

## ORIGINAL RESEARCH

# Fixed versus adjustable length loop device for femoral fixation of graft in arthroscopic anterior cruciate ligament reconstruction

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### ABSTRACT

**Background:** The knee joint is the most commonly injured of all joints due to modern high speed vehicular trauma and sporting life style. The Anterior cruciate ligament (ACL) is the most commonly injured ligament. Anterior cruciate ligament reconstruction is one of the common procedures in knee surgery. Arthroscopic ACL reconstruction using adjustable loop device and fixed loop devices, both are being practiced nowadays with successful functional outcome. However limited evidence is available to support which amongst the two is better. The present study is therefore conducted to compare the functional outcomes post ACL reconstruction using Fixed Vs Adjustable loop device for femoral fixation of graft.

**Objectives:-** 1. TO assess the functional outcome in FIXED LOOP ENDOBUTTON in Arthroscopic ACL reconstruction cases. 2. TO assess functional outcome in ADJUSTABLE LOOP-LENGTH devices in Arthroscopic ACL reconstruction cases. 3. TO compare both these outcomes. **Material and Methods:-** An observational prospective study was conducted among 60 patients who underwent ACL reconstruction (by using fixed loop device in 30 patients and adjustable loop device in 30 patients.), in the department of Orthopaedics, Adesh Institute of Medical Sciences and Research, Bathinda. **Results:-** Majority of the patients were males between 21-30 years of age with right knee injury in both the groups. Most common mode was Sports injury and most common associated injury was medial meniscal tear in both the groups. There were significant improvement in functional outcomes in terms of Lachman test, anterior drawer test, Single leg hop test and Tegnerlysholm scores, post 6 and 9 months of ACL reconstruction in both the groups separately. But the difference in functional outcome between groups in terms lysholm score were not statistically significant. **Conclusion:-** The present study concluded that there is no significant difference in functional outcomes between ACL reconstruction using fixed loop device and adjustable loop device. In Anterior Cruciate Ligament Reconstruction using adjustable loop device.

**Key words:** ACL tear, ACL reconstruction, Adjustable Loop Device, Fixed Loop Device, Lachman Test, Anterior Drawer Test, Single Leg Hop Test, TegnerLysholm Score

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### INTRODUCTION

- The Anterior cruciate ligament (ACL) is the most commonly injured ligament. ACL tear diagnosis has increased as the role of MRI as a diagnostic tool has increased. The vehicular trauma and sporting life style has led to increased ligament injuries of the knee.<sup>1</sup>
- The Anterior cruciate ligament functions in association with the other ligaments, Capsule, Muscles and bone to provide stability to the knee. It is the primary stabilizer of the knee and prevents against anterior translation. It also counteracts rotational and valgus stress. The ACL functions along with other anatomical structures in and around the knee joint to control and limit the motion and maintains static and dynamic equilibrium.<sup>2</sup>

### GRAFT FOR RECONSTRUCTION

- Several graft options exist for ACL reconstruction: Patellar tendon, the quadriceps tendon, Hamstring tendons and peroneus longus. Nevertheless, They have some disadvantages, Such as postoperative anterior knee pain, Donor site morbidity, Quadriceps weakness in peroneus longus autograft and decreased hamstring tendon strength and delayed graft incorporation.<sup>3</sup>
- The use of the semitendinosus and gracilis tendons is becoming the choice of method in ACL Reconstruction. A wide variety of fixation methods to attach the hamstring tendons has been proposed. Most commonly used devices for femoral fixation are interference screws, transfix screws and cortical suspension devices. Devices

for tibial fixation can be divided according to the location of fixation: intra-tunnel fixation and extra-tunnel fixation. Intra-tunnel fixation methods primarily rely on the metallic or bio-resorbable interference screw.<sup>4</sup>

- Cortical suspension devices have been widely used in ACL reconstruction for femoral side graft fixation. Various studies have shown that cortical suspension devices have the necessary biomechanical properties with regard to ultimate failure strength, Displacement and stiffness for initial fixation of soft tissue in the femoral tunnel for ACL reconstruction.<sup>5</sup>

**AIMS & OBJECTIVES**

To compare the functional outcome using fixed versus adjustable length loop device for femoral fixation of graft in arthroscopic anterior cruciate ligament reconstruction.

**MATERIALS & METHODS**

- **Study Setting:** Study was conducted in a Orthopedic department of tertiary care hospital
- **Study Duration:** Study was conducted for a period of 18 months
- **Type of study:** An observational cross-sectional study design.
- **Study Subjects:** Patients with anterior cruciate ligament tear of knee within age between 18 to 50 years.
- **Sample size:** 60 patients fulfilling our inclusion criterion are included for the study purpose.

The patients are divided into 2 Groups randomly 30 patients in each group.

- Group 1- Arthroscopic ACL tear repair with Adjustable loop
- Group 2- Arthroscopic ACL tear repair with

Fixed loop

**INCLUSION CRITERIA**

1. Age: 18 to 50 years of age
2. Clinically ACL deficient knee confirmed on MRI
3. ACL tear associated with meniscal injury.

**EXCLUSION CRITERIA**

1. Multiligament injury including MCL, LCL, PCL, etc.
  2. Patient suffering from diagnosed prior knee pathology e.g. stiffness, Osteoarthritis, Synovitis, Infection.
  3. Presence of osteochondral defect more than 1.5cm.
  4. ACL tear associated with polytrauma injury.
  5. Prior knee surgery.
  6. ACL tear associated with tibia plateau fractures and tibial spine fractures.
- Group 1 -30 patients were treated with Adjustable loop
  - Similarly in Group 2- repair with Fixed loop

Postoperative rehabilitation protocols were same for both the group. Their clinical and functional status were assessed preoperatively on the day prior to surgery with Tegner-Lysholm Score and at the last follow up at least 9 months following the surgery.

**EXAMINATION**

**ANTERIOR DRAWER TEST**

The patient's knee is flexed to 90° and the hip to 45°. The normal amount of movement that should be present is approximately 2 mm. If the test is positive (that is, if tibia moves forward more than 2 mm on the femur) the, anterior cruciate ligament (especially the anteromedial bundle) may be torn.

**DEMONSTRATION OF ANTERIOR DRAWER TEST ON A PATIENT PREOPERATIVELY DURING EXAMINATION**



### LACHMAN TEST

- Patient lies in a supine position with the involved leg beside the examiner. The examiner holds the patient's knee between full extension and 30° of flexion. The patient's femur is stabilized with one of the examiner's hands while the proximal aspect of the tibia is moved forward with the other hand.

A positive sign is indicated by a “mushy” or soft end feel when the tibia is moved forward on the femur and the infrapatellar tendon slope disappears. A positive sign indicates that the anterior cruciate ligament (especially the posterolateral bundle) may be torn.

### DEMONSTRATION OF LACHMAN TEST ON A PATIENT PREOPERATIVELY DURING EXAMINATION



### PIVOT SHIFT TEST

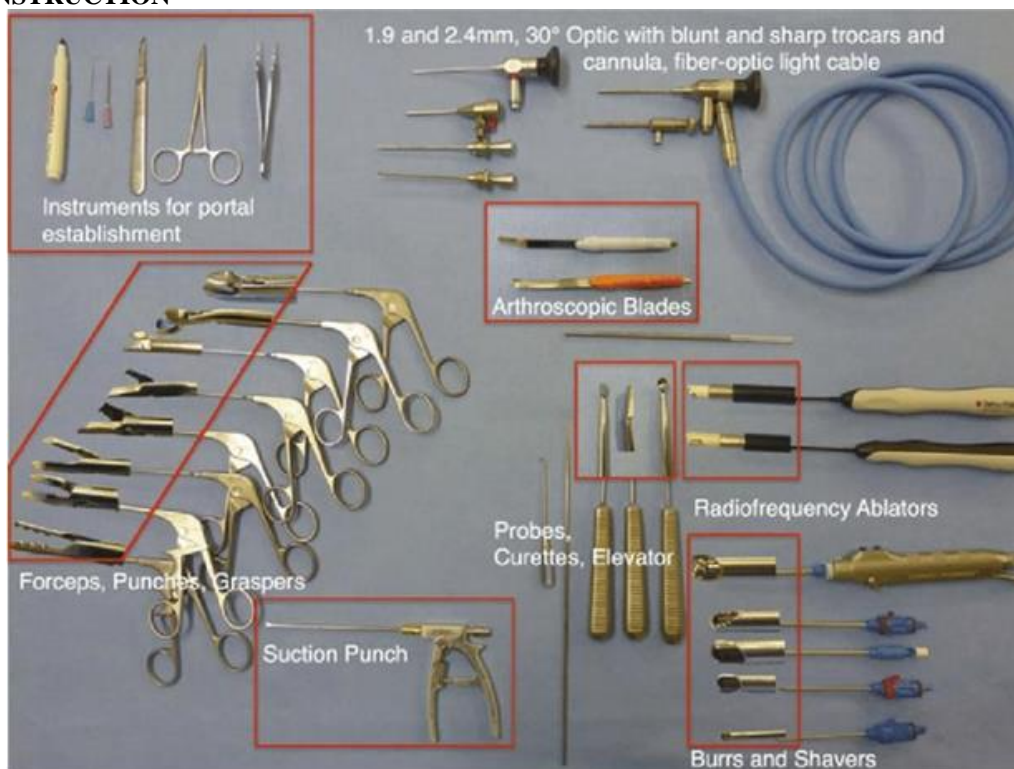
- The examiner holds the patient's foot with one hand while the other hand flexes the knee slightly. This is done by placing the heel of the hand behind the fibula over the lateral head of the gastrocnemius muscle with the tibia medially rotated, causing the tibia to sublux anteriorly. As the knee approaches extension, the secondary restraints (hamstrings, lateral femoral condyle,

and lateral meniscus) are less sufficient than in flexion. The examiner then applies a valgus stress to the knee while maintaining a medial rotation torque at the tibia at the ankle. If the leg is then flexed at about 30° to 40°, the tibia will reduce or jog backward and the patient will say that is what the “giving way” feels like indicating a positive test.

### DEMONSTRATION OF PIVOT SHIFT TEST



### ARTHROSCOPIC INSTRUMENTS USED IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION



### RESULTS

**Table 1: Sex distribution of patients**

Sex	Adjusted		Fixed		Total
	No.	%age	No.	%age	
Female	5	16.7	1	3.3	6
Male	25	83.3	29	96.7	54
Total	30	100.0	30	100.0	60

$X^2 = 2.96$ ;  $df = 1$ ;  $p = 0.085$ ; Not significant

Table 1 shows that out of 30 patients 25 (83.3%) were males in group 1 and in group 2, out of 30 patients 29 (96.7%) were males. There was no statistically significant difference in sex distribution between group 1 and 2.

**Table 2: Age distribution of patients**

Age Group (in years)	Adjusted		Fixed		Total
	Number	%age	Number	%age	
<20	02	6.7	04	13.3	06
21-30	20	66.7	16	53.3	36
31-40	7	23.3	08	26.7	15
41-50	01	3.3	02	6.7	03
Total	30	90.00	30	100.00	60

$X^2 = 2.63$ ;  $df = 3$ ;  $p = 0.45$ ; Not significant

Table shows the Mean age of patients was  $26.8 \pm 4.4$  (years) and  $27.6 \pm 3.4$  (years) in group 1 and group 2 respectively. The patients are divided into four categories based on age groups for study purpose. Majority of the patients are in the age group of 21-30 years ( $n=36$ , 60.00%), followed by 31-40 years ( $n=15$ , 25.00%) and only 03 (5.00%) were in the age group >40 years. Chi square test reveals that there is no statistically significant difference in age distribution of the patients in the study ( $p=0.45$ ).

**Table 3: Distribution of patients on basis of duration of injury.**

Duration (in months)	Group 1 (n=30)		Group 2 (n=30)		Total (N=60)
	Number	%age	Number	%age	
<6	04	13.3	05	16.7	09

<b>6-12</b>	16	53.4	15	50	31
<b>13-24</b>	07	23.3	09	30	16
<b>&gt;24</b>	03	10	01	3.3	04
<b>Total</b>	30	100	30	100	60

Table 3 shows that majority of patients with ACL tear underwent surgery within 6-12 months of injury ( i.e 31 out of 60 patients), followed by 16 patients who underwent surgery within 13-24 months and only 09 were operated within 6 months of injury. There is no statistically significant different in duration of injury between group 1 and 2.

**Table 4:Pre-operative &post operative functional scoring of patients in group 1 i.e Adjusted loop, n=30)**

Test	Pre operative	Post operative (6 months)	Post operative (9 months)	P value
<b>Lachman</b>	Positive=24 Negative= 06	Positive=0 Negative= 30	Positive=0 Negative= 30	<0.01 <sup>a</sup>
<b>Anterior Drawer</b>	Positive=26 Negative= 04	Positive=02 Negative= 28	Positive=00 Negative= 30	<0.01 <sup>a</sup>
<b>Single leg hop test</b>	Positive=28 Negative= 02	Positive=0 Negative= 30	Positive=0 Negative= 30	<0.01 <sup>a</sup>
<b>TegnerLysholm</b>	Poor=27 Fair=03 Good=00 Excellent=00	Poor=00 Fair=00 Good=09 Excellent=21	Poor=00 Fair=00 Good=07 Excellent=23	0.03 <sup>b</sup>

Table 4 shows shows preoperative and post-operative functional scoring of patients who underwent ACL tear repair by fixed loop. Pre-operatively, out of 30 patients 24 patients had positive Lachman test, 26 had positive Anterior Drawer and 27 had poor TegnerLysholm score.

After post-operative 6 months, all the patients had negative Lachman test, 2 had positive Anterior Drawer test who were asymptomatic. TegnerLysholm score was excellent for 21 and good for 9 patients. Post operative after 9 months all the patients had negative Lachman test and anterior drawer test. TegnerLysholm score was excellent in 23 and good in 7 patients.

Statistical analyses shows significant improvements in functional outcome post operatively.

**Table 5: Pre operative & post operative functional scoring of patients. (group 2, fixed loop, n=30)**

Test	Pre operative	Post operative (6 months)	Post operative (9 months)	P value
<b>Lachman</b>	Positive=21 Negative= 09	Positive=01 Negative= 29	Positive=0 Negative= 30	<0.01 <sup>a</sup>
<b>Anterior Drawer</b>	Positive=25 Negative= 05	Positive=03 Negative= 27	Positive=02 Negative= 28	<0.01 <sup>a</sup>
<b>Single leg hop test</b>	Positive=21 Negative= 09	Positive=01 Negative= 29	Positive=0 Negative= 30	<0.01 <sup>a</sup>
<b>TegnerLysholm</b>	Poor=25 Fair=05 Good=00 Excellent=00	Poor=00 Fair=00 Good=09 Excellent=21	Poor=00 Fair=00 Good=01 Excellent=29	<0.01 <sup>b</sup>

- Table 5 shows preoperative and post-operative functional scoring of patients who underwent ACL tear repair by fixed loop. Pre-operatively, out of 30 patients, 21 patients had positive Lachman test, 25 had positive Anterior Drawer and 21 had poor TegnerLysholm score.
- After post-operative 6 months, 29 patients had negative Lachman test, and 27 had negative Anterior Drawer test. TegnerLysholm score was excellent for 21 and good for 9 patients. Post-operative after 9 months all the patients had negative Lachman test, 2 had positive Anterior Drawer test who were asymptomatic and 29 had excellent TegnerLysholm score. Statistical analyses show significant improvement in functional outcome post operatively in group 2.

**Table 6: Comparison of TegnerLysholm score pre-operatively and post operatively**

	Tegnerlysholm score		p value
	Adjustable Loop (Mean ± SD)	Fixed Loop (Mean ±SD)	
<b>Pre- operatively</b>	48.65 ± 5.64	46.87±5.15	0.21
<b>6 months post-operatively</b>	86.66±4.44	84.17±6.52	0.08

<b>9 months post-operatively</b>	97.34±3.56	96.78. ±0.06	0.39
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The mean TegnerLysholm Score pre-operatively in adjustable group was 48.65 and post operatively at 6 months and 9 months it was 86.66 and 84.17 respectively. In fixed group the mean score was 46.87 pre-operatively and post-operatively it was 84.17 and 96.78 at 6 and 9 months respectively. On applying t-test the p value was  $p > 0.05$  which means that the difference in results are not statistically significant.

## DISCUSSION

- The Mean age of patients was  $26.8 \pm 4.4$  (years) and  $27.6 \pm 3.4$  (years) in group-1 and group-2 respectively. In group-1 out of 30 patients, 25 (83.3%) were males and in group-2, out of 30 patients 29 (96.7%) were males. Patients in the study were of active age group, involved in various physical activities and sports which makes them prone to knee injuries. It could be attributed to higher physical activity level including sports activities and driving among males especially in 20-30 years age group. This correlates well with the study done by **C. Benjamin Ma et al** in which the mean age of patients with ACL tear was  $27 \pm 8$  years. Previous studies have documented the mean age as 24 to 28 years and male preponderance.<sup>1,2</sup> A previous study also reported male sex as a risk factor for ACL tears (OR, 2.288 [95% CI, 1.596-3.280]).<sup>3</sup> In an epidemiological evaluation on the ACL reconstruction procedures performed in Italy from 2001 to 2015, The average male/female ratio was 4.54, implying that men were more subjected to this surgery and peaks at the young age class (15–39 years).<sup>3</sup> A study conducted by **Ranjan R et al** on Arthroscopic reconstruction of anterior cruciate ligament injury with autogenous hamstring graft and functional recovery of the patients also reported higher male involvement in ACL tear and most of the patient were in age range of 20-30 years and the mean age was 31.6 years.<sup>4</sup>
- In Group 1, Pre-operatively, out 30 of patients 24 patients had positive Lachman test, 26 had positive Anterior Drawer, 28 had positive Single leg hop test and 27 had poor TegnerLysholmscore.
- After post-operative 6 months, all the patients had negative Lachman test, 2 had positive Anterior Drawer test who were asymptomatic and none had positive Single leg hop test. TegnerLysholmscore was excellent for 21 and good for 9 patients.
- Post-operative after 9 months all the patients had negative Lachman test, anterior drawer test and Single leg hop test. TegnerLysholmscore was excellent in 23 and good in 7 patients. A significant improvement in functional outcomes is reported post 6-months and 9- months of ACL reconstruction by adjusted loop method. Statistical analyses shows significant improvements in functional outcome postoperatively.
- In Group 2 Pre-operatively, out 30 patients 21 patients had positive Lachman test, 25 had positive Anterior Drawer, 21 had positive Single Leg Hop Test and 21 had poor TegnerLysholmscore. After post-operative 6 months, 29 patients had negative Lachman test, and 27 had negative Anterior Drawer test and 29 had negative Single Leg hop test. TegnerLysholmscore was excellent for 21 and good for 9 patients. Post-operative after 9 months all the patients had negative Lachman test, 2 had positive Anterior Drawer test who were asymptomatic and none had positive Single Leg Hop Test and 29 had excellent TegnerLysholmscore. Statistical analyses shows significant improvements in functional outcome postoperatively.
- The mean TegnerLysholm Score pre-operatively in adjustable group was 48.65 and post operatively at 6 months and 9 months it was 86.66 and 84.17 respectively. In fixed group the mean score was 46.87 pre-operatively and post-operatively it was 84.17 and 96.78 at 6 and 9 months respectively. On applying t-test the p value was  $p > 0.05$  which implies that there is no significant difference in functional outcome between adjustable and fixed loop device ACL reconstruction.
- The results were similar to a study done by **Lanzetti RM et al** in which they concluded that the use of a fixed or adjustable-loop length device products, on the femoral side, led to similar clinical and radiological results.<sup>5</sup>
- In a similar study by **Pokharel B et al** the average Tegner- Lysholmscore before and after surgery in Endobutton group was  $56.63 \pm 6.7$  and  $93.97 \pm 4.1$  respectively. For Tightrope group it was  $56.5 \pm 7.1$  and  $94.7 \pm 3.7$  respectively. Two sample student t-test implied that there was no statistically significant difference between two groups.<sup>6</sup>
- **Mohamed RSA et al in 2020** conducted a study on Clinical Outcome of Fixed Versus Adjustable Loop Cortical Suspension Devices in Arthroscopic Anterior Cruciate Ligament Reconstruction. The study shows that there was no statistically significant difference between the two groups regarding the Lysholmscore. However both fixed loop and adjustable loop devices in ACL reconstruction provided good clinical outcomes. but without significant statistical difference between both groups from the clinical point of view postoperatively using the Lysholmscore.

## CONCLUSION

- The main finding of our study was that there is no significant difference in ACL reconstruction using

fixed loop device and ACL reconstruction using adjustable loop device in femoral fixation of graft as measured by Tegner Lysholm Score (pre-operatively and post operatively at 6 and 9 months). These results are clinically relevant to surgeons performing arthroscopic ACL reconstruction because ACL technique has shown a transition, which has been described as a simpler and more reproducible technique.

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