



Original Article

One Year Follow Up of Arthroscopic Double Bundle ACL Reconstruction with Internal Bracing

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ABSTRACT

Introduction: Anatomically anterior cruciate ligament (ACL) consists of two bundles, anteromedial and posterolateral bundle. These two bundles play different roles in biomechanics and stability of knee joint. (1) As the knee flexes, anteromedial bundle tightens and posterolateral bundle is relatively lax. In knee extension the posterolateral bundle tightens (1). The essence of anatomical double bundle ACL reconstruction lies in reproducing the natural anatomy of ACL and hence the natural biomechanics.

Purpose: To assess results of one year follow up of double bundle ACL reconstruction with internal bracing.

Methods: Retrospective evaluation of results of double bundle ACL reconstruction with internal bracing. Total 100 knees were included in this study. All patients met our inclusion criteria and the results were evaluated by Tegner Lysholm Knee Scoring Scale and lachman test at the end of one year.

Results: At the end of one year the average Tegner Lysholm Knee Scoring Scale increased from a pre op value of 52 (39 to 58) to a post op value of 89 at the end of one year. (74 to 94). All patients demonstrated a negative lachman's test. Three patients had flexion deformity between 5 to 10 degrees. Ten patients missed follow up. 15 patients had more than 15-degree loss of motion. One patient complained of abnormal painless clicking sensation. None of the patients were reoperated. None of the patients had infection.

Conclusions: double bundle ACL reconstruction is worth recommending for patients. Its technically demanding. Although, at present Superiority of this technique from conventional single bundle ACL reconstruction is not established but theoretically it reproduces natural knee kinematics and biomechanics by reconstructing the natural anatomy of ACL. Internal bracing may protect the newly reconstructed ACL bundles from trauma in early post op period.

Keywords: Double, bundle, ACL, reconstruction, internal, bracing.

INTRODUCTION

Anterior cruciate ligament (ACL) has two bundles, anteromedial and posterolateral bundle. These two bundles have different roles in biomechanics and kinematics and hence stability knee joint⁽¹⁾ As the knee flexes, anteromedial bundle tightens and posterolateral bundle is relatively lax. In knee extension the posterolateral bundle tightens⁽¹⁾. These two bundles have different femoral origin. The anteromedial bundle arises from a more proximal and anterior location in the femoral condyle (high and deep in the notch when the knee is flexed at 90 degrees); the posterolateral bundle arises from the distal and posterior part of the femoral condyle (shallow and low when the knee is flexed at 90 degrees). At the tibial insertion, the anteromedial bundle lies in the anterior part and the posterolateral bundle in the posterior part of the ACL

footprint. The anteromedial bundle is the primary restraint against anterior tibial translation, the posterolateral bundle stabilizes the knee in near full extension, particularly against rotatory loads⁽¹⁾. The femoral origin was described as oval shaped with a longitudinal diameter of 18 mm and a width of approximately 11 mm^(2,3). Due to the oval shape of the femoral condyles, the position of the joint axis varies during flexion in the sagittal plane⁽⁴⁾. This oval/flat structure of the ACL plays an important role in stabilizing the knee joint under different flexion angles and, therefore, compensating for shifting knee flexion axes^(5,6). The AM bundle tends to stabilize the knee at higher flexion angles whereas the PL bundle has been shown to stabilize effects on the anteroposterior and rotational forces in near-to-extension positions of less than 30 degree^(1,7,8). Suture tape internal bracing of bone-patellar tendon-bone allograft ACL reconstruction has been experimentally shown to provide the initial construct stability by decreasing the cyclic displacement, which has clinical implications regarding initial construct stability.⁽⁹⁾ The internal suture augmentation acts as a backbone supporting and protecting the graft until the process of healing and ligamentization of the graft is completed. It also allows early return to activity by providing more secure rehabilitation and prevents early failure and stretching of the graft⁽¹⁰⁾. So, in this study we presume that the double bundle ACL reconstruction with fibre tape internal bracing has the advantage of reproducing the natural kinematics of knee and a better rotational stability. Additional internal bracing with the fibre tape tends to augment the newly reconstructed ligament, protects it till ligamentisation is complete and helps in accelerated rehabilitation and recovery.

METHOD:

Retrospectively evaluation of results of double bundle ACL reconstruction with internal bracing. Total 100 knees were included in this study. Inclusion criteria was all male female patients were not included in the present study as female has a smaller notch.⁽⁹⁾ As in author's opinion double bundle ACL would stuff the smaller notch in females and may lead to impingement. All patients who met the inclusion criteria, were operated by single surgeon after taking written informed consent from the patients. Regular follow ups were done and the results were evaluated by Tegner Lysholm Knee Scoring Scale and lachman test at the end of one year. The rationale for double bundle acl reconstruction is to restore the native anatomy of the ACL this is done by identifying the femoral and tibial insertion sites of both the anteromedial (AM) and posterolateral (PL) bundles. The implanted bundles can match the measured dimensions of the patient's native ligament to individualize ACL reconstruction for that patient. Fibretape was used in all patients which will prevent the newly reconstructed ACL until the process of ligamentisation is complete. Finally, these bundles can be independently tensioned to act as the native ligament does at varying degrees of knee flexion and rotation.

Technique

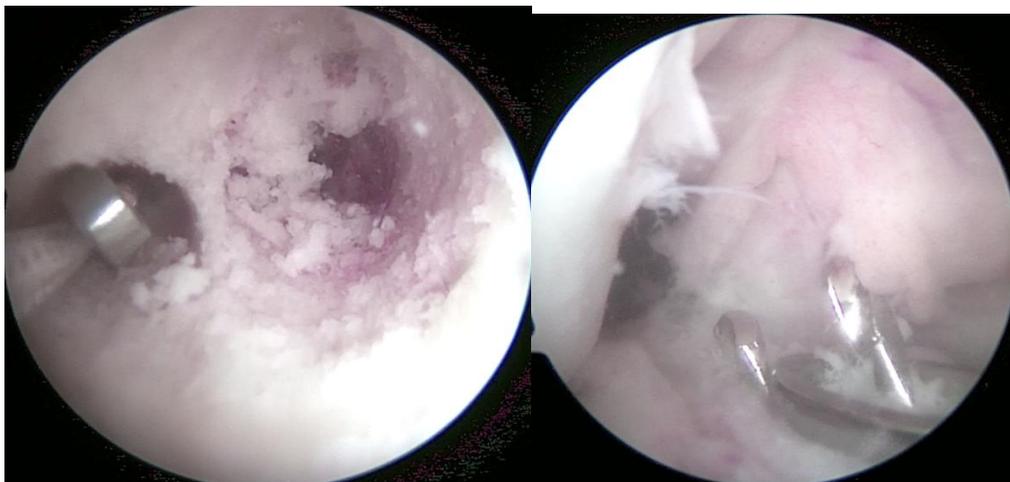
- Under all aseptic precautions the patient is positioned on the OT table under spinal anaesthesia. Position should allow the operative limb to be flexed maximally around round 110 to 120 degree. We used tourniquet.
- Two standard portals a tight and high anterolateral portal and a low antero medial portal were utilized for visualisation.
- These two portals give an excellent view of ACL stump on the tibia and the medial surface of lateral femoral condyle respectively.
- Looking from the antero- lateral portal, the ACL insertion site on tibia is identified, debrided carefully and marked with a radio frequency device.
- We ensure at least a 10 mm of bone bridge between the two tunnels so that the tunnels shouldn't coalesce.

All tunnel diameters should match the diameter of their respective grafts.

Tibial tunnels

A standard medial incision is taken between the anterior border and medial crest of India. A tip directed aiming device is centered at the marked footprints of both the tunnels, first with 55 degrees for PL bundle and then with 45 degrees of AM bundle respectively. Guide wire is passed through a more medial position from antero-medial tibial surface for the PL bundle and then through a more lateral position on the antero-medial tibial surface for the AM bundle. Then both tunnels are reamed and drilled to the desired diameter and length respectively.(Fig;1) There should be a sufficient bone bridge around 10 mm between the both tunnels on the antero-medial tibial surface after reaming.

For femoral insertion a guide wire is advanced through AM portal, 5 to 7 mm below the overtop position for the AM bundle first and then using a 5 mm offset with the same portal for the PL bundle. The tunnels are then reamed and drilled to the desired diameter and length respectively.(Fig; 2)



FIGURE; 1 The two tibial tunnels

FIG; 2 The two femoral tunnels



FIGURE ;3 The two reconstructed ACL bundles

Graft passage

The harvested and prepared soft tissue graft is shuttled and passed through their respective tunnels (Fig; 3) with the help of fibre wire. First we pass the PL bundle and then the AL bundle. The grafts are then secured with suspensory fixation on the femoral side and with interference screw fixation on the tibial side. The grafts are then checked both in flexion and in extension. The grafts should be tight in extension and should cross each other in flexion. This shows our tunnels are anatomical.

Post op

Postoperatively, the patient's knee is immobilized in a knee brace locked in full extension. Weight bearing as tolerated was allowed from the day of surgery. The brace is typically discontinued after 3 weeks. The focus of the first 6 weeks is to regain ROM. Thereafter gradually strengthening exercises were added. Squats and leg presses were added after 4 weeks. Open kinetic chain exercises were added after 6 weeks. Return to sports with Cutting and pivoting activities are permitted between 9 and 12 months. .

DISCUSSION

The two-bundle structure of ACL was first described by Weber brothers (9) in the year 1836. The main indication of ACL reconstruction surgery is the recurrent and frequent instability episodes in ACL injury patients (10,11)

High demand persons, such as Sports men and athletes should be treated operatively. (12,13)

Single bundle ACL reconstruction is considered to be the gold standard but it recreates only the AM bundle.(14) In an attempt to recreate the natural anatomy of the knee , double bundle ACL reconstruction started(14)

The rationale for double bundle ACL reconstruction is that it recreates the natural anatomy and hence the kinematics and biomechanics. The combined thickness of both the bundles exceeds that of a single bundle. So this double bundle ACL

construct is more stable and provides more strength also. Theoretically the PL bundle reconstructed separately, will provide a better rotational stability as compared to the single bundle.

RESULTS.

At the end of one year the average Tegner Lysholm Knee Scoring Scale increased from a pre op value of 52 (39 to 58) to a post op value of 89 at the end of one year. (74 to 94). All patients demonstrated a negative lachman's test. Three patients had flexion deformity between 5 to 10 degrees. Ten patients missed follow up. One patient complained of abnormal painless clicking sensation. None of the patients were revised. None of the patients had infection.

CONCLUSIONS:

Double bundle ACL reconstruction is worth recommending for high demand patients like sportsmen and in athletes . Its technically demanding as we have to accommodate the two bundles in a small area. Although, at present Superiority of this technique from conventional single bundle ACL reconstruction is not established but theoretically it reproduces natural knee kinematics by reconstructing the natural anatomy of ACL. Internal bracing may protect the newly reconstructed ACL bundles from trauma in early post op period.

C.O.I: The authors declare no conflict of interest

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