

COMPARATIVE STUDY OF ARTHROSCOPIC SINGLE BUNDLE ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION AND NON-ANATOMICAL DOUBLE BUNDLE WITH SINGLE TIBIAL TUNNEL ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH SEMITENDINOSUS ± GRACILIS AUTOGRAFTS USING LAXOMETRY

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ABSTRACT

BACKGROUND

The knee joint is the most commonly injured of all joints and the ACL is the most commonly injured ligament. Arthroscopic reconstruction of ACL has become gold standard in treating these injuries.

AIM

1. To compare the short-term results of ACL reconstruction using single bundle (one Tibial + one Femoral tunnel) and non-anatomical double-bundle (one Tibial + two Femoral tunnels) techniques using Hamstrings (Semitendinosus ± Gracilis) graft.
2. To evaluate ACL graft reconstruction stability measured by laxometry and to find out an association with clinical findings.

MATERIAL & METHODS

We performed a prospective study between 2014-2015 of 20 case of ACL injuries & compared single bundle reconstruction with Non – anatomical double Bundle reconstruction with semitendinosus ± Gracilis, Autograft using laxometry.

CONCLUSION

Arthroscopic Non-anatomical double ACL Reconstruction is Bio-mechanically stable reconstruction resembling anatomy of the ACL.

KEYWORDS

Anterior cruciate ligament (ACL), Arthroscopic reconstruction, Hamstring auto graft.

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INTRODUCTION: The knee joint is the most commonly injured of all joints and the anterior cruciate ligament is the most commonly injured ligament.¹

The Anterior Cruciate ligament (ACL) is the primary stabilizer of the knee and it prevents the knee against anterior translation and counteracts the rotational and valgus stress.^{2,3,4,5} After ACL injury, most patients experience recurrent episodes of instability, pain and decreased function.

Reconstruction of ACL is essential to restore the stability of the knee and allows the patient to return to a pre trauma activity level and delays the occurrence of associated meniscal injury and onset of osteoarthritis.⁶ The incidence of associated cartilage damage in acute tears is reported at 15 -40% whereas it increases to 79% in chronic tears.⁷

Arthroscopic reconstruction of torn ACL has become the gold standard in treating ACL tears.⁸ The surgical reconstruction of the anterior cruciate ligament with Hamstrings autograft represents an attempt to re-establish knee kinematics.⁹

AIMS & OBJECTIVES: This study had the following aims:

1. To compare the short-term results of ACL reconstruction using single bundle (one Tibial + one Femoral tunnel) and non-anatomical double-bundle (one Tibial + two Femoral tunnels) techniques using Hamstrings (Semitendinosus ± Gracilis) graft.
2. To evaluate ACL graft reconstruction stability measured by laxometry and to find out an association with clinical findings.

MATERIALS AND METHODOLOGY:

Inclusion Criteria:

- Age 18-45 years.
- Willingness to participate and follow up.
- No prior knee surgery.
- Normal contralateral knee.

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- Clinical evaluation of instability by surgeon.

Exclusion Criteria:

- ACL injuries with associated intra articular fractures.
- ACL injuries with PCL and collateral ligament injury.
- Osteoarthritic changes in X ray.

METHODOLOGY:

SURGICAL TECHNIQUE: After giving anaesthesia, on operating table patient knee examined clinically, diagnostic arthroscopy was done and ACL tear was confirmed, incision was given on pes anserinus and semitendinosus ± gracilis tendon was harvested and prepared, notch plasty was done when impingement was suspected, after placing tibial and femoral tunnel graft passed and fixed with interference screw and wound closed and protocol rehabilitation protocol followed and periodically followed the patient at 3 and 6 months period.

EVALUATION: The patients were evaluated with Lachman’s test, anterior drawer test, pivot shift tests, post-operative laxometry x rays were taken and all the patient documented with International Knee Documentation Committee Score-2000 (IKDC-2000) and grades were given accordingly.^{10,11,12,13}

RESULTS: The prospective study consists of 20 (10 cases SB+10 cases Non-anatomical DB) patients who had undergone Arthroscopic ACL reconstruction using semitendinosus ± Gracilis autograft in this study majority of the patients were in age group of 26-35 yrs of age, and majority were males and left knee were involved in majority, majority of patient presented within 3 months of injury, meniscal injury were associated in majority of the patients.

Results of manual knee laxicity test before single bundle v/s non-anatomical double bundle ACL reconstruction: Manual knee laxity test were performed in all cases of ACL injury. First it was performed in normal knee which was taken as standard of that patient than it was performed in injured side.

It was recorded as +, ++, +++ (if positive) and-(if negative). Anterior Drawer Test, Lachman test and Pivot shift test were positive in 100%. Various grades of these tests shown in (Table IX).

Sl. No.	Test	Negative	Positive +	Positive ++	Positive +++
1	Lachman test	0	4/0	6/4	0/6
2	Anterior Drawer Test	0	6/2	4/2	0/6
3	Pivot shift	4/0	4/2	2/6	0/4

Table 1

Results of knee laxity test after single bundle v/s non-anatomical double bundle ACL reconstruction: Two cases were last follow up (1case SB & 1case non-anatomical DB). Results of single bundle ACL reconstruction were 8 cases were negative Lachman test, 2 cases were+

positive. Results of non-anatomical double bundle ACL reconstruction were all cases were negative Lachman test. Results of Anterior Drawer Test after single bundle ACL reconstruction were 8 cases were negative, 2 cases were+ positive, after non-anatomical double bundle ACL reconstruction were all 10 cases were negative.

Results of Pivot shift test after single bundle & non-anatomical double bundle ACL reconstruction all cases were negative.

There were no cases of severe instability in our series with ++ and +++ positive for Lachman test, Anterior drawer test and Pivot shift test.

Sl. No.	Test	Negative SB/NADB	+Positive SB/NADB	++Positive SB/NADB	+++Positive SB/NADB
1	Lachman test	7/9	2/0	0	0
2	Anterior Drawer Test	7/9	2/0	0	0
3	Pivot shift	9/9	0	0	0

Table 2

Results in ACL reconstruction: We had 4 cases of Single bundle, 7cases of Non anatomical double bundle with excellent results, 3 cases of Single bundle 2cases of Non anatomical double bundle had good results, 2 case of single bundle had fair result and no poor results in our study.

Sl. No.	Results	Single bundle	Non anatomical double bundle
1	Excellent	4	7
2	Good	3	2
3	Fair	2	0
4	Poor	0	0

Table 3

No major complication were seen in our series, 2 cases had difficulty in regaining the motion. There were no cases in our series which had graft avulsion and graft impingement. There were 1 case of superficial infection which were all treated and responded well to intravenous antibiotics.

DISCUSSION & CONCLUSION: This was prospective study was conducted in NRI institute of medical sciences, Vishakhapatnam, to clinically evaluate the results of arthroscopic single bundle v/s Non-anatomical double bundle anterior cruciate ligament reconstruction.

ACL has two bundles both has biomechanically different functions,¹⁴ previously ACL was reconstructed using single bundle but recent literature evidence supporting that reconstituting with two bundle has more biomechanically stable than single bundle reconstruction.¹⁵

ACL non-anatomical double bundle reconstruction aims to reconstruct the two bundles of AM and PL as close to anatomical position as possible thus theoretically provides stability and knee kinematics close to the anatomical ACL.¹⁶

Since we reconstruct the two femoral bundle AM and PL bundle and one tibial bundle, PL bundle is stretched in extension and the AM in flexion. Thus the two bundles are

under tension or relaxed at different angles of flexion, providing anterior and rotational stability.

The statistically analysis comparing the preoperative and post-operative Lachman test, Anterior drawer test and pivot shift test were highly significant suggesting that Non-anatomical double bundle ACL reconstruction provides anterior and rotational stability.

This subjective study suggests the most of patient undergoing non-anatomical double bundle ACL reconstruction were satisfied with results and achieved preinjury status.

In a study by Lohmanders et al¹⁷ showed that single bundle reconstruction was associated with limitation of knee functions, in various biomechanical studies showed that double bundle reconstruction closed to intact knee.¹⁸

In a clinical study conducted by Kazunori et al¹⁹ and Hiroto Asagumo²⁰ showed that double bundle ACL reconstruction has good outcome compared with single bundle ACL reconstruction.

CONCLUSION: Arthroscopic Non-anatomical double bundle ACL reconstruction is bio-mechanically stable reconstruction closely resembling the anatomy of the ACL. It is good option for the ACL reconstruction in the treatment of athlete and high demanding patients who has to undergo pivoting most often in their life time as Non-anatomical double bundle reconstruction aims to restore anterior drawer and rotational stability.

Long follow up studies are required in future to know long term outcomes of this procedure moreover this arthroscopic procedure has a long learning curve and should be performed by experienced arthroscopic surgeon.

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