In supine position under anesthesia anterior drawer test, posterior drawer test, Lachmans test, pivot shift test are done

### Arthroscopic Acl Reconstruction Technique

The technique used was based on the creation of one femoral and one tibial tunnel with centres corresponds with centre of ACL femoral and tibial attachment sites.

Harvested graft was fixed on the femoral side with one endobutton continuous loop and on the tibial side with one interference screw.

### Sites of Port Insertion

The normal and defective parts were examined. Once all the pathologies were recorded.

### Hamstring Graft Harvestation

A 3 to 4 cm oblique incision is placed over the anteromedial aspect of tibia (4cm distal and 3 cm medial to medial joint line and tibial tubercle respectively) exactly over the pes anserinus which is identified by palpating the semitendinosus and gracilis tendon by running the fingers from above downwards in the anteromedial aspect of the upper tibia. The tendons slip under the finger like the bumps of speed breakers, the lowest one being semitendinosus.

After placing the knee in 90–100 degrees of flexed position, the tendon was dissected proximally while constant traction was applied through the threads. Special consideration was given to the consistent fibrous band approximately 8-10 cm proximal to tendon insertion, which was released using Mayo's scissors. Once the tendon was free, traction was given and the taut tendon was felt in popliteal fossa from outside to confirm its distal position.

Then a closed-end stripper was passed over the tendon and advanced carefully in line with it giving firm, steady but gentle pressure and simultaneously applying counter-traction using the previously placed suture. After harvesting the graft was placed on graft master board. They were stripped of their residual muscle fibers proximally using the blunt end of scalpel blade.

The tendon end were carefully trimmed to uniform size, verified, measured and made of equal lengths. They were placed together and using a number 5 Ethibond suture a running baseball stitch was placed in tendon in a Chinese finger trap configuration. About 3-4 cm of both ends of tendon was stitched together. The tendon was looped (using an umbilical tape around the stitched tendons) and passed through various holes in the graft sizer. The diameter of reamer chosen for subsequently making the tunnels was equivalent to smallest sizing sleeve that passed over the four stranded graft with minimal friction.

Circular marks were made 3cm distal to loop proximal end for ensuring exact placement of graft inside the femoral tunnel while viewing through arthroscope. The loop of the quadrupled tendons was then tied to the graft master posts and a pressure of about 15 pounds was applied for 10-15 minutes for pre-stressing the graft.<sup>[4]</sup>

### Arthroscopic Reconstruction After Graft Harvestation

#### Intraarticular Preparation

(Anterolateral portal for inserting scope and anteromedial portal for inserting instruments and central portal for better visualization and femoral tunnel placement)

The arthroscope is introduced through the anterolateral portal and the 4mm or 5mm shaver blade is inserted through the anteromedial portal and the joint is debrided of the ligamentum plicae, some pad of fat and

some synovial reflections which hinder a through visualization of the medial surface of lateral femoral condyle, the over the top position and the tibial foot print of the anterior cruciate ligament. The medial surface of the lateral femoral condyle is shaved of the native ACL remnants and the over the top position is identified without misinterpreting the residents ridge. Then the ACL foot print in the tibia is prepared. Throughout this joint debridement undue care is taken to avoid injury to the native posterior cruciate ligament.

### Femoral Tunnel Preparation

With the help of 6mm or 7 mm femoral offset aimer, guide wire was drilled from entry point. After drilling to 3mm, knee was flexed upto 120 degree, drilling was continued until guide wire tip visualized on lateral aspect of distal thigh. Once confirmed guide wire was exactly in middle of anteroposterior cortex of distal femur.<sup>[5]</sup>

Femoral tunnel was created with 4.5 mm drill bit, drilling both near and far cortex and tunnel length was measured with depth gauge. Femoral side of the prepared graft was measured with sizer, with that diameter drill bit, femoral tunnel was reamed without reaming 15 to 20 mm of lateral Cortex of the femoral tunnel based upon the length of the graft. Once tunnel prepared, beath pin with Ethibond at its end was passed into femoral tunnel for easier passage of prepared graft.

### Tibial Tunnel Preparation

The tibial tunnel is made using the 'Tibial Guide'. The tibial guide pin was drilled and brought at 7mm anterior to intact PCL or remnant of ACL. The tibial tunnel is reamed using cannulated drills over this guide pin up to the measured width of the hamstring tendon. Care is taken not to form a vertical tunnel. The tunnel intra articular edges are smoothened using the automated shaver leaving remanant of ACL for better proprioception.<sup>[6]</sup>

### Graft Preparation, Passage And Fixation

After graft preparation, based on the length of the graft, it is quadrupled, loop part of the graft is connected to endobutton with looped silk (length of the silk based upon graft length and unreamed femoral tunnel length). Ethibond sutures which were already inside the joint was pulled out through tibial tunnel and connected to white and blue threads of ethibond. With the help of these ethibond sutures, both the threads were pulled through tibial tunnel and brought via femoral tunnel followed by pulling the graft from tibial to femoral tunnel. By alternative pulling of both the threads, graft was passed and position was confirmed by sudden absence of resistance and flipping of endobutton.

Once graft positioned, tensional loading of the graft was applied by 20-30 cycling maneuver by repeated flexion and extension of knee with the graft kept in constant pull from tibial side. Once satisfactory cyclical loading was achieved, reconstructed graft was visualized by viewing portal and looked for any graft impingement, graft laceration and proper alignment of graft.



### Post-operative C-arm Image

Graft on tibial entry site was fixed with titanium interference screw of appropriate length over guide wire. Intra-articular placement of screw also visualized with arthroscope. Remaining part of the graft outside the tunnel was sutured with fascia.

### Post Operative Management

Immobilisation in knee brace and limb elevation immediate post operatively. Intravenous antibiotics were given post-operatively for 3 days. Drainage tube was removed on 2<sup>nd</sup> post operative day. Wound was inspected on 2<sup>nd</sup>, 5<sup>th</sup>, 7<sup>th</sup> post operative day. The Sutures were removed on 12<sup>th</sup> postoperative day. Gradual physical rehabilitation was

started from day 1.

1. Post-operatively, patients were followed up at 3, 6 weeks and 3, 6 months.

**Goals:** Full range of motion (ROM), normal gait pattern, stability of the knee joint, pain free movement.

After 6 weeks – 3 months, gaining full knee range of motion, normal gait including step climbing and descending.

At 6 months- Gaining full activity and resuming sports activity Ability to bear weight (graded as full, partial, or impossible) was assessed preoperatively and at 6 weeks, 3 months, 6 months.

## MATERIALS AND METHODS

### 1. Study population

Patients aged between 18 to 45 years of either sex

### 2. Sample Size

Minimum 50 patients having ACL tear

### 3. Sampling technique

Simple random sampling technique

### 4. Operational definition

Three Portal Technique is a modality for treating ACL tear.

Study requires the following investigations.

- MRI of Knee
- X-ray of the affected knee joint in anteroposterior view & lateral view.

## OBSERVATIONS AND RESULTS

Intra-operative femoral and tibial attachment of ACL insertion was analyzed and results are as follows.

### Distribution of age(years) of study subjects.

In present study, 26(52.00%) patients belonged to age group 31-40 years. Age group was 18-30 years of only 24 out of 50

### Distribution of mode of injury of study subjects.

In majority [29(58.00%)] of patients, mode of injury was sports injury followed by self fall [14(28.00%)]. Mode of injury was road accident in only 7 out of 50 patients (14.00%).

### Distribution of side of knee injured and diagnosed of study subjects.

Left knee was injured 28.00% and Right knee was injured 72.00% times.

### Distribution of post-operative Lachman grading of study subjects.

Grade 0 in 60.00% and Grade 1 in 40.00

## DISCUSSION

Intra-operative femoral and tibial attachment of ACL insertion was analyzed. All patients underwent the three-portal ACL repair using trans-portal approach with single bundle hamstring graft and anatomical placement.

**Sherman MF et al** found that among 50 cases needing primary ACL repair, 80.0% cases were sports-related injuries, with football being the predominant sport.

### Comparison of Lachman grading between pre-operative and post-operative.

Proportion of patients with lachman grading:- grade 2, grade 3 was significantly higher in pre-operative as compared to post-operative. (Grade 2:- 54% vs 0% respectively, Grade 3:- 46% vs 0% respectively).

Proportion of patients with lachman grading:- grade 0, grade 1 was significantly lower in pre-operative as compared to post-operative. (Grade 0:- 0% vs 60% respectively, Grade 1:- 0% vs 40% respectively). (p value<0.0001)

### Comparison of Lysolm score between pre-operative and post-operative.

Proportion of patients with lysolm score:- excellent, good, fair was significantly lower in pre-operative as compared to post-operative. (Excellent:- 0% vs 28% respectively, Good:- 0% vs 66% respectively, Fair:-0% vs 4% respectively).

## SUMMARY AND CONCLUSION

In majority [36(72.00%)] of patients, presenting complaint was instability of knee followed by knee pain and swelling [10(20.00%)]. In majority [29(58.00%)] of patients, mode of injury was sports injury followed by self-fall [14(28.00%)]. Mode of injury was road accident in only 7 out of 50 patients (14.00%).

Proportion of patients with lachman grading:- grade 2, grade 3 was significantly higher in pre-operative as compared to post-operative. (Grade 2:- 54% vs 0% respectively, Grade 3:- 46% vs 0% respectively). (p value<0.0001)

**Proportion of patients with lysolm score:-** poor was significantly higher in pre-operative as compared to post-operative. (Poor:- 100% vs 2% respectively). Proportion of patients with lysolm score:- excellent, good, fair was significantly lower in pre-operative as compared to post-operative. (Excellent:- 0% vs 28% respectively, Good:- 0% vs 66% respectively, Fair:-0% vs 4% respectively).

Thus the three portal technique of ACL repair using trans-portal approach with single bundle hamstring tendon autograft and anatomical placement is associated with good outcomes.

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