

ISSN Print: 2664-8318
ISSN Online: 2664-8326
Impact Factor: RJIF 5.42
IJOT 2023; 5(1): 07-13
www.orthopedicsjournal.in
Received: 03-01-2023
Accepted: 07-02-2023

Dr. Sujay Gupta
Post Graduate Resident,
Department of Orthopaedics,
Government Medical College,
Kota, Rajasthan, India

Dr. Lokesh Jangid
Senior Resident, Department
of Orthopaedics, Government
Medical College, Kota,
Rajasthan, India

Dr. Mahendra Meena
Senior Resident, Department
of Orthopaedics, Government
Medical College, Kota,
Rajasthan, India

Dr. Ram Prasad Meena
Senior Professor and HOD,
Department of Orthopaedics,
Government Medical College,
Kota, Rajasthan, India

Dr. Rajesh Goel
Ex-Senior Professor,
Department of Orthopaedics,
Government Medical College,
Kota, Rajasthan, India

Corresponding Author:
Dr. Sujay Gupta
Post Graduate Resident,
Department of Orthopaedics,
Government Medical College,
Kota, Rajasthan, India

Outcome analysis of arthroscopic reconstruction of anterior cruciate ligament in adults

Dr. Sujay Gupta, Dr. Lokesh Jangid, Dr. Mahendra Meena, Dr. Ram Prasad Meena and Dr. Rajesh Goel

DOI: <https://doi.org/10.33545/26648318.2023.v5.i1a.21>

Abstract

Background: Anterior cruciate ligament injury is the common knee injury consequent to contact sports. There are different techniques recommended for the ACL reconstruction, with different graft materials. The aim of this study is to evaluate the functional outcome of arthroscopic single bundle ACL reconstruction using hamstring tendon graft in ACL deficient knees in adults.

AIM: To evaluate the functional outcome of arthroscopic single bundle anterior cruciate ligament reconstruction using quadrupled hamstring tendon (Gracilis and semitendinosus) autograft with endobutton as femoral fixation device and interference screw as tibial fixation device in ACL deficient knees in adults.

Methodology: Between December 2020 to December 2022, a prospective study was conducted in Government Medical College, Kota on 21 ACL deficient patients (M =19, F = 2] but 1 male patient was lost to follow-up. All patients were evaluated pre-operatively using the Lysholm & Gillquist score and IKDC – 2000 score. All patients underwent arthroscopic single bundle ACL reconstruction with hamstring tendon graft, which was fixed with an endobutton fixation system on the femoral side and an interference screw on tibial side. They were advised a regular rehabilitation protocol. All patients were evaluated post-operatively at 6 weeks, 3 months, 6 months and a year by same assessment scores.

Results: 20 patients were available for follow up for a period of 6 months to 2 years. The mean follow-up period was 10.5 months. When compared with their respective pre-operative knee assessment scores, it was found that a definite improvement was there in their knee function. The results were good to excellent in 80% patients and fair in 20%.

Conclusion: For young active adults, single bundle reconstruction by arthroscopic methods gives acceptable results. The problems which are faced post-operatively can be again settled arthroscopically. A long term follow-up of these cases is a must to analyze if there is degeneration that happened in the time between injury and ligament reconstruction.

Keywords: ACL tear (1), arthroscopic reconstruction (2), hamstring tendon graft (3), single bundle (4)

Introduction

Anterior cruciate ligament has a main role not only in the function but also as a stabilizer of the knee joint. Along with all other ligaments, capsule, muscles, ACL is a prime stabilizer of the knee preventing the anterior translation of tibia over femur. Also anterior cruciate ligament also restricts valgus and rotational stress to certain degree. Anterior cruciate ligament injury is one of the most common injuries around knee and also poses a lot of controversies in the management. When an individual sustains an ACL injury, they will have recurrent episodes of knee instability, knee pain and decreased knee function. With severe symptoms, young active patients may need reconstruction of the injured ligament. Arthroscopic reconstruction of torn ACL has become the gold standard in treating ACL tears. The surgical reconstruction of the anterior cruciate ligament with hamstring graft establishes knee kinematics. It does not sacrifice other stabilizers of knee. Development of early osteoarthritis, meniscal injuries are delayed and the stability of the joint is restored (1) as anterior cruciate ligament injury is often associated with meniscal injury. If left alone, it can develop early onset of osteoarthritis. Earlier open arthrotomy, extra-articular procedures and intra articular reconstructions were done. But in current understanding of knee biomechanics and with current knowledge of newer arthroscopic instruments and implants, arthroscopic anterior cruciate ligament reconstruction is needed.

Also usage of soft tissue grafts is increasing in number than bone patellar tendon bone graft in recent times. Unlike open procedures, in arthroscopic reconstruction, there are small key hole incisions, decreased post-operative inflammation, almost near absence of post-surgical knee stiffness and possibility of early full range of movements post-operatively.

Materials and Methods

Between December 2020 to December 2022, a prospective study was conducted in Government Medical College, Kota. All young and middle aged patients presenting with unilateral knee complaints and history of trauma to the knee in the orthopaedics emergency and out patient department in Government Medical College, Kota were evaluated by a thorough general and local clinical examination of the knee. In a relaxed patient and in supine position, the uninjured knee was examined first to establish reference values after which the affected knee was examined. The following specific tests were performed for diagnosing anterior cruciate ligament deficiency:

1. Lachmann test in 20° flexion
2. Anterior drawer test in 90° flexion
3. Lateral pivot shift maneuver

Injuries to the associated structures were assessed by performing the following clinical tests:

1. Valgus / Varus stress test (for collateral ligaments)
2. McMurray's test / Apley grinding test (for menisci)
3. Posterior drawer test (for posterior cruciate ligament)
4. Reverse pivot shift maneuver (for Posterolateral complex)

Routine radiographs of both knees in standing position in anteroposterior view and lateral view of the affected knee were taken. MRI of the knee was done in all ACL torn cases for confirmation.

Inclusion criteria

The following patients were included

1. Clinical /MRI evidence of symptomatic individuals with anterior cruciate ligament deficiency.
2. Radiological evidence of skeletal maturity patient between 20-40 years of age.
3. A normal contralateral knee for comparison and rehabilitation.
4. Associated with medial or lateral meniscus tear that may or may not require repair

Exclusion criteria

The following patients were not included in the study.

1. Asymptomatic individuals
2. Patients with the systemic diseases compromising their pre-anaesthetic fitness
3. Associated with PCL tear
4. Patients with osteoarthritic knee.
5. Patients with associated fracture of the tibial plateau.
6. Patients with local skin infections

Methods

Pre-operative work up

Patients with ACL tear proven clinically and radiologically were admitted in Department of Orthopaedics and Traumatology, Government Medical College, Kota. Routine

investigations like haemoglobin, total and differential counts, platelet count, ESR, blood sugar, renal parameters, chest X-ray, ECG were taken and anaesthetist assessment for regional and general anaesthesia was done.

1. All Patients in this study were given education on joint protection and likely outcomes of rehabilitation
2. Patients were educated to avoid deep squatting and low chairs prior to surgery.
3. All patients were instructed and taught on post-operative exercises.
4. Pre-operative strength and ROM of knee joint were measured and documented.

Consent

All patients in this study group were explained about the injury, diagnosis, operative procedure, complications of non-operative treatment and operative treatment, intraoperative and postoperative complications, donor site morbidity, injury to surrounding structures, infection, compartment syndrome, extravasation of fluid, anaesthesia risks, postoperative knee pain, restriction of range of motion. Consent for surgery was obtained for all patients who are under this study. All consent were obtained prior to surgery. Patients and their attenders were well explained about advantages and disadvantages of procedure. Risk benefit ratio was explained. Some patients in this study group were obtained high risk consent considering cardiac and pulmonary problems, need for postop ventilatory support. After obtaining consent patient were shifted inside operation theatre for surgery.

Post-operative management

Immobilisation in knee brace and limb elevation immediate post operatively. Intravenous antibiotics were given post-operatively for 5 days. Wound was inspected on 2th, 5th, 7th post-operative day. The Sutures were removed on 12th postoperative day. Gradual physical rehabilitation was started from day 1. Post-operatively, patients were followed up at 3, 6weeks and 3, 6 months.

Post-operative rehabilitation

The general post-operative protocol for anterior cruciate ligament reconstruction is followed and progression of the rehabilitation is individualized for each patient. Goals: Full range of motion (ROM), normal gait pattern, stability of the knee joint, pain free movement. On the 1st Postoperative day, the knee was rested in extension in long knee brace and static quadriceps exercise, ankle and foot movement were advised and limb kept elevated.

In the 1st 2 Weeks, full knee extension to 90 degrees knee flexion Strong quadriceps setting and straight leg raising exercise without extension lag. The Emphasis is given to gain normal gait pattern. Passive, active, and active – assisted range of motion for knee flexion. Partial weight – bearing with walker or weight-bearing to tolerance with knee immobilizer with a walker.

At 2nd – 4th weeks, full extension to 120° flexion; Full weight bearing without crutches; Progress SLR with weights (resisted) is advised; Walking is continued with emphasis on normal gait.

At 4th – 10th Weeks, progress to full range of movements by 6 weeks; Progress closed chain exercises; Progress all the exercises. At 12th -14th Weeks, full range knee extension

exercises initiated with light weight and high repetition. At this stage, jogging program is initiated.

At 16th –18th weeks, isokinetic strength test for quadriceps and hamstrings is done; Agility training and sport-specific training is also done.

At 6 weeks, 3 months, 6 months and at 1 year Ability to bear weight (graded as full, partial, or impossible) was assessed preoperatively.



Fig 1: The donor site showing the harvesting of Semitendinosus.



Fig 2: Graft preparation after harvesting



Fig 3: Quadrupled graft



Fig 4: Sizing the graft after Quadrupling

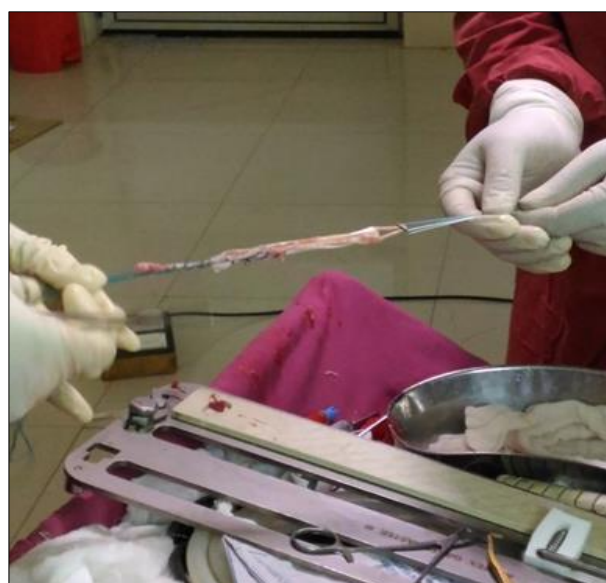


Fig 5: Prepared quadrupled graft



Fig 6: Graft passage

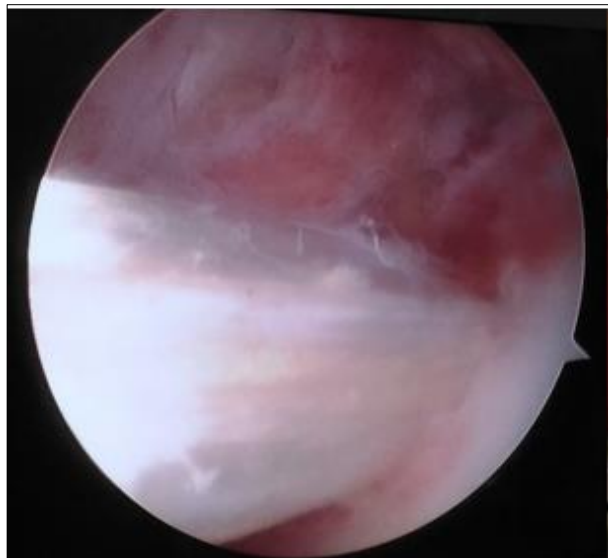


Fig 7: Hamstring graft after passage



Fig 8: Flipping of endobutton (in the place of native ACL) for confirmation of position of graft



Fig 9: Fixation of graft on the tibial side with interference screw

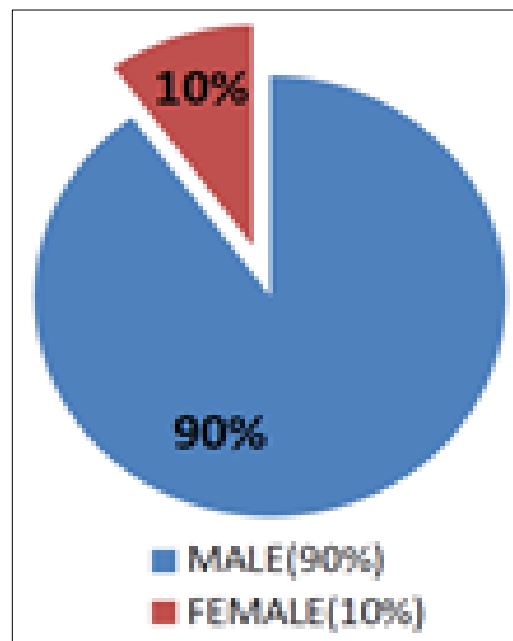
Results

20 cases of arthroscopic ACL reconstruction were regularly observed for a period of 4 months upto 2 years in

Government Medical College, Kota (from December 2020 to December 2022). The mean follow up period was 10.5 months

Table 1: Age distribution

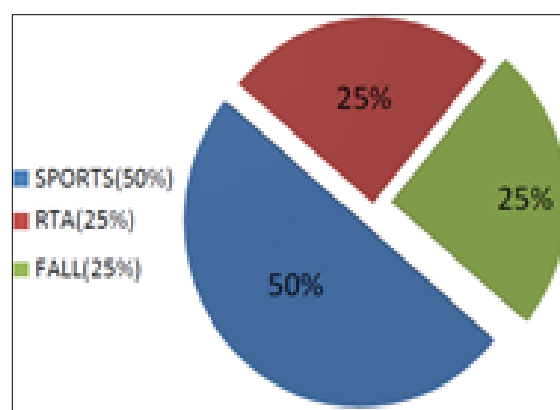
Age (Years)	Patients	Percentage
20-25	9	45%
26-30	4	20%
31-35	5	25%
36-40	2	10%
TOTAL	20	100%



Pie chart 1: Sex distribution

Table 2: Side involved

Side	Patients	Percentage
RIGHT	13	65%
LEFT	7	35%
TOTAL	20	100%



Pie chart 2: Mode of injury

Table 3: Duration of injury

Duration	Patients	Percentage
Upto 3 months	9	45%
Upto 6 months	6	30%
Upto 9 months	3	15%
Upto 1 year	2	10%
Total	20	100%

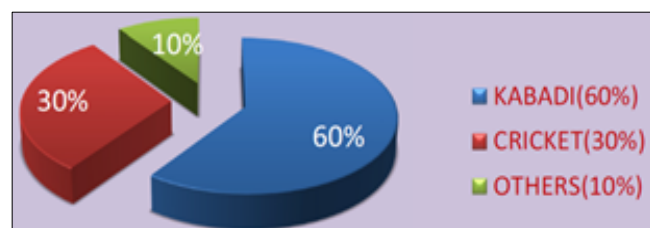


Pie chart 3: Symptoms at presentation

Table 4: Pre- operative treatment: (aspiration / knee immobilization):

	Patients	Percentage
Yes	9	45%
No	11	55%
Total	20	100%

In my part of the country, Kabaddi is the most common cause of ACL tears.



Pie chart 4: Sports V/S patients

Table 5: Associated meniscal injuries:

S.no	Associated injuries	No. Of cases	Percentage
1	Isolated ACL tear	7	35%
2	Medial meniscal tear	5	25%
3	Lateral meniscal tear	3	15%
4	Medial & lateral meniscal tear	2	10%
5	Mild chondral changes	3	15%

Table 6: Overall results (Lysholm knee score):

S.no	Results	No. Of cases	Percentage
1	EXCELLENT	10	50%
2	GOOD	6	30%
3	FAIR	4	20%

Table 7: Range of motion:

S.no	Range of motion	No. Of patients	Percentage
1	0-120 Degree flexion & above	15	45%
2	Loss of (>15*) terminal flexion	4	20%
3	Loss of (>5*) terminal extension	1	5%

Discussion

Incidence of anterior cruciate ligament reconstruction has increased significantly in the past decade owing to the increased number of road traffic accidents and more involvement in sports activities. Arthroscopic ACL reconstruction have become gold standard for these injuries [2]. The arthroscopic procedure has the advantage of reduced morbidity, reduced incidence of patellofemoral adhesions, decreased anterior knee pain following reconstruction. Arthroscopic also has a technical advantage of better visualisation of intraarticular structures and helps in accurate placement of tunnels. The goal of reconstruction is to provide a normal stable joint with painless full function and to prevent the complications following ACL tear like meniscal injury and early onset of secondary osteoarthritis. Our prospective study was conducted in Government Medical College, Kota to clinically evaluate the results of arthroscopic single bundle anterior cruciate ligament reconstruction. This study group comprises of 21 patients with one male patient lost for follow up. 20 patients were followed up with minimum of 1 year follow up. There were 18 males and 2 females in this study. In our study, there was male preponderance (90%). In our study, we did ACL reconstruction with quadrupled Hamstring graft with transportal technique using endobutton as femoral fixation device and titanium interference screw as tibial fixation device. Sports injuries, fall and road traffic accidents predominated as the cause of injury accounting for 50%, 25% and 25% respectively. Sports injuries accounted for 50% similar to all international studies. Beynon BD [3] reported 58% meniscal injury associated ACL tear at presentation. Medial meniscus was involved more than the lateral meniscus in his study and he also proposed meniscal repair or resection did not alter the outcome and chondral lesions are a better predictor of functional outcome. Pattee GA *et al.* [4] reported more than 50% meniscal procedures with ACL reconstructions in 2009. In our study 45% of patients had meniscal injury at presentation and medial meniscus injury predominated lateral meniscus injury like other studies. None of our patients had significant chondral damage at diagnostic arthroscopy. The graft options include bone patellar tendon bone graft, Hamstring graft, Quadriceps tendon graft, allograft, and synthetic grafts [5]. Hamstring grafts are superior in strength and avoiding extensor mechanism disruption. John A. Feagin, Jr *et al.* [6] recommended hamstring graft for ACL reconstruction. John W. Janreguito *et al.* [7] reported patellar chondrosis and anterior knee pain with bone patellar tendon bone graft. Veltri DM proposed allografts has a good alternative of graft but it carries the risk of disease transmission [8]. In our study we used Quadrupled Hamstring graft in all patients which had greatest ultimate load to failure 4140 N. The fixation of the graft [9] has been proved to be the site of failure rather than the graft itself irrespective of the type of graft especially in the early rehabilitation phase when the graft integration has not taken place and the fixation is of little significance after 8 to 12 weeks when graft has integrated with the bone as proposed by Cercillo. Petherikousa based on in his biomechanical study comparing various fixation devices published that the Bone mulch screw is superior to any other device in providing stiffer fixation of soft tissue grafts and endobutton second only to bone mulch screw [10]. We didn't use bone mulch screw in our study because of it's cost and availability. Studies have

proved that interference screws to be inferior to the endobutton and the bone mulch screw. One another concern was the laceration that interference screw can cause to the soft tissue graft. But despite the concerns, interference screw fixation of soft tissue grafts have shown comparable results with that of interference screw fixation of bone patellar tendon bone grafts. Robert G Marx reported two cases of failure with femoral cross pins. Chae Gwan Kong showed endobutton to be superior than cross pins in femoral fixation, Whereas Young Ho oh showed that a hybrid fixation with a endobutton and a bio screw in femoral tunnel provided adequate stability and stiffness ^[11]. Young Ho Oh published his results of bioabsorbable round contoured screw to be better than the regular titanium interference screws ^[12]. We used endobuttons as femoral fixation device and titanium interference screw as tibial fixation device. Though there are concerns about the bungee effect of the graft while using endobutton causing movement of graft in the tunnel, tunnel widening and interference to graft incorporation, a recent study had reported tunnel widening was more with interference screw than the endobutton and attributed tunnel widening to biological factors rather than mechanical factors of the fixation device. In our study there was no pull outs or graft fixation site failures and in our patients endobutton was able to withstand the post-operative rehabilitation. We used transportal single bundle reconstruction with quadrupled hamstring graft placing the femoral tunnel between 10: 30 and 11'o clock position in the right knee and between 1'o clock and 1: 30 position in the left knee. This is very close to the position as proposed by John Paul's placement of graft at 10:30 position and 1:30 position in single bundle reconstruction reconstructs portions of anteromedial and posterolateral bundles ^[13]. Masayoshi Yagi ^[14] showed that anatomic reconstruction allowed better rotatory stability than non-anatomic placements of graft. Asheesh Bedi showed that trans portal placement of tunnel achieved more lateral placement than the trans tibial drilling and trans tibial approach to achieve lateral tunnel placements resulted in over reaming of tibia ^[15]. Our patients had 80% good to excellent results and 20% fair results were documented. Lewis *et al.* reported 81% good results in his review article which showed 19% patients had positive pivot shift post operatively. In our study 33% patients presented with less than 5 degree extensor lag, 16% had minimal anteroposterior laxity. Overall patient satisfaction was good in 18 patients. Riley J Williams ^[16] reported 8% extensor lag and 11% positive lachmans and positive pivot shift. He reported 2% infection which required arthroscopic joint lavage, similar 2% in our study which required arthroscopic joint lavage and joint debridement similar to his study. John C Austin ^[17] showed fixing of graft in 30 degree flexion cause loss of extension and he recommended fixation of graft in extension. Kurt Spindler ^[18] stated regular exercise can lead to better outcomes in ACL deficient individuals. Our patients are put on home based physiotherapy programe insisting on knee flexion and quadriceps strengthening and mean flexion achieved was 135 degree. Postoperatively results are excellent in pure ACL tear alone whereas fair to good results in individuals with ACL tear and associated menisci injuries. ACL single bundle reconstruction aims to reconstruct the deficient torn ACL following trauma and vehicular accidents as close to near anatomical position as possible thus theoretically provides stability and knee

kinematics close to the anatomical ACL. Quadrupled hamstring graft provides both anterior and rotatory stability to knee post operatively almost similar results to pre trauma level. This prospective subjective study suggest that most of patients undergoing single bundle ACL reconstruction were satisfied with results and almost achieved the functional status like uninjured contralateral knee. Most of our patients in this study were satisfied with these results. This may imply that this is good technique for young and sport patients involving pivoting most of times in their life time but more quantitative and long term studies are required. ACL single bundle reconstruction with hamstring autograft is preferred over other techniques since it has advantages of less donor site morbidity, early recovery time, less damage to surrounding bony and soft tissue structures. Limitations in our study are small duration study and small sample size. Our study was subjective study based on the Lysholm and Gillquist score, IKDC -2000 score and was not objective based, as KT 1000 is required to quantify our results. The procedure needs long learning curve and the surgery should be performed by experienced arthroscopic surgeon. Follow up studies of long duration are required to know long term outcomes of this procedure.

Conclusion

The summary of our prospective study is as follows:

1. Post- operative knee assessment scores are compared with preoperative knee assessment scores, it shows a definite improvement in knee function post-operatively.
2. For young active adults, single bundle reconstruction by arthroscopic methods gives acceptable results.

Our short term results of our prospective study of Arthroscopic ACL reconstruction assessed in terms of the Lysholm knee scoring system has a good functional outcome with lesser postoperative complications and early return to activities of pre injury level.

References

1. Michael Dienst MD, Robert T, Burks MD, Patrick E, Greis MD. Anatomy and biomechanics of ACL. OCNA. 2002;33:605-620.
2. Paul P Weitzel MD, John C Richmond MD, Gregory H Altman, Tara Calabro, David L Kaplan. Ph D., Future direction of the treatment of ACL ruptures. OCNA. 2002;33:6453-661.
3. Beynon BD, Johnson RJ. Relevant biomechanics In: Delee JC, Drez D, editor. Orthopaedic sports medicine philadelphia: WB saunders; c1994. p. 1113-1133.
4. Pattee GA, Fox JM, Del Pizzo W, *et al.* Four to ten year followup of unreconstructed anterior cruciate ligament tears. Am J Sports Med. 1989;17:430-5.
5. Suzanne L Miller, MD, James N Gladstone. Graft selection in anterior ligament reconstruction., MD. OCNA. 2002;33:675-683.
6. John A Feagin Jr, MD, Robert P Wills MD, *et al.* ACL Reconstruction, BPTB Vs Semitendinosus Anatomic Reconstruction. CORR 341, August; c1997. p. 69-72.
7. John W Janreguito MD, Paulos LE. Why Grafts fail. CORR. 1996 Apr;325:25-41.
8. Veltri DM. Arthroscopic assisted ACL Reconstruction. Clinical sports Medicine. 1997 Jan;16(1):1223-44.
9. Cercillo Puddu Pigozzi. Knee surgeries sports traumatology and arthroscopy. 1995;3(1):14-7.

10. Petteri Kousa MD, Teppo LN. Ja"rvinen,†§ MD, PhD, Mika Vihavainen, Pekka Kannus, MD, PhD, and Markku Ja"rvinen, MD, PhD The Fixation Strength of Six Hamstring Tendon Graft Fixation Devices in Anterior Cruciate Ligament Reconstruction
11. Chae-Gwan Kong, MD1, Yong In, MD2, Geon-Hyeong Kim, MD1 Cross Pins versus Endobutton Femoral Fixation in Hamstring Anterior Cruciate Ligament Reconstruction: Minimum 4-Year Follow-Up Knee Surg Relat Res. 2012;24(1):34-39.
12. Young Ho Oh, MD, Suk Namkoong MD, Eric J. Strauss MD. Hybrid Femoral Fixation of Soft-Tissue Grafts in Anterior Cruciate Ligament Reconstruction Using the EndoButton CL and Bioabsorbable Interference Screws: A Biomechanical Study Arthroscopy: The Journal of Arthroscopic and Related Surgery. 2006 Nov;22(11):1218-1224.
13. John-Paul H Rue, MD, LCDR, MC, USN, Neil Ghodadra MD, Bernard R Bach Jr. MD Femoral Tunnel Placement in Single- Bundle Anterior Cruciate Ligament Reconstruction.
14. Masayoshi Yagi, Eric K Wong, Akihiro Kanamori, Richard E Debski, Freddie H Fu, Savio L-Y. Biomechanical Analysis of an Anatomic Anterior Cruciate Ligament Reconstruction. Woo Am J Sports Med. 2002;30:660.
15. Asheesh Bedi MD, Volker Musahl MD, Volker Steuber MD. Transtibial Versus Anteromedial Portal Reaming in Anterior Cruciate Ligament Reconstruction: An Anatomic and Biomechanical Evaluation of Surgical Technique Arthroscopy: The Journal of Arthroscopic and Related Surgery. 2011 Mar;27(3):380-390.
16. Riley J Williams III, MD, Jon Hyman, MD, Frank Petrigliano MD, Tamara Rozental MD, Thomas L Wickiewicz MD Anterior Cruciate Ligament Reconstruction with a Four-Strand Hamstring Tendon Autograft. JBJS. 2004;86A:225-232.
17. John C Austin MD, Chanakarn Phornphutkul MD, Edward M Wojtys. MD Loss of Knee Extension After Anterior Cruciate Ligament Reconstruction: Effects of Knee Position and Graft Tensioning J Bone Joint Surg Am. 2007;89:1565-74 doi:10.2106/JBJS.F.00370.
18. Kurt PS, Todd AW, Claiborne C Jr – Clinical outcome at a minimum of five years after reconstruction of the anterior cruciate ligament. J Bone Joint Surg. 2005;87(8):1673-1678.