# Saving Versus None Saving of Anterior Cruciate Ligament Remnant in Arthroscopically Assisted Anterior Cruciate Ligament Reconstruction(ACLR)

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# ABSTRACT:

**BACKGROUND:** 

Anterior Cruciate Ligament injury is one of the most common injuries of the knee and reconstruction is a commonly done surgical procedure. Successful outcome depend on factors that affects the stability like anatomic graft placement and secure fixation and other factors that affects the proprioception and revascularization of the graft like preservation of the ACL remnant which is used to reduce repeated graft rupture.

**OBJECTIVE:** 

To compare the effect of saving of ACL remnant versus none saving on functional outcome and stability of the knee joint postoperatively.

**PATIENTSANDMETHODS:** 

A prospective comparative non randomized study was used on 30 patients (28 male and 2 female) who underwent arthroscopic ACLR. The patients were divided into 2 groups (A and B), in group A (15 patients), reconstruction was done without saving of ACL remnant and in group B (15 patients), saving of the ACL remnant was performed. In one year follow up the result was compared according to the anterior drawer, Lachman, Pivot shift tests and Lasholm score changes (preoperative and postoperative).

**RESULTS:** 

Regarding to Lasholm score the result was better in group B than in group A which was statistically significant (p value = 0.025). The knee stability was better in group B than in group A which was statistically insignificant.

**CONCLUSION:** 

It is recommended to save the ACL remnant if possible with better knee joint functions and less repeated graft rupture.

**KEYWORDS:** saving ACL remnant, anterior cruciate ligament.

## **INTRODUCTION:**

Anterior cruciate ligament tear is a common injury during athletic activity and nearly half of these injuries occurs in  $isolation^{(1)}$ . Ninety percent of knee ligament injuries occurs in young and active individuals<sup>(2)</sup>. Most ACL tears occur from indirect injuries with majorty of these tears occurring in female up to nine times more than male<sup>(3)</sup>. Rarely ACL tears occurs in isolation, about 41% to 82% of tears occurs in association with other injuries of the knee such as collateral ligaments or menisci<sup>(4)</sup>. The Lachman test is the most sensitive test to determine the stability of the knee and a possibility of ACL tear<sup>(5)</sup>. Magnetic resonance imaging is the most sensitive study used usually to diagnose ACL injury in the United States, with Its ability to diagnose associated meniscal injury, collateral ligament tear, and bone

contusions<sup>(5)</sup>. A successful outcome is depend on many factors including, age, occupation, hobbies ,patient selection, activity, anatomic graft placement with secure fixation, incorporation of graft, revascularization of graft and ligamentization (process of healing of the graft<sup>(8,16,17,18)</sup>.Treatment consists of conservative or operative, with the operative treatment being the better option for patients who wish to return to athletic activity. Those who underwent surgery must commit to do good physiotherapy for the best result <sup>(3)</sup>. Anterior cruciate ligament (ACL) reconstruction using graft commonly done surgical procedure with more than 80,000 to 100,000 operation per year in united state<sup>(6)</sup>. Usually the remnant fiber are removed and traditional reconstruction of ACL is done. But

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## **CRUCIATE LIGAMENT RECONSTRUCTION**

with more understanding of the anatomy of double bundle ACL, the remnant tissue saving with single bundle augmentation of the injured bundle also suggested<sup>(7)</sup>. There are four types of ACL remnant: Type 1 partial tear of ACL remnant either anteromedial(AM) or posterolateral(PL) bundle that still connect the femur to the tibia: Type 2 interruption of ACL completely at the femoral side; Type 3 interruption of ACL completely at tibial side; and Type 4 is a residual remnant of ACL not enough to form an envelope around the  $graft^{(7)}$ . The aim of this study is to compare the result of saving ACL remnant versus none saving in arthroscopically assisted ACL reconstruction on knee joint functions and stability.

#### **PATIENTS AND METHODS:**

A prospective comparative non randomized study was used on thirty patients 28 male and 2 female with mean age 31 years ranging from 24 to 38 years with chronic ACL tear of the knee diagnosed clinically, radiologically and with MRI. Eighteen patients left knee, 12 patients right knee. All the patients require ACL reconstruction during the period from 3/2/2014 to 3/2/2015. The patients were divided into two groups A and B, group A (15 patients) 14 male and 1 female, group B (15patients)14 male and 1 female. Admission for all patients to the orthopedic ward one day before operation, all required preoperative preparations were done, prophylactic antibiotics one hours before surgery was given, supine position, general anesthesia or spinal or epidural anesthesia were used, examination of

knee under anesthesia with(anterior drawer test, Lachman, and pivot shift). Pneumatic tourniquet, proper positioning of the knee to permit flexion to 130 degree, diagnostic arthroscopy to start with unless clear diagnosis of ACL injury clinically confirmed then it is usually to begin with tendon harvesting of gracillis, semitendenosis from the same limb, measuring its diameter and putting it in a moist area, then dealing with chondral or meniscal lesion through arthroscope, the remnant of ACL fiber shaved and removed and cleaned until well visualization of the femoral origin and tibial insertion of the ACL in all patients of group A, then femoral tunnel preparation and drilling followed by preparation and drilling of tibial tunnel, after that insertion of the graft and fixation interference biodegradable hv screw of appropriate diameter and length according to the measured femoral and tibial tunnels, then pretensioning with cyclic loading, closure of the wound, dressing and knee splint in extension. Patients in group B the same technique was used as in group A except saving of ACL remnant (femoral and tibial),(Figure 1 and 2) shows one of our patient operated on. All patients evaluated for stability of operated knee by Anterior Drawer, Lachman and pivot shift tests, 6 weeks, 3 months, 6 months and 12 months post-operative and only those patients with recurrent instability sent for MRI. Instability from (zero to 5 mm) was considered to be satisfactory according to grad 1 Lachman test. Lasholm score was used for assessment of the clinical outcome subjectively pre-operative and 12 months post-operative. The result of group A compared with group B.



F ig 1: Shows the ACL remnants.



Fig 2: A C L remnant.

#### **RESULTS:**

The time from injury to surgery relatively short which was ranging from three months to one year. Anterior Drawer test clinically measured was significantly better in group B than in group A. Lachman test was positive in 4 patients in group A and in 2 patients in group B while Pivot shift test was positive in 2 patients in group A and in 1 patients in group B, 12 months post-operative. Statistically there is no difference between group A and B with Lachman test (Pvalue = 0.65). The result of Pivot shift test also insignificant between the two groups( p value = 1.00). Rupture of graft occur in 1 patient in group B while in group A The successful result of ACL reconstruction depend on many foctors, including age, occupation, hobbies, patient selection, activity, accurate placemesecure graft fixation, incorporation, revascularization and ligmentization(process of graft healing)<sup>(19,20,21)</sup>.In addition to stability high quality proprioception after required ACL reconstruction<sup>(22,23,24)</sup>.mechanoreceptors and nerve ends present in the ACL remnant can enhance auto graft reinnervations<sup>(25,26,27)</sup>. Examination of human ACL remnant histologically shows their tendency for healing due to its vascular supply in

2patients developed graft rupture( p value = 1.00). The mean value of Lasholm score in group( A) was 70.2 pre-operative and 85.5 postoperative( table 1) which was statistically significant ( p value less than 0.001). The mean value of Lasholm score in group( B) was 66.9 pre-operative and 94.2 post-operative (table 1) which was statistically significant( p value less than 0.001). The difference of result of improvement between group( A) and improvement in group( B) was statistically significant( p value = 0.025). **DISCUSSION:** 

sheath(28,29). synovial Thus The saving mechanoreceptors and vascular supply in ACL remnant may improve joint positioning and revascularization of the graft. Most of them describe this technique as tissue preserving surgery <sup>(31)</sup>. In spite of improvement in ACL technique the risk of repeated ACL ruptures is 5.8% resulting in recurrence of giving way and instability<sup>(30)</sup>. Saving of ACL remnant tissue had been found to improve proprioceptive function and mechanical stability and it may reduce repeated ACL rupture <sup>(32)</sup>. Technique of ACL

Patients number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Group A	68	75	70	74	67	66	68	72	73	67	70	72	70	73	68
Lashlom															
Score															
Preoperative															
Group A	86	83	87	95	90	77	78	88	93	85	78	83	80	95	85
Lasholm															
Score															
Postoperative															
Group B	73	64	67	60	67	72	65	72	68	70	69	66	64	71	65
Lasholm															
Score															
Preoperative															
Group B	93	96	84	84	96	94	97	95	93	95	96	95	96	94	93
Lasholm															
Score															
Postoperative															

Table 1: Preoperative and Postoperative Lasholm Score for group (A) and (B).

#### **CRUCIATE LIGAMENT RECONSTRUCTION**

reconstruction that save the ACL remnant have give been found to а satisfactory result<sup>(9,10.11,12,13,14,15)</sup>. In this study ACL injury more common in male than in female which doesn't coinside with other study<sup>(3)</sup>. This can be partially explained as less participation of female in sport activity in our community. There is significant functional improvement statistically significant in both groups following ACL reconstruction, which also coinside with other studies<sup>(33,34)</sup>. Although Knee stability was better in group B, but it is insignificant statistically

between both groups. Lasholm score was statistically better in group B regarding the improvement and functional result(estimated marginal means of measure shows the difference) and it is might be due to the factors mentioned above. Despite the limitation in this study which include some difficulties in saving the remnant, short term follow up (long term follow up may provide some clinical result) and small sample size. This study shows some clinical benefit like reducing the incidence of repeated ruptures after primary ACL reconstruction.



The graph above shows the improvement in Lasholm score in both groups( A) and B) with obviously better score in group( B).(

# **CONCLUSIONS AND RECOMMENDATIONS:**

Saving of ACL remnant may enhance recovery of joint function and reduce the incidence of repeated graft rupture . So it is recommended to preserve ACL remnant if possible. Further studies required in future and large sample size with longer follow up to compare the result of this study with other studies for better clinical result. **REFERENCES:** 

- 1. De franco M, Bach B. A comprehensive review of partial anterior cruciate ligament tear. Bone Joint Surg. Am 2009;91:198-208.
- 2. Miyasaka K, Daniel D, Stone M, Hirshaman p. The incidence of knee ligament injuries in general population. Am J Knee Surg. 1991;4:3-8.
- **3.** Barber-Westen S, Noyes F, Galloway M. Jump-land charactristics and muscle-strength development in young athletes: a gender comparison of 1140 athletes 9 to 17 years of age. Am J SportsMed.2006;34:375-84.

- Bellabarba C, Bush- joseph C, Bach B. Pattern of meniscal injury in anterior cruciate-deficient knee: A review of literature. Am J Orthop(Belle Mead N J). 1997;26:18-23.
- 5. Cimino F, Volk B, Setter D. Anterior cruciate ligament injury. Am Fam Physician. 2010;828:917-22.
- 6. Postrone A, Ferro A, Bruzzone M, Bonasia E,Pellegrino P, D'Elicio D, et al. Anterior cruciate ligament reconstruction creating the femoral tunnel through the anteromedial portal, surgical technique. Curr Rev Musculoskeletal Med.2011;4:52-56.
- Chen J, Chen S, Weitao Z, Yinghui H, Yunxia L. Technique of arthroscopic anterior cruciate ligament reconstruction with preserved residual fibers as a graft envelope. Tech Knee Surg. 2008;7:70–77.
- **8.** David M, Junkin J, Darren L, Johnson, ACL Tibial remnant, to save or not. Sports Medicine Update.2008;31:32.

- **9.** Adachi N, Ochi M, Uchio Y, Uchio Y, Anter ior cruciate ligament augmentation under arthroscopy. A minimum 2-year follow-up in 40 patients. Arch Orthop Trauma Surg. 2000;120:128–33.
- **10.** Ahn J, Lee Y, Anterior cruciate ligament reconstruction with preservation of remnant bundle using hamstring autograft: technical note. Arch Orthop Trauma Surg. 2009;129:1011–15.
- **11.** Löcherbach C, Zayni R, Zayni R, Chambat P, Sonnery-Cottet B. Biologically enhanced ACL reconstruction. Orthop Traumatol Surg Res. 2010;96:810–15.
- 12. Ochi M, Adachi N, Deie M, Kanaya A. Anterior cruciate ligament augmentation procedure with a 1-incision technique: anteromedial bundle or posterolateral bundle reconstruction. Arthroscopy. 2006;22:463. e1 -5.
- **13.** Ochi M, Abouheif M, Abouheif M, Kongchar oensombat W, Nakamae A,Adachi N,Deie M . Double bundle arthroscopic anterior cruciate ligament reconstruction with remnant preserving technique using a hamstring autograft. Sports Med Arthrosc Rehabil Ther Technol. 2011;3:30.
- 14. Spindler K, Kuhn J, Freedman K, Matthews C, Dittus R, Harrell F. Anterior cruciate ligament reconstruction autograft choice: bone-tendon-bone versus hamstring: does it really matter? A systematic review. Am J Sports Med.2004;32:1986–95.
- **15.** Yasuda K, Kondo E, Kitamura N, Kawaguchi Y, Kai S, Tanabe Y. A pilot study of anatomic double-bundle anterior cruciate ligament reconstruction with ligament remnant tissue preservation. Arthroscopy. 2012;28:343–53.
- 16. Aglietti P, Giron F, Buzzi R, Biddau F, Sasso F. Anterior cruciate ligament reconstruction: bone-patellar tendon-bone compared with double semitendinosus and gracilis tendon grafts. A prospective, randomized clinical trial. J Bone Joint Surg Am. 2004;86:2143–15.
- 17. Bach B, Tradonsky S, Bojchuk J,Levy M, Bu sh-Joseph C, Khan N. Arthroscopically assisted anterior cruciate ligament reconstruction using patellar tendon autograft. Five- to nine-year follow-up evaluation. Am J Sports Med.1998;26:20–29.

- Beynnon B, Johnson R, Fleming B, et al. Anterior cruciate ligament replacement: comparison of bone-patellar tendon-bone grafts with two-strand hamstring grafts. A prospective, randomized study. J Bone Joint Surg Am.2002;84-A:1503–13.
- **19.** Aglietti P, Giron F, Buzzi R, Buzzi R, Sasso F. Anterior cruciate ligament reconstruction: bone-patellar tendon-bone compared with double semitendinosus and gracilis tendon grafts. A prospective, randomized clinical trial. J Bone Joint Surg Am. 2004;86:2143–55.
- **20.** Bach B,Tradonsky S,Bojchuk J, Levy M, Bus h-Joseph C, Khan N.Arthroscopicallyassisted anterior cruciate ligament reconstruction using patellar tendon autograft. Five- to nineyear follow-up evaluation. Am J Sports Med.1998;26:20–29.
- **21.** Beynnon B, Johnson R, Fleming B, et al. Anterior cruciate ligament replacement: comparison of bone-patellar tendon-bone grafts with two-strand hamstring grafts. A prospective, randomized study. J Bone Joint Surg Am.2002;84-A:1503–13.
- **22.** Barrett D. Proprioception and function after anterior cruciate reconstruction. J Bone Joint Surg Br. 1991;73:833–37.

- Barrena E, Nunez A, Ballesteros R, Martinez -Moreno E, Munuera L.Anterior cruciate ligament reconstruction affects proprioception in the cat's knee.Acta Orthop Scand. 1999;70:185–39.
- 24. Noyes F, Butler D, Paulos L, Grood E. Intraarticular cruciate reconstruction. Perspectives on graft strength, vascularization, and immediate motion after replacement. Clin Orthop Relat Res. 1983;172:71–77.
- **25.** Denti M,Monteleone M, Berardi A, Panni A. Anterior cruciate ligament mechanoreceptors. Histologic studies on lesions and reconstruction. Clin Orthop Relat Res. 1994;308:29–32.
- **26.** Georgoulis A, Pappa L, Moebius U, et al. The presence of proprioceptive mechanoreceptors in the remnants of the ruptured ACL as a possible source of reinnervation of the ACL autograft. Knee Surg Sports Traumatol Arthrosc.2001;9:364–68.
- 27. Ochi M, Iwasa J, Uchio Y, Sumen Y. The regeneration of sensory neurones in the reconstruction of the anterior cruciate ligament. J Bone Joint Surg Br. 1999;81:902–6.

**<sup>23.</sup>** Gomez-

- **28.** Arnoczky S. Blood supply to the anterior cruciate ligament and supporting structures. Orthop Clin North Am. 1985;16:15–28.
- **29.** Dhillon M, Bali K. Immunohistological evaluation of proprioceptive potential of the residual stump of injured anterior cruciate ligaments (ACL). Int Orthop. 2010;34:737– 41.

Wright R, Magnussen R, Dunn W, Spindler K. Ipsilateral graft and contralateral ACL rupture at five years or more following ACL reconstruction: a systematic review. J Bone Joint Surg Am. 2011;93:1159–65.

- **30.** Crain E, Fithian D, Paxton E, Luetzow W. Va riation in anterior cruciate ligament scar pattern: does the scar pattern affect anterior laxity in anterior cruciate ligament-deficient knees? Arthroscopy. 2005;21:19–24.
- **31.** Fithian D, Paxton E, Luetzow W. Variation in anterior cruciate ligament scar pattern: does the scar pattern affect anterior laxity in anterior cruciate ligament-deficient knees? Arthroscopy. 2005;21:19–24.
- **32.** Tahami S, Derakhshan S. Outcome of ACL reconstruction and concomitant articular injury treatment Arch Bone JT Surg. 2015;3:260-63.
- Dahm D, Walf C, Dajani K, Dobbs R, Levy B, Stuart M. Reconstruction of Anterior Cruciate Ligament in patient over 50 years. J Bone joint surg(Br).2008;90:1446-50.