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Functional Outcome of Arthroscopic Reconstruction of Single Bundle Anterior Cruciate Ligament with 5 Strand Hamstring Autograft

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Abstract

Background: Most commonly reconstructed ligament of knee is Anterior Cruciate Ligament that aims to halt or minimise the number of instability episodes 1. Testing with biomechanical parameters has shown that there is correlation between graft cross-sectional area and maximum load to failure 2. This study attempts to analyse the functional outcome of ACL reconstruction with 5 strands of hamstring autograft **Aims and Objectives:** This study is based on hypothesis that larger graft will be stronger, stiffer providing better functional outcome. **Materials & Methods:** 35 Patients having ACL injury were treated at a tertiary care hospital; using a 5-strand hamstring graft, fixed with suspensory fixation at femoral side and aperture fixation at the tibial side. Cases were diagnosed with ACL on clinical examination & MRI. Tegner-lyshom score and International Knee Documentation Committee - Orthopaedic Scores (IKDC) is used post-operatively to grade the functional outcome of an ACL reconstruction. **Results**: Male predominance was observed in study subjects than female with left side slightly more commonly involved than right. Laterality didn't influenced outcome. Graft diameter observed is 9mm in 68.6%, 8 mm and 10 mm was observed in 11.4% and 20% respectively. Lysholm score at baseline was 41.63 which increased progressively to 93.45 at the end of 9 months. The IKDC score at baseline was 32.5 which increased progressively to 83.45 at the end of 12 months. Superficial infections was seen in 8.6% while complaint of knee pain was given by 2.9% cases. Lachman test was positive in 2 (5.7%) cases. **Conclusion**: Five-strand graft offers very high strength and more length than the 4ST. It is useful in patients with ligamentous laxity, small tendons, or other stability risk factors.

Keywords: ACL, Autograft, Graft Diameter, 5 Strand

1. Introduction

Commonly used ligament for anterior cruciate ligament (ACL) reconstruction is four stranded hamstring autograft. Proponents of this method claim to reduce potential for catastrophic extensor mechanism complications and a lower incidence of anterior knee pain associated with central-third bone–patellar tendon–bone (BPTB) autograft. Additionally, when 4-strand gracilis and

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semitendinosus autograft have tested biomechanically, it has proved a higher load to failure than that with BPTB autograft[1-3]. Clinical outcomes are similar with 4-strand hamstring autograft and that of BPTB autograft[4].

Prodromos *et al.*[5] hypothesised that a stronger, stiffer five-strand HS (5HS) graft would produce higher stability compared to 4HS graft. Their study concluded that 5HS ACL reconstruction had higher stability than a high stability 4HS cohort. Thus 5HS is preferable to 4HS for ACL reconstruction, especially for double bundle techniques.

Considering the research, this study uses Lysholm scoring and IKDC system of scoring to evaluate the results of arthroscopic reconstruction performed for single bundle ACL using 5 strands of hamstring autograft.

2. Aims and Objectives

To analyse the functional outcome of ACL reconstruction with 5 strands of hamstring autograft

3. Materials and Methods

This research is a prospective study design in a sample of 35 patients attending Department of Orthopaedics of a tertiary care private hospital. The study was approved by the Institutional ethics committee.

All patients were informed about details of study, and a valid informed consent was obtained. 35 patients were treated using five stranded hamstring autograft. Cortical fixation (suspensory fixation) in the form of EndoButton was used for the femoral fixation and aperture fixation using interference screw was used for the tibial fixation according to the graft length and diameter.

Care was taken to have a minimum of 15 mm graft in the femoral tunnel.

Age group between 20 yrs to 50 yrs, irrespective of sex, complete anterior cruciate ligament tear confirmed clinically and radiologically on MRI and incidental finding of Anterior Cruciate Ligament injury found during diagnostic arthroscopy are included in the study.

Any infections or any lesion over the skin, multiligamental injuries, revision of Anterior Cruciate ligament or any associated lower limb fracture patients are excluded from the study.

After doing ACL reconstruction using 5 strand Hamstrings autograft, the patient were assessed for the functional outcome using Tegner-lysholm knee scoring scale at 3, 6 and 9 months and also with International

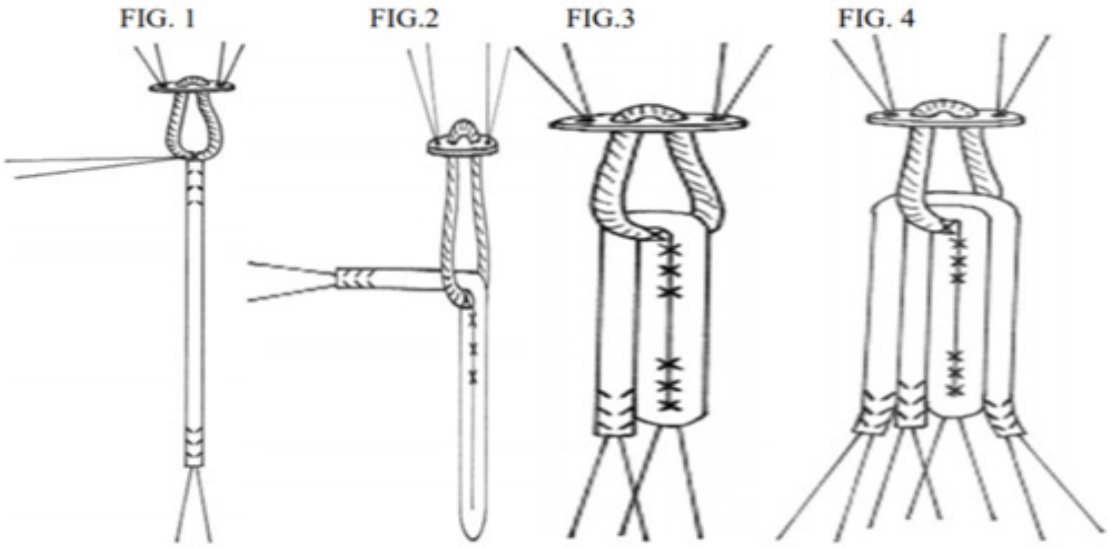

Figure 1-4. Surgical procedure for ACL five strand graft preparation.

Knee Documentation Committee - Orthopaedic Scores at post-operative interval of 3, 6, 9 and 12 months.

To study the post-operative complications of procedure the patients were assessed immediately after surgery, at 24 hrs, 48 hrs, 5 days and on subsequent schedule follow-up.

The study participants were informed to report to health facility as and when required apart from schedule visit.

3.1 Surgical Technique

One end of the semitendinosus tendon is fixed with nonabsorable sutures to the EndoButton loop with free end from its running, locking sutures (Figure 1). The other, free end of the semitendinosus is passed from the EndoButton loop to make 3 equal-length tendon strands (Figure 2). The preserved suture limbs previously used to secure the end of semitendinosus to the EndoButton loop are used to secure the 2 graft strands connected by a tendon loop distally away from the EndoButton (Figure 3). The gracilis tendon is passed from the EndoButton loop and the 5-strand graft is completed (Figure 4 & 5)[6]

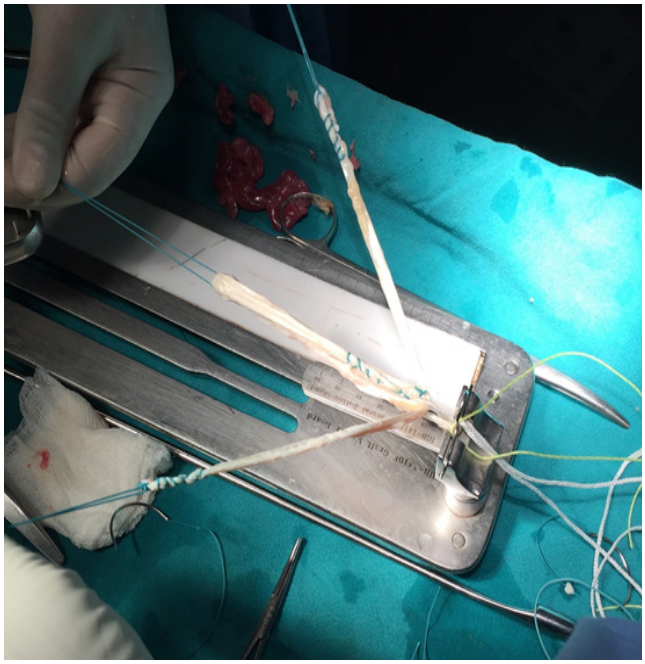

Figure 5. Five strand ACL graft.

4. Observation and Results

35 Patients having ACL injury were treated at a tertiary care hospital; using a 5-strand hamstring graft, fixed with suspensory fixation at femoral side and aperture fixation at the tibial side.

Most of the subjects were between 21-40 years of age (80%) with mean age of 34.12 +/- 4.7 years (Figure 6).

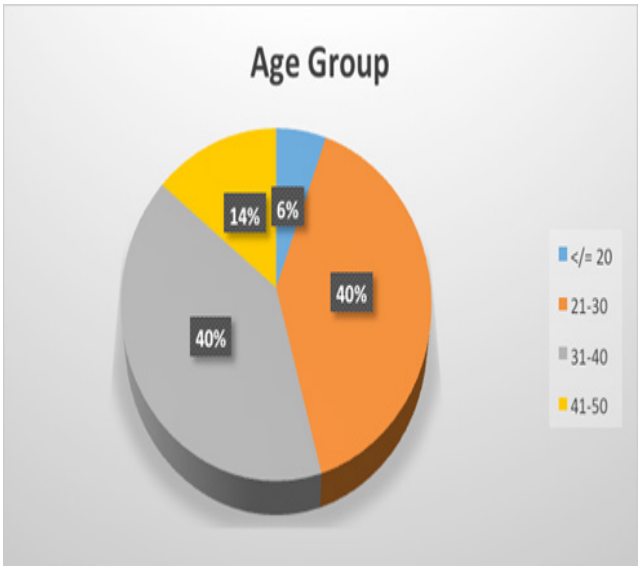

Figure 6. Age wise distribution of patients.

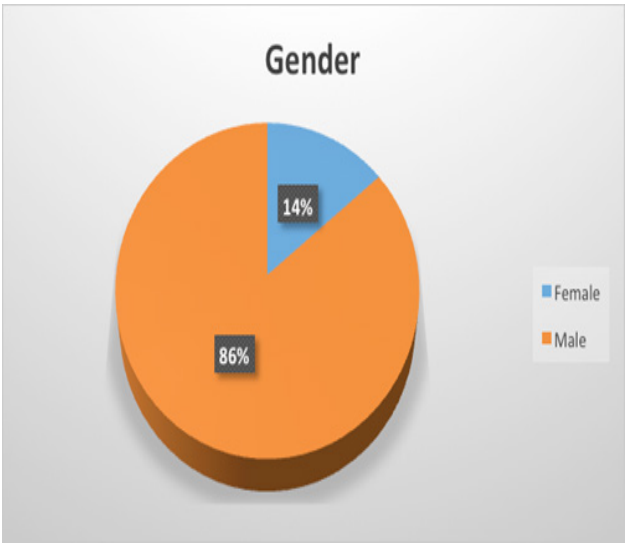

Figure 7. Gender wise distribution of patients.

Male predominance was observed in study subjects with 85.7% males to 14.3% females (Figure 7).

Most common mechanism of injury for ACL tear was sports injury (40%) followed by RTA (34.3%) and domestic injuries due to fall (25.7%) (Figure 8).

There is no superficial or deep infection seen, while complaint of knee pain was given by 2.9% cases (Figure 12).

Lachman test was positive in 2 (5.7%) cases (Figure 12).

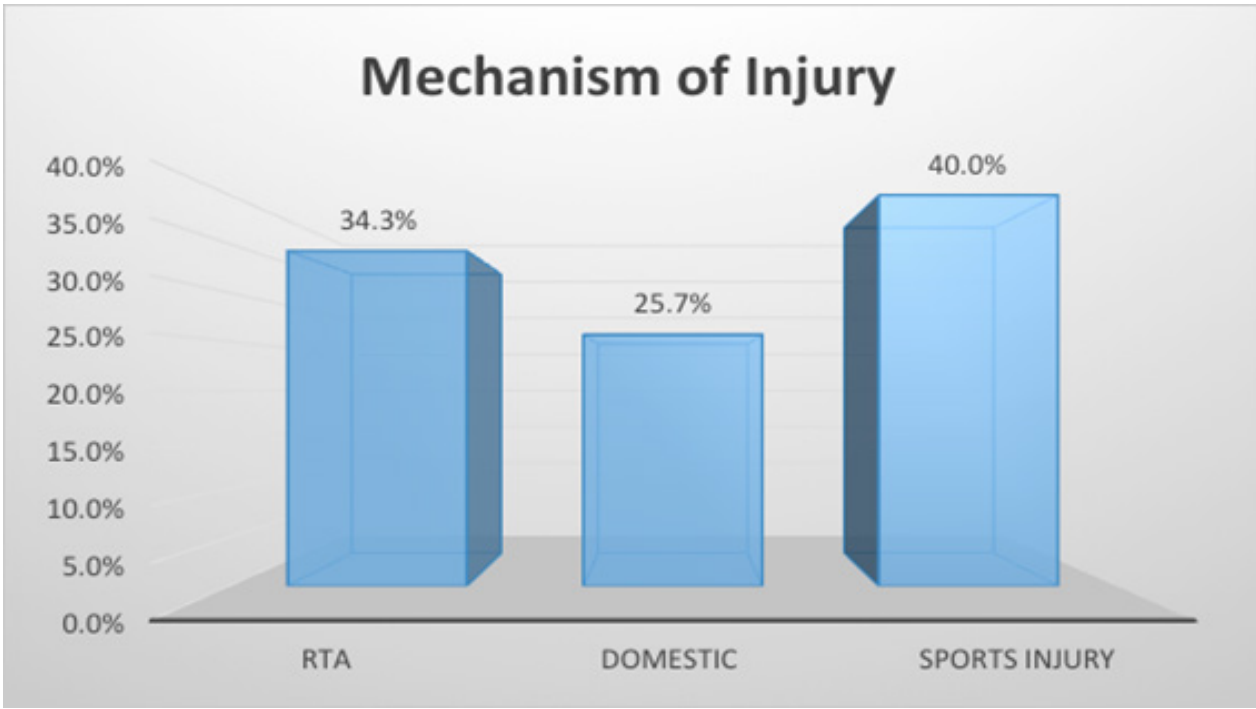

Figure 8. Distribution of patients according to mechanism of injury.

The graft size was 9 mm in 68.6% cases while size of 8 mm and 10 mm was used in 11.4% and 20% respectively (Figure 9).

Lysholm score at baseline was 41.63 which increased progressively to 93.45 at the end of 9 months. The mean improvement was significant at each follow up (i.e. at 3, 6 and 9 months) from the last follow up ($p<0.05$) (Figure 10).

The IKDC score at baseline was 32.5 which increased progressively to 83.45 at the end of 12 months. The mean improvement was significant at each follow up (i.e. at 3, 6, 9 and 12 months) from the last follow up ($p<0.05$) (Figure 11).

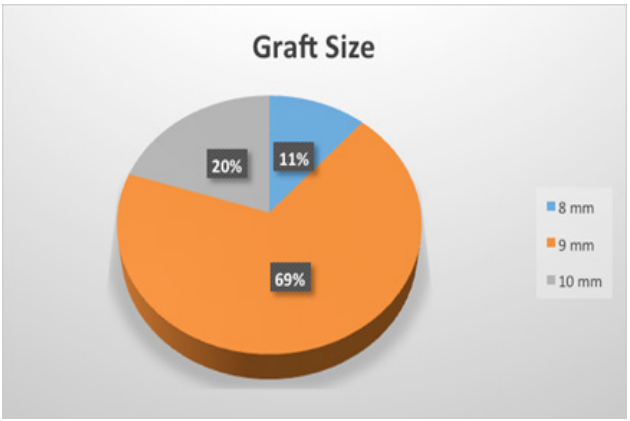

Figure 9. Distribution of patients according to graft diameter.

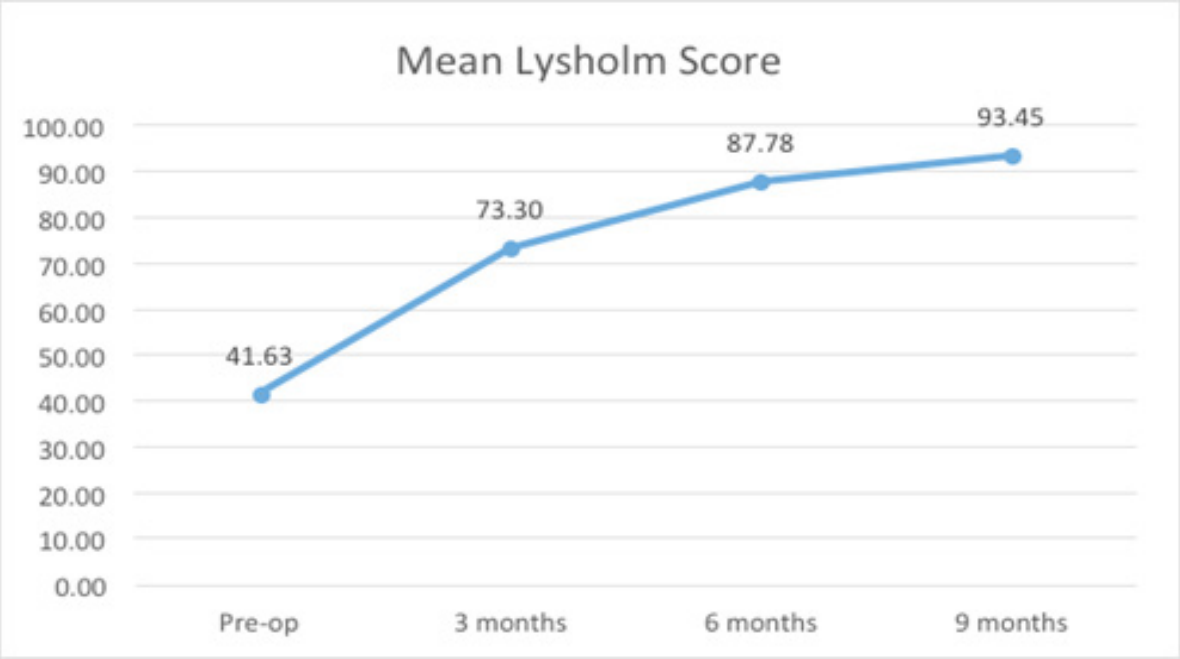

Figure 10. Distribution of patients according to Tegner Lysholm score.

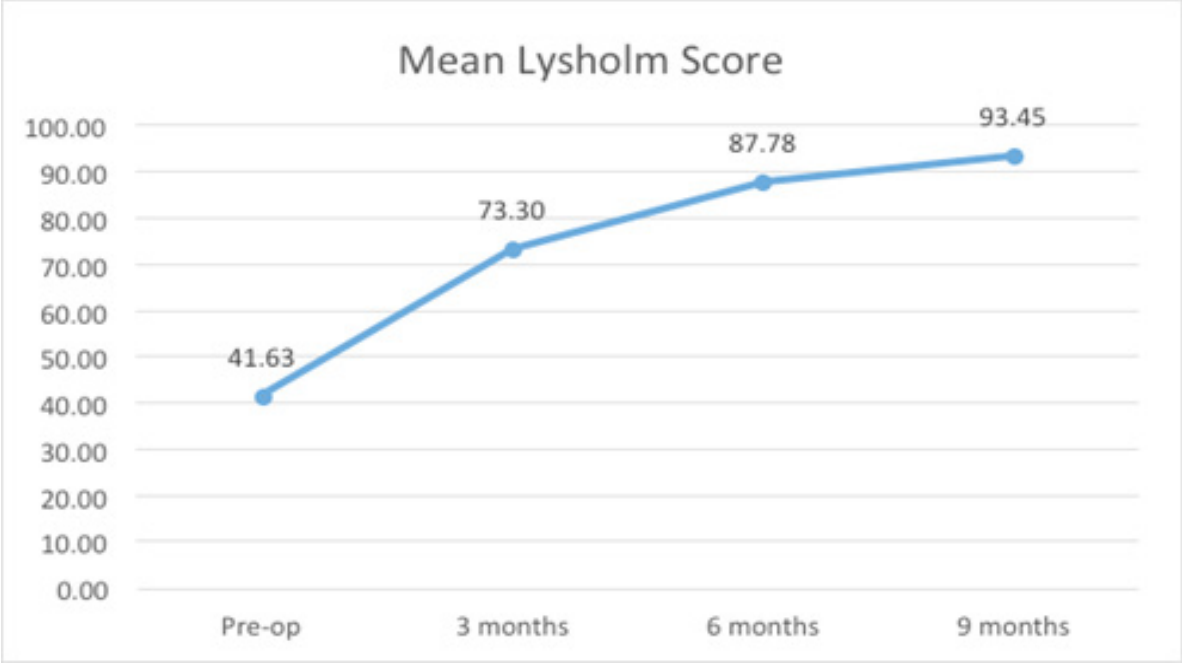

Figure 11. Distribution of patients according to IKDC score.

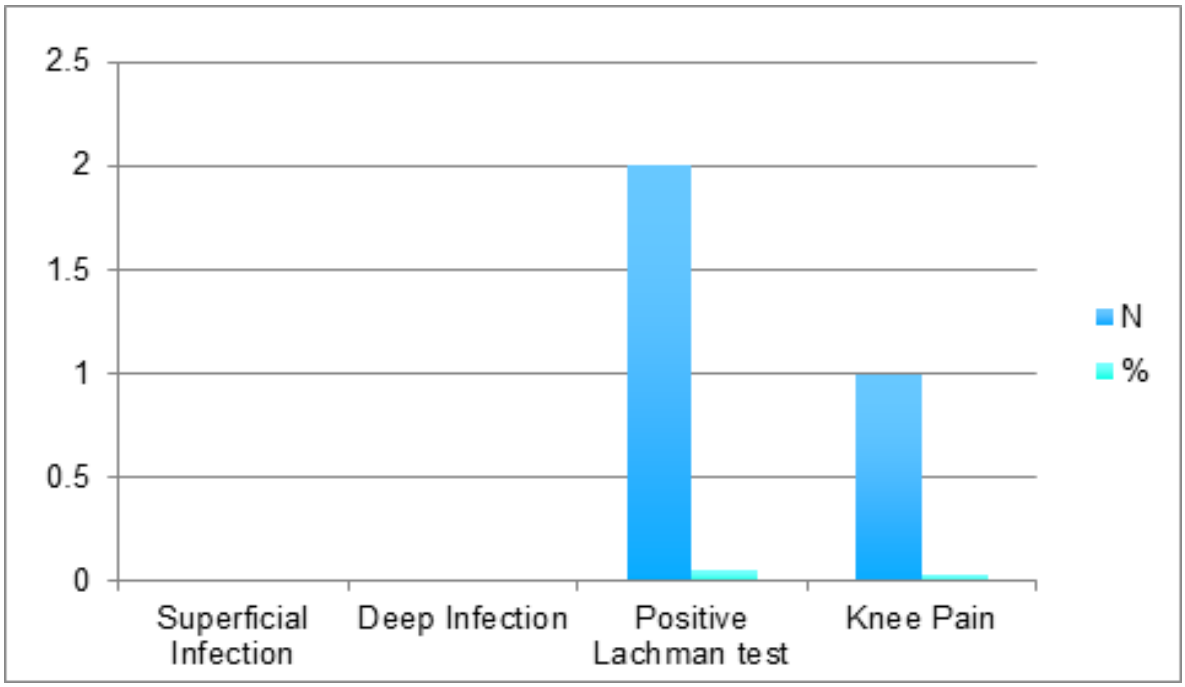

Figure 12. Distribution of patients according to complications.

5. Discussion

Anterior cruciate ligament injuries are significant when they involve a complete intrasubstance tearing of the anterior cruciate ligament (ACL) in the knee.

The injury is characterized by joint instability that leads to pain, decreased activity and function, poor-knee-related quality of life, and an increased risk of osteoarthritis of the knee. The ultimate goal for the reconstruction of ACL is the restoration of normal knee kinematics. Various options for the graft are available for the treatment and each option has its own set of advantages and limitations.

The present study was conducted to assess the functional outcome of single bundle 5 strand Anterior crucial ligament post operatively using Tegner Lysholm score and International Knee Documentation Committee - Orthopaedic Scores.

Most of the subjects were between 21-40 years of age (80%) with mean age of 34.12 +/- 4.7 years. Male predominance was observed in study subjects with 85.7% males to 14.3% females.

In a large study by Mei Y *et al.* a total of 4355 ACL deficient inpatients (612 athletes and 3743 non-athletes) were registered. Of all the 4355 cases, the mean age at the time of first injury was (25.4±8.8) years (range: 8 years to 63 years). Totally 3078 patients (70.68%) were male and 1277 (29.32%) were female[7].

In a study by Kim *et al.* there were 8 females and 25 males with a mean age of 29.8 years (range, 17 to 58 years)[8].

Our results are also consistent with Haitao *et al.*[9], who found ACL tears to be 2.5 times more in boys than girls.

These observations can be explained as men and boys are more involved in highly competitive and contact sports games, for example, soccer, basketball, skateboarding and road traffic accidents in India.

The 3ST/2Gr five-strand graft offers very high strength and more length than the 4ST. It is useful in patients with ligamentous laxity, small tendons, or other stability risk factors. In present study too, at the end of follow up, excellent results were seen in 71.4% patients while good to fair results were seen in 20% and 8.6% patients.

The functional outcome was measured by Lysholm knee scoring scale and International Knee Documentation Committee score.

Lysholm knee scoring scale was another score which gives information as to how the knee problems have affected the patient's ability to manage things in everyday life. In present study, Lysholm score at baseline was 41.63 which increased progressively to 93.45 at the end of 9 months. The mean improvement was significant at each follow up (i.e., at 3, 6 and 9 months) from the last follow up ($p<0.05$).

International Knee Documentation Committee (IKDC) score was used for subjective knee evaluation of difficulty in daily activities. It is the standard score used for treatment of knee ligament injuries. The IKDC score at baseline was 32.5 which increased progressively to 83.45 at the end of 12 months. The mean improvement was significant at each follow up (i.e. at 3, 6, 9 and 12 months) from the last follow up ($p<0.05$).

In a similar study by Wagh *et al.*[10], 40 Patients having ACL injury were treated using a 5-strand hamstring graft. A total of 30 patients had excellent outcome (75%), 7 (17.5%) patients had good outcome and 3 patients (7.5%) had fair outcome and none had poor outcome as per Tegner lyshom score.

Figueroa F *et al.*[11] observed an average postoperative Lysholm score as 93.3 in group A (quadruple ST-G graft) and 97.1 in group B (5-strand graft). Mean postoperative IKDC: 91 points in group A and 96.8 in group B ($p=0.18$). The score were higher in 5-strand hamstring graft technique, suggesting that it is a valid option when there is an insufficient diameter graft.

Lavery KP *et al.*[6] in their observation study concluded that use of Five-Strand Hamstring Autograft for Anterior Cruciate Ligament Reconstruction significantly reduces revision rates.

Prodromos *et al.*[5] treated 20 consecutive patients with 5HS ACL reconstruction using 3ST/2Gr. Study concluded that 5HS ACLR had higher stability than a high stability 4HS cohort. Authors recommended that 5HS is preferable to 4HS for ACL reconstruction, especially for double bundle techniques.

Lee RJ *et al.*[12] in their series also used 5 strand hamstring graft with success and observed less revision rates.

However, Sideris A *et al.*[13] in their study observed no benefit of using a Five-Strand Hamstring Tendon Autograft when compared to the gold standard Four-Strand Repair, specifically with regards to anterior stability of the knee in the first 12 weeks postoperatively

We thus observed that 3ST/2Gr five-strand graft offers very high strength and more length than the 4ST. Using a 5-strand hamstring graft by creating 3 equal strand of semitendinous and double of gracilis gives an increase in diameter >2 mm in our study maximum to 9mm diameter which leads to stronger graft and it decreases revision rate.

6. Conclusion

We thus conclude that 3ST/2Gr five-strand graft offers very high strength and more length than the 4ST. It is useful in patients with ligamentous laxity, small tendons, or other stability risk factors. Regarding minimum graft tunnel length: 15 mm of graft would appear to be all that is necessary in the tunnels for adequate healing. Gracilis harvest does not disable two hamstrings because Gr is not a hamstring but rather is an adductor, both anatomically and functionally.

Using a 5 strand hamstring graft by creating 3 equal strand of semitendinosus and double of gracilis gives an increase in diameter >2 mm in our study maximum to 9mm diameter which leads to stronger graft and it decreases revision rate.

7. References

1. Shelbourne KD, Gray T. Minimum 10-year results after anterior cruciate ligament reconstruction: How the loss of normal knee motion compounds other factors related to the development of osteoarthritis after surgery. Am J Sports Med 2009; 37: 471–80. https://doi.org/10.1177/0363546508326709
2. Hamner D.L., Brown C.H., Jr., Steiner M.E., Hecker A.T., Hayes W.C. Hamstring tendon grafts for reconstruction of the anterior cruciate ligament: Biomechanical evaluation of the use of multiple strands and tensioning techniques. J Bone Joint Surg Am. 1999; 81: 549–557. https://doi.org/10.2106/00004623-199904000-00013
3. Wilson T.W., Zafuta M.P., Zobitz M. A biomechanical analysis of matched bone-patellar tendon-bone and double-looped semitendinosus and gracilis tendon grafts. Am J Sports Med. 1999; 27: 202–207. https://doi.org/10.1177/03635465990270021501

4. Sajovic M., Strahovnik A., Dernovsek M.Z., Skaza K. Quality of life and clinical outcome comparison of semitendinosus and gracilis tendon versus patellar tendon autografts for anterior cruciate ligament reconstruction: An 11-year follow-up of a randomized controlled trial. Am J Sports Med. 2011; 39: 2161–2169. https://doi.org/10.1177/0363546511411702
5. Prodromos CC, Joyce B. 5-Strand Hamstring ACL Reconstruction: A New Technique with Better Long-Term Stability Versus 4-Strand (SS-13). Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2006 Jun 30; 22(6): e7. https://doi.org/10.1016/j.arthro.2006.04.015
6. Lavery KP, Rasmussen JF, Dhawan A. Five-Strand Hamstring Autograft for Anterior Cruciate Ligament Reconstruction. Arthroscopy Techniques. 2014; 3(4): e423–e426. doi:10.1016/j.eats.2014.01.013.
7. Mei Y, Ao YF, Wang JQ, Ma Y, Zhang X, Wang JN, Zhu JX. Clinical characteristics of 4355 patients with anterior cruciate ligament injury. Chin Med J. Dec 2013; 126(23): 4487–92.
8. Kim MK, Lee BC, Park JH. Anatomic single bundle anterior cruciate ligament reconstruction by the two anteromedial portal method: the comparison of transportal and transtibial techniques. Knee surgery & related research. 1 Dec 2011; 23(4): 213–9. https://doi.org/10.5792/ksrr.2011.23.4.213
9. Haitao Z. The investigation on students sports tastes and their choices of events. Sports Sci 1999; 20: 63–64.
10. Wagh N et al. Functional outcome of Arthroscopic reconstruction of single bundle anterior cruciate ligament using 5 strand hamstring graft. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2015; 14(12): 59–62
11. Figueroa F, Calvo R, Figueroa D, Vaisman A, Arellano S. Five-Strand Hamstrings Autograft Versus Quadruple Hamstrings Autograft, with Graft Diameters 8.0 Millimeters or More, in Anterior Cruciate Ligament Reconstruction: Clinical Outcomes with a Minimum Two-Year Follow-Up. Arthroscopy. 1 Oct 2017; 33(10): e142. https://doi.org/10.1016/j.arthro.2017.08.175
12. Lee RJ, Ganley TJ. The 5-strand hamstring graft in anterior cruciate ligament reconstruction. Arthroscopy techniques. 31Oct 2014; 3(5): e627–31. https://doi.org/10.1016/j.eats.2014.07.002
13. Sideris, A., Hamze, A., Bertollo, N., Broe, D. and Walsh, W. (2017) Five Strand Hamstring Tendon Autograft for Anterior Cruciate Ligament Reconstruction Provides No Benefit over the Gold Standard Four Strand Repair for Anterior Stability of the Knee: A Prospective Cohort Study. Open J Orthop., 7, 156–172. https://doi.org/10.4236/ojo.2017.76018

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