www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727



Comparative Study of Suture Disc Suspensory Fixation Versus Interference Screw Fixation in for Tibia Fixation in Arthroscopic Reconstruction of Anterior Cruciate

Ligament Using Soft Tissue

M.R. Abhilash^{*1}, Hari Sivanandan², Dr.soundararajan .k³, .Narendran pushpasekaran ⁴, Adith sugavanam⁵, Shebin Christin⁵,

¹.Post graduate resident, Department of Orthopaedics, Vinayaka mission's kirupananda variyar medical college and hospitals, VMRFDU, Salem.

².HOD & Professor, Department of Orthopaedics, Vinayaka mission's kirupananda variyar medical college and hospitals, VMRFDU, Salem.

³. Professor, Department of Orthopaedics, Vinayaka mission's kirupananda variyar medical college and hospitals, VMRFDU, Salem.

⁴.Associate professor, Department of Orthopaedics, Vinayaka mission's kirupananda variyar medical college and hospitals, VMRFDU, Salem.

⁵.Senior resident, Department of Orthopaedics, Vinayaka mission's kirupananda variyar medical college and hospitals, VMRFDU, Salem.

***Correspondence: Dr. M.R.Abhilash

(Received: 04 February 2024 Revised: 11 March 2024 Accepted: 08 April 2024) **ABSTRACT:** BACK GROUND: Anterior Cruciate ligament injuries are the most common among sports **KEYWORDS** related injuries. ACL reconstruction using hamstring grafts is the most common technique Anterior cruciate followed worldwide (63%) (1). Two common modalities used worldwide for Anterior ligament, Cruciate Ligament reconstruction are suspensory fixation with a Suture disc and interference suspensory fixation with an Interference screw on the tibia. fixation, AIM AND OBJECTIVES: To evaluate the clinical outcome of a series of patients who interference underwent Arthroscopic ACL reconstruction with suspensory method & interference screw screw fixation on tibia. MATERIALS AND METHODS: A Prospective Comparative Hospital Based Study on 30 patients (15 with suture discs and 15 with interference screws), and three clinical evaluations were taken into account at the three-month, six-month, and one-year postoperative time points, whenever a clinical evaluation for follow-up is performed. Patients of age group 20 to 45 years, those with Grade II and III ACL injuries with radiological confirmation from a knee MRI and Related meniscal damage were included in the study. RESULTS: Studies shows IKDC scores were dependent on our regular rehabilitation protocol consisted of wearing a knee brace while walking for4 weeks in a normal patient and up to 6 weeks in a patient with generalized ligamentous laxity. They were ambulated with crutch support during this period of 4-6 weeks. They were started on quadriceps and hamstring strengthening, active range of movement exercises during this period. CONCLUSION: In arthroscopic ACL reconstruction employing autogenous hamstring grafts, fixation strength of the interference screw (interference) is demonstrated to have an

equivalent functional outcome to suture disc (suspensory).

www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727

INTRODUCTION:

Anterior Cruciate ligament injuries are the most common among sports related injuries. ACL reconstruction using hamstring grafts is the most common technique followed worldwide (63%) (1). Two common modalities used worldwide for Anterior Cruciate Ligament reconstruction are suspensory fixation with a Suture disc and interference fixation with an Interference screw on the tibia. Interference screw fixation is the most common type of fixation of the hamstring graft (40%) worldwide (1).

The incidence of ACL tears has increased in the general population with the rise of participation in sports. (1) The development of symptomatic knee instability after ACL injury ranges from 16% to almost 100% (2). There have been significant technical advances during recent decades to treat ACL insufficiency and many studies have documented the successful results of contemporary arthroscopic ACL reconstruction (7). Hamstring grafts are used as it results in less anterior knee pain which helps in early post-operative rehabilitation period and in the long term period compared to patellar tendon autograft.

The patients who undergo ACL fixation with Suture disc develop widening of the femoral and tibial tunnel. The widening is more in the femoral tunnel (72%- twice as that of the tibial side) than the tibial tunnel (38%) (2).

The widening in the tunnel was found to be due to movement of the graft inside the tunnel, as the tunnel is slightly larger than the graft, a phenomenon called windshield wiper effect (2,3). The tunnel widening happens more when the fixation points are far apart than when the fixation points are close to each other, because when the fixation points are far it causes more mobility of the intervening graft (4). The tunnel widening happens maximum within 6weeks (3) of the surgery and is almost complete by 3months (5) and remains the same till 12 months after the surgery, hence a 6 month to 2 year follow up was taken.

Fixation devices [500N] can fail earlier than graft [2500N - 4000N] when subjected to loads that's why many studies have demonstrated that

hamstring grafts have fewer problems with anterior knee pain, quadriceps muscle deficits, loss of extension compared with BPTB autografts. Low harvest morbidity and excellent biomechanical graft properties coupled with improved fixation of soft tissue grafts are all reasons for excellent clinical outcomes of ACL reconstruction using hamstring tendons.

The central ideology to perform is to compare the strength, stability and outcome of autograft [Hamstring] in Anterior Cruciate ligament reconstruction at the tibial end with Suture disc (Suspensory) fixation v/s Interference screw (interference) fixation, postoperatively.

In knee anterior cruciate ligament (ACL) reconstructive surgery, there are many ways to fix or stabilize graft tissue; controversies abound regarding fixation technique including the location of fixation, and the optimal method for anterior cruciate ligament graft fixation has not determined.

The management of the anterior cruciate ligament tear has developed extensively during the past decades. Intra-articular reconstruction with a biologic graft is currently the procedure of choice to treat a ruptured ACL. Numerous factors influence the clinical success of the ACL reconstruction, including the graft material itself, the graft's fixation, the placement of the graft, and the rehabilitation after the reconstruction.

AIM AND OBJECTIVE

To evaluate the clinical outcome of a series of patients who underwent Arthroscopic ACL reconstruction with suspensory method & interference screw fixation on tibia.

MATERIALS AND METHODS:

A Prospective Comparative Hospital Based Study on 30 patients (15 with suture discs and 15 with interference screws), and three clinical evaluations were taken into account at the three-month, sixmonth, and one-year postoperative time points, whenever a clinical evaluation for follow-up is performed. Patients of age group 20 to 45 years, those with Grade II and III ACL injuries with radiological confirmation from a knee MRI and Related meniscal damage were included in the study. Patients of age < 19 years, Bone with



www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727



osteoporosis, Knee osteoarthritis, Joint diseases and infections, Multiple ligaments are unstable, generalized laxity of the joints were excluded from the study.

After obtaining the patient's agreement, the surgical profile was completed for each patient prior to surgery, and they were all operated on while under spinal or epidural anaesthesia. Anterior cruciate ligament reconstruction using arthroscopic techniques.

Following surgery, the patient received intravenous antibiotics, analgesics, antacids, and multivitamins. There is proper wound care, physiotherapy, and rehabilitation. On the eleventh post- op day, the suture was removed. Patients underwent routine clinical evaluations at 3 months,6 months, and 1 year to evaluate the study's success. The patient's height and weight were assessed in a consistent manner. The Discovery 750 Helical CT from General Electronics was used for the CT scan. Both the IKDC and Lysholm scores for the patient were completed. A test using just one leg was also run. The study's CT scan measurements were performed by a skilled radiologist who was unaware of the various ways that the ACL graft fixation was done. After restoration of the tunnel in the oblique coronal and sagittal planes, which was standardized for all patients, the tunnels were measured. The lead investigator and the radiologist measured X-rays. The immediately postoperative x-rays were used to calculate the initial tunnel diameter.

DISCUSSION:

Anterior cruciate ligament injuries are the most frequent knee ligament injuries. Anterior cruciate ligament restoration is crucial because it keeps the knee stable and stops osteoarthritic alterations that may occur quickly after damage. Because the all-inside ACL technique has evolved to indicate a shift from interference fixation to suspensory fixation, which has been described as a more stable fixation method, the current results are therapeutically important to surgeons undertaking all-inside ACL restoration a method that is easier to use and more dependable. [8,9,10] Despite the fact that both techniques have theoretical advantages, fixation at the interference results in a shorter overall

length of the graft construct, which theoretically increases knee stiffness if the elastic modulus of the graft is assumed to be constant over its length due to the reduction of the "bungee cord" effect. Biomechanical laboratory research has provided evidence in support of this notion. The literature is contentious, though. (11,12,13) Another has biomechanical laboratory study demonstrated that by using suspensory and interference fixation techniques, it is possible to restore anterior laxity and stiffness in the knee fixing with screws. The "windshield wiper" effect, in which suspensory fixation can allow the graft "to migrate sagittally back and forth between the tunnel borders as the knee flexes and expands," is another potential benefit of fixation at the interference. [14-19]

Theoretically speaking, suspensory fixation is advantageous. The tibial and femoral insertions of the ACL have been demonstrated to cover a significant surface area in the anatomy lab, known as the "footprint, "which may be more accurately replicated with suspensory fixation. [20-23]. In contrast to suspensory fixation, the footprint area is compromised during interference fixation (using interference screws at the joint line) because the screws themselves fill much of the footprint, displacing graft collagen. This results in less anatomic restoration of the footprint. [24,25] However, we are unaware of published research data testing this theory, and we are unaware of clinical evidence that anatomic footprint reconstruction results in a more stable knee.

RESULT:

Fixation	Gender		
at Tibial	Female	Male	
end			
interference	5	10	15(50.0%)
	17.3%RT	82.7%RT	
	54.2%CT	49.2%CT	

Table 1 - Gender Wise Distribution

www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727

	8.3%GT	41.7%GT	
Suspensory	5	10	15(50.0%)
	14.3%RT	85.7%RT	
	45.5%CT	50.8%CT	
	7.1%GT	42.9%GT	
	10	20	30
	(15.7%)	(84.3%)	
Chi-squared	0.109		
DF	1		
P-value	P=0.75		
	(NotSig.)		

As per table1 shows the comparison between two groups in relation to gender distribution. The mean distribution of males in interference fixation and suspensory fixation are 15 and 15 respectively. The mean distribution of female patients in interference fixation and

suspensory fixation are 5 and 5, respectively. The total number of males and females are 20 (84.3%) and 10 (15.7%) respectively. After applying the t test, the difference value came as 1 and the chi-square test is 0.109 which shows a P-value of 0.75 that shows that there is no significance among gender distribution.

Table 2- Mode of In	jury
---------------------	------

Fixationat	Mode of Injury		
Tibial end	RTA	Sport	
interference	10	5	15(50.0%)
	45.7%R T 47.1%C T 22.9%G T	54.3%RT 52.8%CT 27.1%GT	

Suspensor	11	4	15(50.0%)
У	51.4%R	48.6%RT	
	1	47.2%CT	
	52.9%C T	24.3%GT	
	25.7%G T		
	21	9	30
	(81%)	(19%)	
Chi- squared	0.215		
DF	1		
P-value	P=0.63		
	(NotSig.))	

As per table 2 shows the comparison between two groups in relation to Mode of injury. The mean distribution of RTA mode in interference fixation and suspensory fixation are 21 and 9 respectively. The mean distribution of sport injuries in interference fixation and suspensory fixation are 11 and 4 respectively. The total number of RTA and Sport injury cases are 21(81%) and 9 (19%) respectively. After applying the t test the difference value came as 1 and chi square test is 0.215 which shows a P- value of 0.63 that shows that there is no significance among mode of injury.

Table 3 - Preferential Side Distribution

Fixation at	Side		
Tibial end	Left	Right	
Interferenc e	5 34.3%R T 46.2%C T 17.1%G T	10 65.7%R T 52.3%C T 32.9%G T	15(50.0%)
Suspensor y	3 40.0%R T 53.8%C T	12 60.0%R T 47.7%C T	15(50.0%)

www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727

	20.0%G T	30.0%G T	
	8	22	20
	-17%	-83%	30
Chi-squared		0.212	
DF		1	
P-value		P=0.62	
		(NotSig.)	

The above table shows the comparison between two groups in relation to Laterality. The mean distribution of left side injuries in interference fixation and suspensory fixation are 5 and 3 respectively. The mean distribution of right side injuries in interference fixation and suspensory fixation are 10 and 12 respectively. The total number of left side and right side cases are 8(17%) and 22 (83%) respectively. After applying the t test the difference value came as 1 and chi square test is 0.212 which shows a P-value of 0.62 that shows that there is no significance among Laterality.

Table 4- Grading of ACL tear

	Classification		
Fixation at Tibial end	Grade IIACLte	Grade IIIACLte	
	ar	ar	
	3	12	
Interferen	20.0%R T	80.0%RT	15(50.0
ce	31.8%C T	58.3%CT	%)
	10.0%G T	40.0%GT	
	5	10	
Suspensor y	42.9%R T	57.1%RT	15(50.0
	68.2%C T	41.7%CT	%)
	21.4%G T	28.6%GT	
	8	22	20
	-17%	-83%	30
Chi squared	3.382		

DF	1
P-value	P=0.04
	(Sig.)

As per table 4 shows the comparison between two groups in relation to grade 2 and grade 3 acl tears. The mean distribution of grade 2 acl tears in interference fixation and suspensory fixation are 3 and 5 respectively. The mean distribution of grade 3 acl tears in interference fixation and suspensory fixation are 12 and 10 respectively. the total number of grade2 acl tears and grade 3 acl tears cases are 8(17%) and 22 (83%) respectively. after applying the t test the difference value came as 1 and chi square test is 3.382 which show a p-value of 0.04 that shows that there is significance.

Table 5 - IKDC follow	ıp
-----------------------	----

IKDC	FIXATION AT TIBIAL	FIXATION AT TIBIAL	P- VALUE	
	END SUSPENSORY	END APERTURE		
IKDC Pre-op	48.513±7.286	47.226±7.16	0.48	
IKDC 3 MONTHS	62.226±6.857	61.313±5.212	0.52	
IKDC 6 MONTHS	84.349±6.265	82.887±7.043	0.39	
IKDC 12 MONTHS	96.149±6.128	93.746±3.615	0.05	

As per table 4 the above table shows the comparison of FOLLOW UP in relation to Preoperative, 3months, 6months, and 12 months with reference to IKDC. The mean distribution of preoperative group in suspensory mode was 48.5143 with a standard deviation value of 7.2856 followed by 3 months,6 months, 12 months' period with a mean distribution values and standard deviation values of 62.226(6.857), 84.349(6.265), 96.149 (6.128) respectively. The mean distribution of preoperative group in interference mode was 47.226 with a standard deviation value of 7.416 followed by followed by 3 months,6 months12 months period with a mean distribution values and standard deviation value 61.313(5.215),

www.jchr.org JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727



82.887(7.043), 93.749(3.615) respectively. The p values show significance with a value of 0.05 for a period of 12 months follow up.

Case -1 interference fixation





Case -2 interference fixation



Case 3 - suspensory fixation:



Case 4 -suspensory fixation:



Case 5- interference fixation on tibia



CONCLUSION:

The fixation strength between the suture disc and interference screw in arthroscopic ACL restoration using autogenous hamstring grafts is found to be statistically insignificant. Additionally, we determined that in the arthroscopic ACL reconstruction employing autogenous hamstring grafts, fixation strength of the interference screw (interference) is demonstrated to have an equivalent functional outcome to suture disc (suspensory).

REFERENCES:

- Chechik O, Amar E, Khashan M, Lador R, Eyal G, Gold A. An international survey on anterior cruciate ligament reconstruction practices. Int Orthop. 2017 Feb;37(2):201– 6.
- Nebelung W, Becker R, Merkel M, Röpke M. Bone tunnel enlargement after anterior cruciate ligament reconstruction with semitendinosus tendon using Endobutton fixation on the femoral side. Arthrosc J ArthroscRelatSurg Off PublArthrosc Assoc N Am Int Arthrosc Assoc. 2018

www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727



- Fink C, Zapp M, Benedetto KP, Hackl W, Hoser C, Rieger M. Tibial tunnel enlargement following anterior cruciate ligament reconstruction with patellar tendon autograft. Arthrosc J ArthroscRelatSurg Off PublArthrosc Assoc N Am Int Arthrosc Assoc. 2011 Feb;17(2):138–43.
- Fauno P, Kalong S. Tunnel widening after 4. hamstring anterior cruciate ligament reconstruction is influenced by the type of graft fixation used: а prospective randomized study. Arthrosc ArthroscRelatSurg Off PublArthrosc Assoc Am Int Arthrosc Assoc. Ν 2016 Nov;21(11):1337-41.
- Parkar AP, Adriaensen MEAPM, Fischer-Bredenbeck C, Inderhaug E, Strand T, Assmus J, et al. Measurements of tunnel placement after anterior cruciate ligament reconstruction--A comparison between CT, radiographs and MRI. The Knee. 2015 Dec;22(6):574–9.
- Clatworthy MG, Annear P, Bulow JU, Bartlett RJ. Tunnel widening in anterior cruciate ligament reconstruction: a prospective evaluation of hamstring and patella tendon grafts. Knee Surg Sports TraumatolArthrosc Off J ESSKA. 2009;7(3):138–45.
- Höher J, Möller HD, Fu FH. Bone tunnel enlargement after anterior cruciate ligament reconstruction: fact or fiction? Knee Surg Sports TraumatolArthrosc Off J ESSKA. 2008;6(4):231–40.45. Middleton JC, Tipton AJ. Synthetic biodegradable polymers as orthopaedic devices. Biomaterials. 2002 Dec;21(23):2335–46.
- Middleton JC, Tipton AJ. Synthetic biodegradable polymers as orthopaedic devices. Biomaterials. 2002 Dec;21(23):2335–46.
- Petricca SE, Marra KG, Kumta PN. Chemical synthesis of poly (lactic-coglycolic acid)/hydroxyapatite composites for orthopaedic applications. Acta Biomater. 2016 May;2(3):27786.
- **10.** Hunt JA, Callaghan JT. Polymerhydroxyapatite composite versus polymer interference screws in anterior cruciate ligament reconstruction in a large animal

model.KneeSurgSportsTraumatolArthroscOffJESSKA.2018Jul;16(7):655–60.JJJJ

- 11. Black KP, Saunders MM, Stube KC, Moulton MJ, Jacobs CR. Effects of interference fit screw length on tibial tunnel fixation for anterior cruciate ligament reconstruction. Am J Sports Med. 2000 Dec;28(6):846–9.
- Kohn D, Rose C. Primary stability of interference screw fixation. Influence of screw diameter and insertion torque. Am J Sports Med. 2004 Jun;22(3):334–8
- 13. Lind M, Feller J, Webster KE. Bone Tunnel Widening After Anterior Cruciate Ligament Reconstruction Using EndoButton or EndoButton Continuous Loop. Arthrosc J ArthroscRelat Surg. 2019 Nov;25(11):1275–80.
- 14. Rork PE. "Bungee cord" effect in hamstring tendon ACL reconstruction. Orthopedics. 2008Mar;23(3):184.
- Ishibashi Y, Rudy TW, Livesay GA, Stone JD, Fu FH, Woo SL-The effect of anterior cruciate ligament graft fixation site at the tibia on knee stability: Evaluation using a robotic testing system. Arthrosc J ArthroscRelat Surg. 2017 Apr;13(2):177–82.
- 16. Dargel J, Gotter M, Mader K, Pennig D, Koebke J, Schmidt-Wiethoff R. Biomechanics of the anterior cruciate ligament and implications for surgical reconstruction. Strateg Trauma Limb Reconstr. 2017 Apr;2(1):1–12.
- 17. L'Insalata JC, Klatt B, Fu FH, Harner CD. Tunnel expansion following anterior cruciate ligament reconstruction: а comparison of hamstring and patellar tendon autografts. Knee Surg Sports TraumatolArthrosc. 2007 Oct 21;5(4):234-8.
- Morgan CD, Stein DA, Leitman EH, Kalman VR. Anatomic tibial graft fixation using a retrograde bio-interference screw for endoscopic anterior cruciate ligament reconstruction. Arthrosc J ArthroscRelat Surg. 2009 Sep;18(7):1–8.
- **19.** Noyes FR, Butler DL, Grood ES, Zernicke RF, Hefzy MS. Biomechanical analysis of human ligament grafts used in knee-ligament



www.jchr.org

JCHR (2024) 14(3), 2739-2746 | ISSN:2251-6727



repairs and reconstructions. J Bone Joint Surg Am. 2001 Mar;66(3):344–52.

- 20. Li S, Chen Y, Lin Z, Cui W, Zhao J, Su W. A systematic review of randomized controlled clinical trials comparing hamstring autografts versus bone-patellar tendon-bone autografts for the reconstruction of the anterior cruciate ligament. Arch Orthop Trauma Surg. 2012 Sep;132(9):1287–97.
- 21. Mohtadi NG, Chan DS, Dainty KN, Whelan DB. Patellar tendon versus hamstring tendon autograft for anterior cruciate ligament rupture in adults. Cochrane Bone, Joint and Muscle Trauma Group, editor. Cochrane Database Syst Rev. 2017 Sep 7
- 22. Xie X, Liu X, Chen Z, Yu Y, Peng S, Li Q. A meta-analysis of bone-patellar tendonbone autograft versus four-strand hamstring tendon autograft for anterior cruciate ligament reconstruction. The Knee. 2019 Mar;22(2):100–10.
- Roe J, Pinczewski LA, Russell VJ, Salmon LJ, Kawamata T, Chew M. A 7-Year Follow-up of Patellar Tendon and Hamstring Tendon Grafts for Arthroscopic Anterior Cruciate Ligament Reconstruction: Differences and Similarities. Am J Sports Med. 2015 Sep;33(9):1337–45.
- Xie X, Xiao Z, Li Q, Zhu B, Chen J, Chen H, et al. Increased, incidence of osteoarthritis of knee joint after ACL reconstruction with bone-patellar tendon-bone autografts than hamstring autografts: a meta-analysis of 1,443 patients at a minimum of 5 years. Eur J OrthopSurgTraumatolOrthopTraumatol. 2015 Jan;25(1):149–59. Freedman KB, D'Amato MJ, Nedeff DD, Kaz A, Bach BR. Arth