



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2023; 9(1): 400-406
© 2023 IJOS
<https://www.orthopaper.com>
Received: 08-12-2022
Accepted: 13-01-2023

Dr. Venkatesh Mulimani
Professor, Department of
Orthopaedics, KIMS, Hubballi,
Karnataka, India

Dr. Sandeep I
Assistant Professor, Department
of Orthopedics, KIMS, Hubballi,
Karnataka, India

Dr. Gautham Mariswamy
Post Graduate Student,
Department of Orthopaedics,
KIMS, Hubballi, Karnataka,
India

Corresponding Author:
Dr. Venkatesh Mulimani
Professor, Department of
Orthopaedics, KIMS, Hubballi,
Karnataka, India

A clinical study to determine the early functional outcome of ACL injuries managed by arthroscopic reconstruction using four strand hamstring graft with interference screw

Dr. Venkatesh Mulimani, Dr. Sandeep I and Dr. Gautham Mariswamy

DOI: <https://doi.org/10.22271/ortho.2023.v9.i1f.3323>

Abstract

Anterior cruciate ligament is the most commonly injured ligament. Arthroscopic reconstruction of anterior cruciate ligament with aperture fixation of graft using the interference screw on the tibial side allows for early firm fixation and healing with tight bone-tendon interface. Even after better surgical techniques and fixation devices many athletes retire early due to residual knee instability. Hence in this study, I am making an effort to assess the early clinical outcome of anterior Cruciate Ligament injuries managed with arthroscopic reconstruction using hamstring graft with Interference screw. Due to rise of RTAs need for study of function outcome of ACL injuries treated by arthroscopic reconstruction in non sports individuals. This prospective comparative observational study related data were captured between October 2020 to April 2022 in a Karnataka institute of medical sciences. About 35 patients with arthroscopic anatomic ACL reconstruction using hamstring tendon graft with interference screw were evaluated and followed up for functional outcome. Patients were evaluated for functional outcome and stability of knee using International knee documentation committee subjective score and Lysholm score over a period of 18 months. This prospective comparative observational study related data were captured between October 2020 to April 2022 in a Karnataka institute of medical sciences. About 35 patients with arthroscopic anatomic ACL reconstruction using hamstring tendon graft with interference screw were evaluated and followed up for functional outcome. Patients were evaluated for functional outcome and stability of knee using International knee documentation committee subjective score and Lysholm score over a period of 6 months. The larger percentage of cases was operated less than 6 months from the date of injury. On evaluation of the patients during the follow up by IKDC and LGS, 100% of the patients had excellent to good results, and were able to return to pre injury level of activity. The technique of arthroscopic ACL reconstruction offers an excellent knee function, knee stability and restoration of preoperative functional status with minimal complications.

Keywords: ACL, arthroscopic, reconstruction, interference screw, graft, IKDC

Introduction

With an estimated 1 million surgical reconstructions conducted each year in the United States, ACL reconstruction ranks among the most common surgical procedures [1]. One of the musculoskeletal system's structures that has attracted the most focus over the last 25 years seems to be the ACL [2].

The current concept of ACL reconstruction is Trans portal anatomic ACL reconstruction. However there is a new found interest in some centers doing double bundle reconstruction, particularly in sports personnel which is much more technically demanding and with technical advancement in computer-assisted navigation and fluoroscopic placement of tunnels, results have improved in a great way.

As J. C. Imbert, suggest it is likely that ligament replacements will take the form of "bio-implants" produced with the aid of cell and tissue culture techniques. Perhaps, fresh lesions could be made to heal with gene therapy. Research along these lines is currently being conducted at Pittsburgh, US.

Recent studies have contributed substantially to our understanding of anterior cruciate ligament anatomy and have revealed that common techniques for anterior cruciate ligament

reconstruction may replicate native ligament functionally. In our prospective study of 35 cases we have undertaken ACL Reconstruction with the four strand hamstring graft through arthroscopy and assessed its functional outcome using Lysholm knee score⁴ & IKDC subjective knee evaluation score.

Materials and Methods

This prospective comparative observational study was approved by the ethics committee of the hospital. Informed consent of each patient was obtained. Study related data were captured between October 2020 to April 2022 in Karnataka institute of medical sciences, Hubli. All the cases presented with anterior cruciate ligament injury attended orthopedic OPD and emergency department were treated with arthroscopic anatomic ACL reconstruction using hamstring tendon graft were evaluated and followed up for functional outcome. About 35 patients underwent the ACL reconstruction surgery february 202 to july 2022, were followed up and evaluated.

Inclusion criteria - Patients operated for ACL reconstruction surgery, both the genders above 15 and below 50 years were included, patients and/or his/her legally acceptable representative willing to provide voluntary written informed consent for participation in the study.

Exclusion criteria

Age below 15 and above 50, immunocompromised patients, pregnant and lactating mothers. Anterior cruciate ligament tear associated with other ligament injuries like posterior cruciate ligament tear, collateral ligament injuries and ACL injuries associated with bony injuries.

All the patients who were diagnosed clinically and radiologically with ACL tear and all who gave the consent were included in the study. Knee examination like Lachman test, pivot test, Varus valgus stress test etc were done. X-ray of the knee joint was taken pre & post-op. Routine laboratory investigation like Hb, BT, CT, and urine complete examination was done. Tegner activity scale and IKDC scale scoring was noted pre & post-operatively. All patients were enrolled to undergo arthroscopically assisted ACL reconstruction.

Surgical procedure

Diagnostic arthroscopy was performed and For harvesting of hamstring graft, a 3-4 cm incision anteromedial on the tibia starting approximately 4 cm distal to the joint line and 3 cm medial to the tibial tuberosity was made. A four strand Graft construct is prepared with whip stitch to the tibial end with the hamstring tendon still attached to the Tibia. (Fig 1)

Routine Arthroscopy performed Meniscal Repair or Meniscectomy if any is done at this stage. Remaining ACL fibres are debrided and tibial foot print outline is left to help with tibial tunnel placement. Lateral wall and roof preparation done for intercondylar notch and is cleared off all debris.

The femoral tunnel is made first at 9:30 O clock/1:30 O clock for right and left sides respectively through the medial portal with the knee in 120° of flexion. Femoral Aimer with 7 offset is used as the Tongue of it is positioned "Over the Top". Knee may have to be extended slightly to get the tongue over the top. Guide wire is inserted through the aimer, flower top reamers are used over Guide wire and an incomplete tunnel of about 25 mm depth is drilled.

The Tibial tunnel is made with the Director Guide –Elbow

Aimer. ACL Tibial guide is inserted through the Antero medial portal and its tip placed on the tibial foot print of ACL. Graft is sized with sizers. The appropriately sized graft is passed through a BEATH PIN (a long wire with an eye at one end) (fig-2). Always hyper flex the knee & exit the pin laterally. With knee back to about 80-90 of flexion, pull the graft into the knee, with the help of probe direct the leading graft into femoral tunnel with its cancellous surface facing anteriorly.

Fixation is done by interference screw through the antero medial portal, the knee is hyper flexed to allow parallel placement of screw to graft by an anti rotation guide wire and interference screw at anterior interface and this may be aided by "Tunnel Notcher". The knee must be hyper flexed and an assistant should keep equal tension on both sides through sutures applied to the graft so that graft does not advance as the screw is inserted. The screw is inserted till it is flush with the end of the bone block. Look for impingement in full extension; lateral wall impingement is safely and easily addressed With a curette. The ideal placement of tunnel is in the foot print of the native ACL on femur which roughly corresponds to 9:30 O clock for right knee and 1:30 O clock position for left knee to minimize impingement.

The knee is cycled through a full range of motion for about 20 times (TENSIONING). The knee is then brought to full extension, maximal manual tension applied to sutures of the graft appropriate sized interference screw applied at anterior interface of the graft with the knee placed in 20-30 of flexion for the initial purchase and in full extension as the screw advances.

Lachman test is performed and the complete range of movements assessed. Anteromedial periosteal flap is closed and the remaining wound closed in layers.

Postop protocol - Knee immobilizer was used. The patient was encouraged to maintain extension as possible and continue static Quadriceps exercises. Patients were mobilized with full weight bearing with elbow crutches the next day and advised to use crutches for a week only. Strengthening exercises of the quadriceps femoris and the hamstrings were initiated after the 1st post-operative day. Closed chain kinetic exercises were initiated after the 1st post operative day and were continued for 12 weeks. Open chain exercises started after the 12th week. Return to sports allowed at the end of 6 months.

Patients were followed up for 6 months and functional outcome of the patients will be checked with IKDC scoring and Lysholm Gillquist scoring system. The score is interpreted as a measure of function such that higher scores represent higher levels of function and lower levels of symptoms.

Results

More number of patients are in the age group of 18-47yrs with the peak incidence between 21-30 years. Nature of the injury in our series was history of fall while doing activities of daily living 17 (48 %) road traffic accidents in 11 (31 %); sports in 7(20%). Most of the injured patients were leading sedentary lifestyle followed by farming community and others. Giving way of the knee is the main presenting symptom (100%) in our study. Evaluation with Lachmen test, under anaesthesia equates with arthroscopic evaluation (100%). Medial meniscus was the commonest associated injury (14%).

All patients presented with complaints of giving way of the

knee. 68.57% of the patients were able to appreciate the clicking of knee. 47.57 % cases were having swelling and 60 % cases presented with complaint of pain. 45.71 % gave history of locking of knee which was correlated with associated injuries in the knee.

Post operatively about 14.27% of patients complained of knee pain after 6 months and other 5.71% patients complained of swelling over the knee joint after 6 months of follow up.

Giving away which was the major symptom preoperatively was completely absent post op.

Pain which was seen in 60% of patients pre operatively was later seen in only 14.29% of patients post op. Similarly swelling which symptom seen in 48.57% of the patients was later seen in 5.711 % post operatively (fig- 3). At the time of admission, the mean ROM of the patients was about 96 degree, with the standard deviation of 7.74. At the about 6 months the mean ROM of the patients was about 135.7 degree, with the standard deviation of 5.02.

The mean IKDC score of study sample pre operatively was 20.57 with Standard deviation of 7.44. The mean IKDC score

of study sample post operatively was 75.17 with the standard deviation of 5.16. (fig – 4) (table – 1). Most of the patients graded their postoperative recovery as normal (57.14 %) which was about 20 patients and 42.86 % as nearly normal which was about 15 patients according to IKDC scoring system. (Table-2).

The mean Lysholm score of study sample pre operatively was 51.20 with Standard deviation of 7.58. The mean Lysholm score of study sample post operatively was 92.74 with the standard deviation of 4.37 (fig – 5)(table -3). Majority of the patients had excellent outcome that is 57.14 % which were 20 in number. 42.86% had good outcome which was 15 in number (table -4). Correlation between post operative IKDC and Lysholm scores by Karl Pearson’s correlation coefficient which was found to be significant. (table -5) (table -6)

On evaluation of the patients during the follow up by IKDC and LGS, more than 100% of the patients had excellent to good results, and were able to return to pre injury level of activity.



Fig 1: Graft preparation



Fig 2: Graft passage

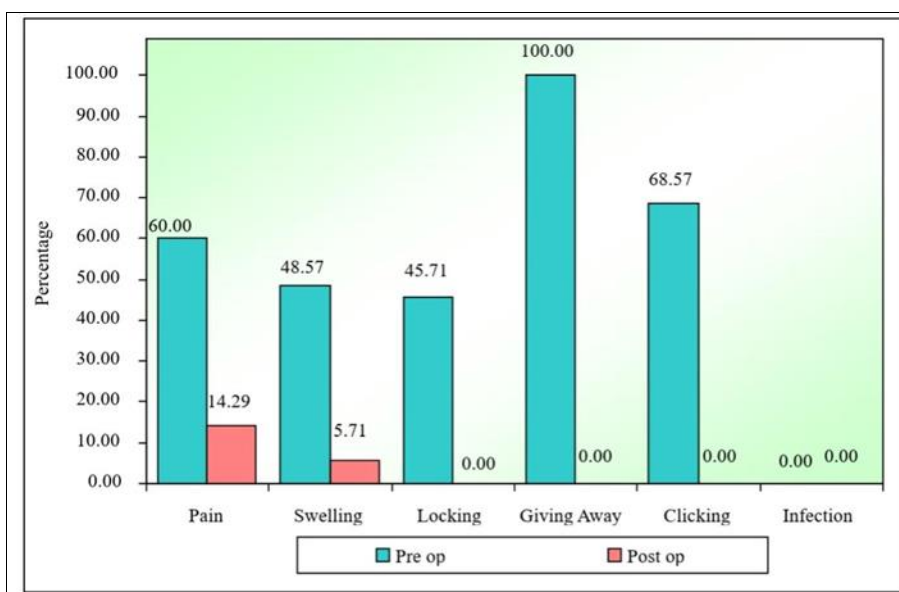


Fig 3: Comparison of status of post Op symptoms

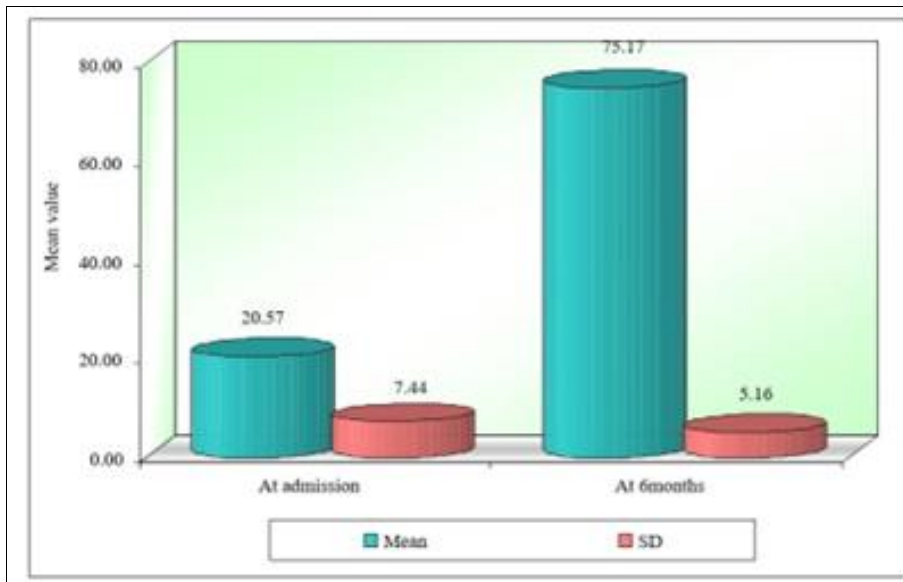


Fig 4: Comparison of At admission and At 6 months with IKDC scores

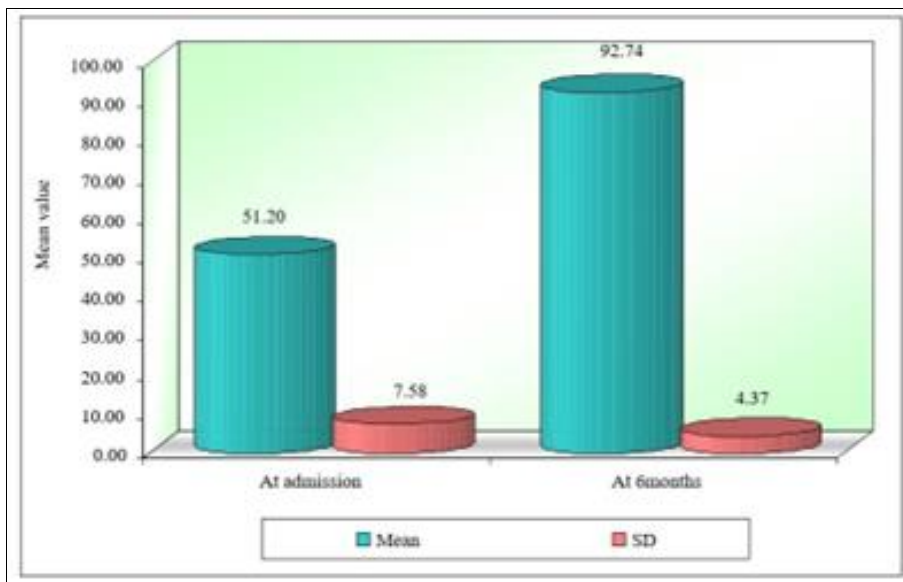


Fig 5: Comparison of pre and post operative Lysholm scores by dependent t test

Table 1: Comparison of At admission and At 6 months with IKDC scores

IKDC	Mean	SD	Mean Diff.	SD Diff.
At admission	20.57	7.44	-54.60	8.39
At 6months	75.17	5.16		

Table 2: Levels of IKDC wise distribution of patients

Levels of IKDC	No of patients	% of patients
Normal	20	57.14
Near normal	15	42.86
Abnormal	0	0.00
Severely abnormal	0	0.00
Total	35	100.00

Table 3: Comparison of pre and post operative Lysholm scores

Lysholm scores at	Mean	SD	Mean Diff.	SD Diff.	% of change	t-value	p-value
At admission	51.20	7.58	-41.54	7.93	-81.14	-30.9737	0.0001*
At 6months	92.74	4.37					

Table 4: Outcome levels according to lysholm scores

Levels of Lysholm	No of patients	% of patients
Excellent	20	57.14

Good	15	42.86
Fair	0	0.00
Poor	0	0.00
Total	35	100.00

Table 5: Association between levels of IKDC and levels of Lysholm criteria

Levels of IKDC	Levels of Lysholm					
	Excellent	%	Good	%	Total	%
Normal	20	100.00	0	0.00	20	57.14
Nearly normal	0	0.00	15	100.00	15	42.86
Total	20	57.14	15	42.86	35	100.00

Chi-square=25.0000, p=0.0001*
Kendali"s tau-b =-20.4940, p=0.0001*

Table 6: Correlation between post operative IKDC and Lysholm scores by Karl Pearson's correlation coefficient

Variables	Mean	Std.Dv.	r-value	t-value	p-value
Post op IKDC	75.17	5.16	0.8299	8.5452	0.0001*
Post op Lysholm	92.74	4.37			

Discussion

Arthroscopic ACL reconstruction is performed to restore the functional stability in ACL deficient knees and restore the normal kinetics of the knee. Increasing number of ACL reconstruction surgeries have been performed and there is an increasing expectation of patients to speedy recovery and more rapid return to activities of daily living, work and study. Long term outcomes and post-op morbidity following arthroscopic ACL reconstruction depends on graft selection, surgical technique, experience of the surgeon and rehabilitation protocol for 6 months during immediate post operative and follow up period.

This is a prospective study to assess the surgical outcome following arthroscopic ACL reconstruction using the quadruple stranded hamstring graft. Although there are many potential graft choices from which to choose for ACL reconstruction, hamstring autografts have over the past decade become increasingly more popular. Several studies have shown that quadrupled-strand hamstring tendon ACL reconstructions have higher strength, stiffness, and cross sectional area compared with patellar tendon grafts.

Harvest of hamstring tendon auto grafts also yields less donor site morbidity than harvest of patellar bone- tendon- bone grafts and carries no risk of patellar fracture, however remote. Technical factors, specifically the absence of adequate fixation techniques, initially limited the use of hamstring grafts for ACL reconstruction. New techniques focus on optimizing graft strength and stiffness.

Successful ACL reconstruction using hamstring autograph requires stable initial graft fixation and, ultimately, graft- to-bone healing. Hamstring reconstruction using femoral interference fixation has been shown to have excellent initial mechanical properties, including pull-out strength. Fixation with an anchoring interferential screw provide excellent soft tissue to bone fixation.

In our study 32 male and 3 female patients underwent ACL reconstruction using quadrupled STG tendon autograft and all these patients underwent graft fixation using an anchoring interferential screw.

All aged between 18 and 47 years of age. The side of injury was distributed accordingly 54.29 % [32 patients] to right knee while 45 % [11 patients] injured their left knee.

In 2009, Brown ⁸ and others studied the incidence of sex and limb differences in anterior cruciate ligament injury and stated that even though females are prone for injury, due their less exposure to strenuous environment makes the incidence of

males more than females. They also concluded that limb differences have no influence either during injury or in the recovery period.

Among the young people the mode of injury was mainly during competitive sports and some of them injured during recreational sporting activity.

Majority of our patients are with the history of fall while doing their activities of daily living and were leading sedentary lifestyle followed by RTA and sport related injuries.

Once the day to day activities of walking, squatting and climbing stairs returned, after following according to Wilk *et al.*, rehabilitation protocol for 6 months during immediate post operative and follow up period, it was observed that adherence to physiotherapy gradually waned in most of the patients.

Vassilios S Nikolaou *et al.*, in June 2008, after a retrospective analysis of MRI efficiency in diagnosing internal lesions of the knee, reported that the accuracy for tears to the medial, lateral meniscus, anterior and posterior cruciate ligaments and articular cartilage was 81%, 77%, 86%, 98% and 60% respectively ^[9]. They found that the clinical examination had significant lower reliability in the detection of these injuries and concluded that MRI is very helpful in diagnosing meniscal and cruciate ligament injuries.

Various studies by different authors shows that arthroscopy still remains the gold standard for definitive diagnosis. In our study, clinical evaluation of the patients for instability was an essential component. Lachman test and Pivot shift test was more specific in diagnosing ACL injury which were further confirmed by MRI and later by arthroscopy, unlike anterior drawer test which in most of the patients was inconclusive as no correlation between pre operative and examination under anaesthesia.

DW Lewis *et al.* in their study on incidence of meniscal injuries at the time of ACL reconstruction found that 58% of patients had meniscal injuries and that medial meniscus was most commonly injured ^[10].

Our study of Arthroscopic ACL Reconstruction is preferred over open method as indicated in the scientific paper published by "chir Narzadow Nuchu *et al.*" ^[5], arthroscopic ACL reconstruction resulted in smaller amount of blood loss and better ROM at least during the first three months.

The use of the patellar bone tendon for the reconstruction of ACL has shown very good results ^[7]. The drawbacks that were noticed at the donor site led to the increase use of

Hamstring tendon autografts. The hamstrings are more tolerant according to several biomechanical studies that have been well documented. This led to the extensive use of hamstrings tendons for ACL reconstruction during the last decade.

Early superficial infection of the graft site was present in only 1 patient (2.85%) in our study which delayed wound healing. There was no deep infection. It was resolved by local wound care and oral antibiotics. No other complications were seen in any of the patients. Williams et al in their study of 2500 cases of arthroscopic ACL reconstruction, reported an infection rate of 0.3% [11].

Our knee scoring system “the Lysholm Knee score” has been accepted as the standard scoring by various studies and the efficacy of its constituents are shown by Boden moyar et al [6], in their 26 months follow-up study showed patient’s subjective rating are highly favorable and objective measure like pivot shift, ROM, thigh circumference and strength clearly favor arthroscopic ACL reconstruction than open method

In 2003, Fareed H *et al.* reported the results of a retrospective study were available for follow up [12]. The purpose of their study was to evaluate their initial experience with this procedure. Between July 97 and march 2001, 29 patients underwent arthroscopic ACL reconstruction with 4 strand hamstring tendon graft. 25 were available for follow up. All patients underwent the same rehabilitative program. Patients were evaluated using the IKDC ligament evaluation system. The average follow up was 25.4 months. Similarly Button K and others, in 2005, evaluated the outcome of ACL reconstruction with semitendinosus tendon autograft with same rehabilitation protocol in 48 patients at 20 months [13].

The final IKDC score of this study were compared with the studies of Ashok Kumar *et al.* 2016, Prasad *et al.* 2017 and Aparajit *et al.* 2016 [14-16].

All three scoring systems had a very high correlation as evidenced by the Kendal-tau values. Statistically, this was found to be highly significant [p value 0.000-0.0001].

Gulick TD [17] and others in 2002 studied on 57 patients and concluded that 84% of their patients returned to pre injury level of function. In our study 92% patients returned to their previous level of function. Development in arthroscopic techniques and improvement in technology and research have allowed anterior cruciate reconstruction to become one of the most successful surgical techniques in sports medicine.

Several limitations should be taken in account firstly, small sample size (n<100). Overestimation of treatment effect is more likely in small sample size compared to large sample size. Another limitation may be that the follow up time in the included study is up to 6 months due to time limitations; a longer follow up time is needed to evaluate some long term complications and graft strength. Our study was not a comparative one; we have exclusively used anatomical single bundle hamstring graft for reconstruction of ACL. Other graft option which can be closely compared with this study is double bundle hamstring graft. The difference in efficacy and strength between them needs to be evaluated. Further research is necessary, in order to evaluate which of this surgical technique in long term provides us with the safe and effective management options for ACL reconstruction.

Conclusion

All patients had instability of knee in the form of giving way evaluated by Lachman test and confirmed by MRI and arthroscopy. The functional outcome of anterior cruciate

ligament reconstruction with quadrupled STG tendon autograft is excellent at the end of 6 months. ACL reconstruction by using four strand hamstring tendon autograft is highly successful in providing a stable knee with very few complications when proper graft, harvest preparation and anatomical tunnel placement is achieved.

Acknowledgments

I would like to thank department of orthopaedics, KIMS, huballi for giving me this opportunity and also kims hospital for letting conduct this study and finally i would like to thank my patients for the co operation in this study

Author’s Contribution

Not available

Conflict of Interest

Not available

Financial Support

Not available

References

1. Anatomic endoscopic anterior cruciate ligament reconstruction with patella tendon autograft. E. Lyle Cain, Jr,MD, William G. Clancy,Jr,MD. OCNA. 2002;33:717-725.
2. Anatomy and biomechanics of ACL. Michael Dienst, MD, Robert T. Burks, MD, Patrick E.Greis, MD. OCNA. 2002;33:605-620.
3. Fate of the anterior cruciate ligament – in injured knee. Donald C. Fithian, MD, Liz W.Paxton, MA, David H. Goltz, MD. OCNA. 2002;33:621-636.
4. Lysholm J, Tegner Y. Knee injury rating scales. Acta Orthop. 2007 Aug;78(4):445-53.
5. Mayo Robson AW: Ruptured cruciate ligaments and their repair by operation Ann Surg. 1903;37:716-718.
6. Chir Narzadow Nuchu. Orthopaedics Poland. 1997;62(3):233-8.
7. Arthroscopic Assisted ACL Reconstruction – 26 months follow-up study. Boden, Moyer, Berz, Sapaga. Contemporary ortho. 1990 Feb;20(2):183-99, 394. Jan 2002. Page 154-60.
8. Clancy WG. Arthroscopic ACL reconstruction with patellar tendon. Tech Orthop. 1988;2:13-134..
9. Brown TN, Palmieri Smith RM, Mclean SG. Sex and limb differences in hip and knee kinematics and kinetics during anticipated and unanticipated jump landings: implications for anterior cruciate ligament injury. Br J Sports Med. 2009;43:1049-56.
10. Nikolaou VS, Chromopoulos E, Savvidou C, Plessas S, Giannoudis P, Nicolas E, *et al.*, MRI efficacy in diagnosing internal lesions of knee: A retrospective analysis. J Trauma Management and Outcomes. 2008, 02-04.
11. Lewis DW, Chan D, Fisher O, Lechford R, Mintowt-Czyz WJ, Lewis MW. Incidence of meniscal and chondral injuries at the time of ACL reconstruction, and their relationship with outcome at 2 years. Orthopaedic Proceedings. 9th ed. London: Bone and Joint Publishing, 2012, 41.
12. Williams RJ, Hyman J, Petrigliano F, Rozental T, Wickiewicz TL. Anterior cruciate ligament reconstruction with a four strand hamstring tendon

- autograft. *J Bone Joint Surg.* 2005;87(1):51-66.
13. Fareed H, Dionellis P, Paterson FWN. Arthroscopic ACL Reconstruction using 4 strand hamstring tendon graft. *J Bone Joint Surg.* 2003;85B:231-6.
 14. Button K, Deursen RV, Price P. Management of functional recovery in individuals with acute anterior cruciate ligament rupture. *Br J Sports Med.* 2005;39:866-71.
 15. Khan RM, Prasad V, Gangone R, Kinmont JC. Anterior cruciate ligament reconstruction in patients over 40 years using hamstring autograft. *Knee Surg Sports Traumatol Arthrosc.* 2010;18(1):68-72. 22.
 16. Aparajit P, Koichade MR, Jain N. Study of Arthroscopic Reconstruction of Anterior Cruciate Ligament Injury. *Int J Biomed Res.* 2020;7(6):32936.
 17. Kumar PA, Rambabu P, Srinivasarao K, Krishna KV, Krishna CV, Sekhar SC, *et al.* Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tears. *J Evol Med Dental Sci.* 2016;5(10):427-33.
 18. Gulick TD, Yoder HN. Anterior cruciate ligament reconstruction: Clinical outcomes of patella tendon and hamstring tendon grafts. *J Sports Science and Medicine* 2002;1:63-71.

How to Cite This Article

Venkatesh M, Sandeep I, Gautham M. A clinical study to determine the early functional outcome of ACL injuries managed by arthroscopic reconstruction using four strand hamstring graft with interference screw. *International Journal of Orthopaedics Sciences* 2023; 9(1): 400-406

Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.