



ORIGINAL RESEARCH PAPER

Orthopaedics

A COMPARATIVE STUDY BETWEEN SUSPENSORY AND APERTURE FIXATION METHOD IN ARTHROSCOPIC SINGLE BUNDLE ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

KEY WORDS:

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ABSTRACT

Purpose: To compare the functional outcome of suspensory and aperture fixation method in arthroscopic single bundle anterior cruciate ligament. **Method:** 30 patient (mean age grp ,35yr) underwent arthroscopic ACL repair with 15 got suspensory and another 15 got aperture fixation in random selection. Similar implant were use to nullify the error. We taken patient with MRI finding of isolated ACL (23) and ACL with medial meniscus tear(7) in our study. No multiligamentous injury were taken. The functional outcome measure with lachman test, Lysholm score ,IKDC score. Post op rehabilitation of early mobilization was done. **Inclusion Criteria:** Patient given their consent , Age 20-60 years , Confirmed Complete ACL Tear in MRI **Exclusion Criteria:** Patients refusing for consent, Patient not ambulatory , Multi-ligament knee injury , Chronic ACL insufficiency with osteoarthritis , Contradiction to Arthroscopy **Result:** Patient were followed up in 3week,6week,3month,6month and 1 year. Lysholm score of suspensory were 65.3%, 81.6%,84.5%, 85.1%,97.2%. Aperture fixation scores were 63.7%,76.8%,80.6%,82.13%,95.9%. The IKDC score is 57%, 62.1%,65%,66.6%,77.7% in suspensory fixation and 58.6%,61.6%,63.8%,65.4%,75.1% in aperture fixation. **Conclusion:** Lysholm score ad IKDC score show no much difference between these two after 3 week,6 week,3 months,6 months of post operation. But after 1 year somehow suspensory had a better result than aperture fixation method.

INTRODUCTION

Arthroscopic anterior cruciate ligament reconstruction is one of the evolving branch of orthopaedic surgery. The arthroscopically aided reconstruction of the ACL with a autogenous quadrupled hamstring graft has been the standard of treatment in ACL deficient knees, particularly in young and athletic individuals .A graft with low morbidity ;excellent cosmetics, strength and stiffness; and secure early fixation and incorporation near the joint line are the ultimate goals of ACL surgery. There are two types of graft fixation at the femoral end namely; Aperture fixation and suspensory fixation.(1,2) There is currently no gold standard for the fixation of soft tissue grafts for ACL reconstruction. A major cause of concern with hamstring autograft that it takes 12 weeks to heal to the osseous tunnel.(3,4) Thus, a secure fixation technique is needed to withstand the forces on the graft resulting from current rehabilitation protocols that allow for early mobilization.(3,5) The purpose of our study is to investigate whether there is any difference in functional outcome of 2 fixation technique and the duration in which the patient return to pre injury activity level.

AIM

This is a prospective observational comparative clinical study between suspensory and aperture fixation method in arthroscopic single bundle ACL reconstruction.

MATERIAL AND METHOD

30 patient(26 male,4 female) admitted to HI-TECH MEDICAL COLLEGE AND HOSPITAL ,BBSR for arthroscopic single bundle ACL reconstruction with a diagnosis of ACL Tear. All were evaluated with Lachman test, IKDC scoring system and Lysholm scoring system at regular follow up intervals (3weeks,6 weeks,3month,6 month and 1 year).

METHODOLOGY

The study was conducted on 30 patients diagnosed with complete Anterior Cruciate Ligament Tear. Patient was explained about the nature of the study and the consent was taken. All the patients were subjected to clinical examination,MRI scanning and diagnostic arthroscopy. Patients with a recent knee injury were managed initially with conservative measures like rest, ice pack application, compression and elevation(RICE Therapy) and were subjected to radiological and clinical evaluation after three

weeks. Then clinical evaluation done by lachman,IKDC scoring system and lysholm scoring system .After confirmation by diagnostic arthroscopy and before the arthroscopic ACL reconstruction procedure, the hamstring autograft were harvested from ipsilateral lower limb and/or contralateral lower limb if desired using standard oblique incision over the pes anserine. After grafts harvest the physical dimensions of the grafts were measured by the operating surgeon by appropriate graft measuring device. Then ACL reconstruction done by aperture fixation method or suspensory fixation method on both tibial and femoral side. The patients were randomised by odd serial numbers (i.e Suspensory Method,Group A) and even serial number (i.e Aperture fixation method,Group B). Similar implants were used in all the cases to nullify the variability. The standard rehab protocol for ACL reconstruction was following on all cases by Lachman test,IKDC scoring system and lysolm scoring system at regular follow up intervals (3 weeks,6weeks,6 months and 1 year).The functional outcomes were analyzed.

Clinical Examination

After taking the preliminary patient demographics (name,age,sex,height,weight,side of the knee injured) mode of injury and history(onset of effusion,presence of popping and locking,giving way and subjective instability),clinical examination for all the patients was carried out by same orthopaedic surgeon which included the presence of effusion, range of motion, joint line tenderness,varus and valgus stress tests, three plane stability test. Standard clinical tests were used for diagnosing pathologies. For meniscus injuries, McMurray's and apley's test were used. Test used for cruciate ligament assessment were anterior and posterior drawer test,lachman test,for rotatory instability Pivot shift test,slocum test and dial test.If suspicion of PCL injury, quadiceps active test and posterior tibial sag sign was done to exclude the patients.

Mri Evaluation

MRI was done for all patients to correlate the clinical diagnosis and for obtaining additional information. All MR imaging were performed using a standard routine knee protocol on a 1.5 tesla MR scanner with a phased array knee coil. All the patient had T1 and T2 weighted and proton dense sequences on coronal and saggital plane images without

contrast.MR pulse sequences includes fast spin echo(FSE) AND fast recovery. The MRI protocol consists of fat suppressed PD(Te 45, TR 2800) in axial,saggital and coronal planes,T2W(Te 80,TR 4000) in saggital plane and T1W(Te 11,TR 495) In saggital plane. The slice thickness was 4 mm.

OBSERVATION:

This is a prospective observational comparative clinical study of 30 patient divided in two groups. Group A (Suspensory fixation method)n=15 and Group-B(aperture fixation method) n=15 admitted to Hi-Tech medical College and Hospital, Bhubaneswar for Arthroscopic single bundle anterior cruciate ligament reconstruction with a diagnosis of Anterior Cruciate Ligament Tear from November 2021 to October 2022.

In our series of 30 patients most number of patients were from 20-24 age group (n=10) with an average of 33.33%.The total number of male patients were (n=24) .

Right side involvement is more in both groups i.e. with an average of 60%.

Most common mode of injury in our study is sports injury, RTA, Domestic twisting injury. We excluded multi-ligamentous injury.

Usual time of presentation since trauma was 20-24 days. The most common MRI finding is isolated ACL-tear, next most common is ACL with medial meniscus injury.

In our series we evaluate Lysholm score preoperatively(61.4), post operatively in 3 weeks(65.3), 6 weeks(81.6), 3 months(84.5) ,6 months(85.1) and in one year(97.2).

In aperture fixation method Lysholm score preoperatively (60.26),3 weeks (63.7),6 weeks (76.8),3 months(80.6), 6 months(82.13) after one year (95.9). Its clearly shows that in suspensory method the scores are better than aperture fixation method.

The average preoperative IKDC score of suspensory fixation method was 54.4% ,post op at 3 weeks(57%) , 6 weeks(62.1%),3 months (65%), 6 months(66.63%) after one year it increase to 77.73%.

The average preoperative IKDC score of aperture fixation method was 54.73% ,post op at 3 weeks(58.6%) , 6 weeks(61.6%),3 months (63.8%),6 months(65.43%) after one year it increase to 75.16%.

Definitely the scores were in increasing manner but the 1 year post-op score of suspensory method was slightly better than aperture.

DISCUSSION

In our study 30 pateint divided in two groups,Group A (Suspensory fixation method)n=15 and Group-B(aperture fixation method) n=15. We randomized it by odd and even serial no. Out of 30 patients most number of patients were from 20-24 age group (n=10) with an average of 33.33%. This type of trend is also seen in Adachi N etal(n=80 aperture 40, suspensory 40)of age 20-24 year. However Han I etal published a paper they show that the common age group were 30-35.

In 2009 volpi P etal has male dominance of 81.2% where as in Tow BP etal got almost same male female ratio. In our study female dominance is low because in east Indian most of women work from house or housewives.

We excluded multi ligmentous injury to nullify the end result variability because the IKDC and Lysholm score are less in compare to isolated ACL injuries. In 2006 Weiler A etal study

over 72 patients and the common mode of injury was RTA(47).in our study most common mode is sports injury.

The common time interval between trauma to presentation is 20-24 days average 31 days. Since we asked all patients to come after 3 weeks of injury after subsiding of swelling. This type of observation had never done before.

MRI finding of isolated ACL tear in an average 66.6% which is almost similar to W.Pichler etal.

In our series we evaluate Lysholm score preoperatively(61.4), post operatively in 3 weeks(65.3), 6 weeks(81.6), 3 months(84.5) ,6 months(85.1) and in one year(97.2).

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The average preoperative IKDC score of suspensory fixation method was 54.4% ,3 weeks(57%) ,6 weeks(62.1%),3 months (65%),6 months(66.63%) after one year it increase to 77.73%. The average preoperative IKDC score of aperture fixation method was 54.73% , 3 weeks(58.6%) , 6 weeks(61.6%),3 months (63.8%), 6 months(65.43%) after one year it increase to 75.16%.

Definitely the scores were in increasing manner but the post-op score of suspensory method was slightly better than aperture.

The aim of our study was to compare between suspensory fixation group and appraisal fixation group. However we took two scoring method Lysholm and IKDC and there were no much difference between the two after 3 weeks , 6 weeks , 3 months , 6 months of post – op. But after one year somehow suspensory had a better result than aperture fixation.

Correlation coefficient of suspensory fixation to aperture after one year (r value =0.471, p value = 0.009) which was statistically significant . Hence we recommend the suspensory method was better than aperture.

RESULTS

There were 20(66.66%)patients with isolated ACL tear ,7(23.33%)with ACL with medial meniscus injury ,3 (avg 10%) with ACL and lateral meniscus. The Lysholm score of suspensory fixation is 97.2 where as for aperture fixation is 95.9.the IKDC Score for suspensory fixation is 77.73% and 75.16% for aperture fixation.

CONCLUSION

Suspensory and aperture fixation of hamstring graft in ACL reconstruction are comparable clinically with relatively better outcome scores of suspensory fixation method over aperture fixation method.

REFERENCES

1. Brand Jr., J.C.Caborn D.N.Johnson D.L.Biomechanics of soft-tissue interference screw fixation for anterior cruciate ligament reconstruction.Orthopedics.2003;26:432-439
2. Brand Jr., J.Hamilton D.Selby jPienkowski D.Caborn D.N.Johnson D.L.Biomechanical comparison of quadriceps tendon fixation with patellar tendon bone plug interference fixation in cruciate ligament reconstruction.Arthroscopy.2000;16:805-812
3. Brand Jr., J.C.Pienkowski D.Steenlage E.Hamilton D.Johnson D.L.Caborn D.N. Interference screw fixation strength of a quadrupled hamstring tendon graft is directly related to bone mineral density and insertion torque.Am J Sports Med.2000;28:705-710
4. Brand J, Weiler A, Caborn DN, Brown CH Jr, Johnson DL. Graft fixation in cruciate ligament reconstruction. Am J Sports Med.2000;28:761-74
5. Buelow JU, Siebold R, Ellermann A. A prospective evaluation of tunnel enlargement in anterior cruciate ligament reconstruction with hamstrings: extracortical versus anatomical fixation. Knee Surg Sports Traumatol Arthrosc.2002;10:80-5.
6. Chen N.C.Brand Jr., J.C.Brown Jr., C.H.Biomechanics of intratunnel anterior cruciate ligament graft fixation. Clin Sports Med.2007;26:695-714

7. Elliott M.J, Kurtz C.A. Peripheral versus aperture fixation for anterior cruciate ligament reconstruction. *Clin Sports Med.* 2007; 26: 683-693
8. Fauno P, Kaalund S. Tunnel widening after hamstring anterior cruciate ligament reconstruction is influenced by the type of graft fixation used: a prospective randomized study. *Arthroscopy.* 2005; 21: 1337-41.
9. Ilahi O.A, Nolla J.M, Ho D.M. Intra-tunnel fixation versus extra-tunnel fixation of hamstring anterior cruciate ligament reconstruction: A meta-analysis. *J Knee Surg.* 2009; 22: 120-129
10. Ishibashi Y, Rudy T.W, Livesay G.A, Stone J.D, Fu F.H, Woo S.L. The effect of anterior cruciate ligament graft fixation site at the tibia on knee stability: Evaluation using a robotic testing system. *Arthroscopy.* 1997; 13: 177-182
11. Liu-Barba, D, Howell S.M, Hull M.L. High-stiffness distal fixation restores anterior laxity and stiffness as well as joint line fixation with an interference screw. *Am J Sports Med.* 2007; 35: 2073-2082
12. Ma CB, Francis K, Towers J, Irrgang J, Fu FH, Harner CH. Hamstring anterior cruciate ligament reconstruction: a comparison of bioabsorbable interference screw and endobutton-post fixation. *Arthroscopy.* 2004; 20: 122-8.
13. Magen H.E., Howell S.M., Hull M.L. Structural properties of six tibial fixation methods for anterior cruciate ligament soft tissue grafts. *Am J Sports Med.* 1999; 27: 35-43
14. Morgan C.D., Kalman V.R., Grawl D.M. Isometry testing for anterior cruciate ligament reconstruction revisited. *Arthroscopy.* 1995; 11: 647-659
15. Morgan C.D., Stein D.A., Leitman E.H., Kalman V.R. Anatomic tibial graft fixation using a retrograde bio-interference screw for endoscopic anterior cruciate ligament reconstruction. *Arthroscopy.* 2002; 18: E38
16. Steenlage E., Brand Jr., J.C., Johnson D.L., Caborn D.N. Correlation of bone tunnel diameter with quadrupled hamstring graft fixation strength using a biodegradable interference screw. *Arthroscopy.* 2002; 18: 901-907
17. Walsh M.P., Wijdicks C.A., Parker J.B., Hapa O., LaPrade R.F. A comparison between a retrograde interference screw, suture button, and combined fixation on the tibial side in an all-inside anterior cruciate ligament reconstruction: A biomechanical study in a porcine model. *Am J Sports Med.* 2009; 37: 160-167
18. Weiler A, Hoffmann RF, Bail HJ, Rehm O, Sudkamp NP. Tendon healing in a bone tunnel. Part II: histologic analysis after biodegradable interference fit fixation in a model of anterior cruciate ligament reconstruction in sheep. *Arthroscopy.* 2002; 18: 124-35.
19. Lubowitz J. No-tunnel anterior cruciate ligament reconstruction: The trans tibial all-inside technique. *Arthroscopy.* 2006; 22: 900.e1-900.e11
20. Lubowitz J., Ahmad C., Anderson K. All-inside anterior cruciate ligament graft-link technique: Second-generation, no-incision anterior cruciate ligament reconstruction. *Arthroscopy.* 2011; 26: 717-727
21. Benea H., d'Astorg H., Klouche S., Bauer T., Tomoia G., Hardy P. Pain evaluation after all-inside anterior cruciate ligament reconstruction and short term functional results of a prospective randomized study. *Knee.* 2014; 21: 102-106
22. Blackman A.J., Stuart M.J. All-inside anterior cruciate ligament reconstruction. *J Knee Surg.* 2014; 27: 347-352
23. Lubowitz J.H., Schwartzberg R., Smith P. Randomized controlled trial comparing all-inside anterior cruciate ligament reconstruction technique with anterior cruciate ligament reconstruction with a full tibial tunnel. *Arthroscopy.* 2013; 29: 1195-1200
24. Lubowitz J.H. All-inside anterior cruciate ligament graft link: Graft preparation technique. *Arthrosc Tech.* 2012; 1: e165-e168
25. McCarthy M.M., Graziano J., Green D.W., Cordasco F.A. All-epiphyseal, all-inside anterior cruciate ligament reconstruction technique for skeletally immature patients. *Arthrosc Tech.* 2012; 1: e231-e239
26. Wilson A.J., Yasen S.K., Nancoo T., Stannard R., Smith J.O., Logan J.S. Anatomic all-inside anterior cruciate ligament reconstruction using the translateral technique. *Arthrosc Tech.* 2013; 2:
27. Yasen S.K., Logan J.S., Smith J.O., Nancoo T., Risebury M.J., Wilson A.J. TriLink: Anatomic double-bundle anterior cruciate ligament reconstruction. *Arthrosc Tech.* 2013; 3: e13-e20
28. Scheffler SU, Sudkamp NP, Gockenjan A, Hoffmann RF, Weiler A. Biomechanical comparison of hamstring and patellar tendon graft anterior cruciate ligament reconstruction techniques: the impact of fixation level and fixation method under cyclic loading. *Arthroscopy.* 2002; 18: 304-15
29. Monaco E, Maestri B, Labianca L, Speranza A, Kelly MJ, Ferretti A. Navigated knee kinematics After tear of ACL and its secondary Restraints: Preliminary results. *Healio orthopaedics.* 2010; 33(10): 87-93
30. Hoher J, Livesay CA, Ma CB, Withrow JD, Fu FH, Woo SL. Hamstring graft motion in the femoral bone tunnel when using titanium button/polyester tape fixation. *Knee Surg Sports Traumatol Arthrosc.* 1999; 7: 215-9
31. Joshi D, Jain V, Goyal A, Bahl V, Modi P, Chaudhary D. Outcome of double bundle Anterior cruciate ligament reconstruction using cross pin and aperture fixation. *Indian J Orthop.* 2014; 48(1): 42-8.
32. Ping LW, Bin S, Rui Y, Yang S, Zheng ZZ, Yue D. Arthroscopic ACL reconstruction with reverse "Y"-plasty grafts and fixation in the femur with either a bioabsorbable interference screw or an Endobutton. *Z Orthop Unfall.* 2012; 19(2): 78-83
33. Wilson TC, Kantaras A, Atay A, Johnson DL. Tunnel enlargement after anterior cruciate ligament surgery. *Am J Sports Med.* 2004; 32: 543-9.
34. Hoher J, Moller HD, Fu FH. Bone tunnel enlargement after anterior cruciate ligament reconstruction: Fact or fiction? *Knee Surg Sports Traumatol Arthrosc.* 1998; 6: 231-40
35. Hantes ME, Mastrokalos DS, Yu J, Paessler HH. The effect of early motion on tibial tunnel widening after anterior cruciate ligament replacement using hamstring tendon grafts. *Arthroscopy.* 2004; 20(6): 572-80
36. Clatworthy FP. Tunnel widening after hamstring anterior cruciate ligament reconstruction is influenced by the type of graft fixation used: A prospective randomized study. *Arthroscopy.* 2005; 21: 1337-4
37. Buelow JU, Siebold R, Ellermann A. A prospective evaluation of tunnel enlargement in anterior cruciate ligament reconstruction with hamstrings: extracortical versus anatomical fixation. *Knee Surg Sports Traumatol Arthrosc.* 2002; 10: 80-5.
38. Fauno P, Kaalund S. Tunnel widening after hamstring anterior cruciate ligament reconstruction is influenced by the type of graft fixation used: a prospective randomized study. *Arthroscopy.* 2005; 21: 1337-41.