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Original Research Article

Comparative Study of Fixed Loop and Adjustable Loop Cortical Suspension Device Used for Femoral Fixation in Arthroscopic ACL Reconstruction

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Abstract: Suspensory devices are extensively used in anterior cruciate ligament (ACL) Reconstruction. This study was conducted to compare the functional outcomes of arthroscopic ACL reconstruction using fixed-loop and Adjustable loop cortical suspension devices by determining their effect on graft laxity on clinical assessment and International Knee Documentation Committee (IKDC) score. ***Method:*** Patients attending Trauma casualty and OPD of Orthopaedics department were randomly chosen according to the criteria. Two groups were formed with 25 patients in each group. Patients in group I received adjustable-loop cortical suspensory devices, and in group II fixed loop cortical suspensory devices. Arthroscopic ACL reconstruction done using autologous ipsilateral Hamstring Tendon as graft. Femoral fixation with of Cortical Suspension Device (Closed Loop or Adjustable Loop) and tibial fixation with biodegradable interference screw. Functional outcome was assessed by using IKDC score. Functional outcomes in the two groups were compared by using independent t-test. ***Results:*** In each group, there were statistically significant improvements in functional outcomes over successive follow-up, showed no statistically significant differences between the two groups at 3 months and 6 months of follow-up. ***Conclusion:*** ACL reconstruction with fixed- and adjustable-loop cortical suspensory devices for femoral side graft fixation gives equivalent and satisfactory functional outcome. However, further authentication is required by doing long term studies.

Keywords: Anterior Cruciate ligament reconstruction, Adjustable loop Cortical Suspension Device, Fixed-loop Cortical Suspension Device, Hamstring Graft.

INTRODUCTION

Arthroscopic anatomic reconstruction is the preferred surgical option for anterior cruciate ligament (ACL) tears(1). Femoral graft fixation includes compression and suspensory devices(2). Cortical suspensory fixation is considered an ideal model of femoral fixation and extensively used worldwide(3). Fixed-loop device requires Additional drilling of the femoral tunnel so that the button comes out of the lateral femoral cortex. This suspensory device leaves some part of the dead space which devoid of graft where graft motion can take place. This can further lead to the widening of the tunnel and jeopardize graft incorporation inside the tunnel(3). Moreover, anatomical tunnel creation can sometimes result in short tunnel length and inadequate graft length inside the bone(4). Second generation adjustable suspensory loop fixation devices came to overcome the dead space which is devoid of graft. In these devices over-drilling of

femoral tunnel is not required. Adjustable loop can be tightened and adjusted according to the tunnel length during the surgical process, thereby decreasing the possibility of bungee cord effect(3,5,6). However, some studies shown loosening in adjustable-loop devices, which may affect functional outcome after ACL reconstruction(3,4,7–9). This study compares functional outcome between Closed Loop and Adjustable Loop Cortical Suspension Device in terms of graft laxity on clinical assessment and International Knee Documentation Committee (IKDC) score.

Materials and methods

This study carried out in the department of Orthopaedics and Trauma centre, Sardar Patel Medical College, Bikaner. Under this prospective study, twenty-five patients in both groups were considered who undergone the procedure. The total follow-up time was 6 months.

Patients were diagnosed with ACL tear based on positive history of knee instability and clinical examination, supported by magnetic resonance imaging (MRI) evaluation.

Inclusion Criteria:

1. Acute or Chronic Complete ACL Tear with or without meniscal tear.
2. Age group between 16 and 50 years both male and female.

Exclusion Criteria:

1. ACL avulsion from the femoral or tibial attachment site with bone fragment
2. ACL tear with other Intra articular and extra articular ligamentous injury
3. Neuromuscular disorder.
4. Osteoarthritis of knee joint (Kellgren and Lawrence grades 3 and 4)
6. **Revision ACL reconstruction surgery.**
7. **Active infection in the knee joint**

In our study, 50 patients with complete ACL tear were studied for arthroscopic single-bundle reconstruction with hamstring graft (semitendinosus and gracilis) autologous ipsilateral graft. After taking informed consent from all patients distributed to respective groups by randomization. In group I, adjustable-loop cortical suspensory devices, and in group II fixed loop cortical suspensory devices were used for femoral side fixation and biodegradable screws were used on the tibial side. Demographic, preoperative, and intraoperative parameters were comparable between the two groups. Senior arthroscopic surgeon from department did all the surgeries and pneumatic tourniquet was used in all cases. Thorough diagnostic arthroscopic evolution and confirming an ACL tear, ipsilateral hamstring tendons were harvested with help of long tendon stripper and Pre-tensioning of the harvested graft was done on a tendon board. A femoral tunnel was prepared in hyper flexion of the knee through the anteromedial portal and rimmed according to graft size. Tibial tunnel was created with help of cannulated tibial reamer and tibial jig keeping an angle of 55°. Harvested graft was fixed on the femoral side either with fixed or adjustable cortical suspensory device. Additional drilling of the femoral tunnel by 10 mm more than the expected intraosseous graft length was done only in the fixed loop suspensory device. Interference biodegradable screw was used for fixation of graft in the tibial tunnel in both the groups. Recycling of the knee was done 20 times to get rid of any residual graft creep. After fixation at tibial site the ACL was assessed for laxity and femoral notch impingement under direct arthroscopic vision(10).

Fig.1: Graft harvested with help of long tendon stripper

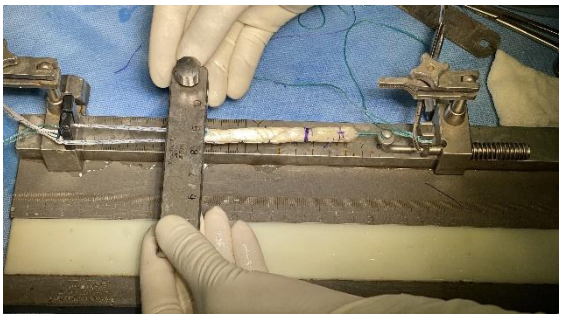

Fig.2: Pre-tensioning of the harvested graft with Measurement of Graft

Fig.3: Femoral Tunnel (Arthroscopic View)

Follow up and assessment:

Dressing was done on the second postoperative day and looked for suture line, swelling or effusion if any, surrounding skin and range of movement of knee. Active toe movement, Ankle pump up exercise and static hamstring muscle exercise were started as spinal effect wean off. Gradual flexion of knee started aiming to achieve 90° of flexion until 2 weeks. Knee brace was used till one month post operative. Patients were discharged on 3rd to 5th post-operative day with home-based physiotherapy protocol.

Evaluation:

All the patients were asked for post-operative radiographs of knee joint in 2 standard view to assess the tunnel placement, position of cortical suspensory loop device in femur and interference screw in the tibia. Patients were followed up at 15 days intervals up to 6 months. All patients were evaluated by clinical examination and IKDC scoring.

Fig.4: Post Operative X-Ray

RESULTS

In this study both groups were analogous in preoperative score and demographic data. In both groups Right side knee was involved more commonly than left side and most common cause of ACL injury is road traffic accident. In our study 26% cases had medial meniscus and only 2% cases had lateral meniscus tear on arthroscopy which were managed by repair. Mean Femoral tunnel in this study was 31±1.5mm in group I and 30±1.5 in group II.

Table 1: Pre-operative clinical assessment by Lachman Test:

Lachman test	Group I	Group II	P-Value
Grade 0	0	0	0.621
Grade 1	0	0	
Grade 2	19	21	
Grade 3	5	3	

Pre-Operative Lachman test 1+ positivity was present in no cases in both group I and group II, 2+ positivity in 76% in group I and 84% in group II, 3+ positivity in 20% cases in Group I and 12% in group II.

Table 2: Post-operative clinical assessment by Lachman Test at 6 months post operative

Lachman test	Group I	Group II	P-Value
Grade 0	21	18	0.78
Grade 1	4	6	
Grade 2	0	0	
Grade 3	0	0	

Post operative 84% patients had negative Lachman test in group I and 72% in group II, 16% cases had 1+ Lachman Test in group I and 24% in group II.

Length of 5 layered Hamstrung graft was ranging from 8.2 cm to 10.8 cm. Challa et al.(11) yielded an average semitendinosus graft length of 24.39 ± 1.3 cm. Mean length of femoral tunnel was 38.25mm. Iriuchishima et al.(12) made the average femoral tunnel length 35.6 ± 4.4 mm.

Table 3: IKDC score at 6 months post operative

IKDC grade	Group I		Group II		P value
	N	%	N	%	
Normal (>90)	13	52	11	44	0.92
Nearly normal (76-89)	11	44	12	48	
Abnormal (50-75)	01	04	02	08	
Severely abnormal (<50)	00	00	00	00	

Final assessment by IKDC found that 86% cases were normal or near normal (88% cases in group A and 84% cases in group B). Abnormal IKDC scores were rated in 14% cases (12% in group A and16% in group B). There is no significant difference in both the groups as per IKDC Score.

Most of the patients returned to their pre-functional level at 6 months.

Hemarthrosis of knee joint was developed in one patient in each group. Knee stiffness developed in 2 patient of group I and one patient in group II and they were managed with under general anaesthesia mobilization. In this study the follow-up period was short terms and there is no screw breakage, graft injury, infection, deep vein thrombosis, synovitis of knee joint and post-operative arthritis.

DISCUSSION

Most of the patients at time of clinical examination initially presented with grades 2 and 3 instability on assessment by Lachman test, which indicated reconstruction. Knee stability was restored in most patients as 84% in group I and 72% in group II tested negative on the Lachman test. Ahn et al. (13) assessed 88.2% in the adjustable-loop device group and 72.7% negative Lachman tests in the fixed-loop device group. Choi et al.(6) assessed a negative Lachman test in 82% in the adjustable-loop device group and 70.1% of the fixed-loop device group.

Significant improvement was noted in functional outcomes in the form of IKDC scores in both groups. In our study IKDC score normal and near normal in 96% in the adjustable loop cortical suspension device group and 92% in the fixed loop cortical suspension device group. Ranjan et al. [10] reported the IKDC

score as being 84.3 in the adjustable loop group and 85.2 in the fixed loop group. Ahn et al.(13) identified IKDC scores of 78.6 in the adjustable loop group and 79.43 in the fixed-loop device group. Asif et al. (14) assessed postoperative IKDC score 91.9 ± 3.6 in adjustable-loop device group and 91.5 ± 3.6 in fixed-loop device group. Our observations matched with the studies mentioned above.

Short femoral tunnel length is a critical issue of the Anteromedial (AM) portal technique, especially when using a fixed-loop device. In a cadaveric study on a Western population, the average femoral tunnel length using the anteromedial portal method was 30.5 mm [25]. Furthermore, five subjects had less than 30 mm femoral tunnel length. In these cases, fixed-loop device use can be compromised because of the short graft length within the femoral tunnel. Many alternative techniques have been suggested to overcome this issue and secure adequate femoral length during the operation. Some authors reported that knee flexion with an anteromedial portal technique can yield a longer femoral tunnel; therefore, the knee joint's hyperflexion during the femoral tunnel drilling could avoid a short femoral socket [26, 27]. Since we created a femoral tunnel by drilling carefully with hyperflexion of the knee, we did not encounter any patient with a femoral tunnel less than 30 mm.

Conclusion:

The two groups were compared by using independent t-test. In this study, functional outcome evaluated by IKDC scoring was nearly equal in Adjustable loop and fixed-loop cortical suspension devices group (P value – 0.92). It shows that there is no significant difference in the outcomes associated with the use of fixed-loop and Adjustable loop cortical suspension devices for ACL reconstruction.

Limitation:

The follow-up period of this study period was short.
Radiological outcome is not included in follow up.
Knee stability was assessed by subjective methods.
A larger number of sample size, more objective data with longer follow-up is required to more authenticate the study.

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