Original article

Arthroscopic ACL reconstruction using fixed suspensory device versus adjustable suspensory device for femoral side graft fixation: What are the outcomes?

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ABSTRACT

Introduction: The aim of the study was to evaluate the outcomes of Arthroscopic ACL Reconstruction using Fixed suspensory device and Adjustable suspensory device for femoral side graft fixation.

Material and methods: We conducted a prospective study of sixty two patients with ACL deficient knees treated with arthroscopic ACL reconstruction. Consecutively patients were operated with fixed loop and adjustable loop suspensory devices for femoral side graft fixation and no randomization was done.

Results: Functional assessment was performed with VAS score, IKDC score and Lyshom score before and after surgery with ACL reconstruction. The postoperative Lyshom score in fixed loop group and adjustable loop group was 94.23 and 94.32 respectively. The IKDC score in fixed group and adjustable group was 92.03 and 92.16 respectively. VAS in fixed loop group improved from score of 5–3, while in adjustable loop group from score of 4–3. There was significant improvement in stability of knee assessed by Lachman's test, anterior drawer test, and Pivot shift's test and both methods of fixation provide stability to knee. The complications included; restriction of terminal flexion in 12 patients: 6 in each group. There was no implant breakage in both groups.

Conclusion: Arthroscopic ACL reconstruction using fixed loop and adjustable loop suspensory devices are equally effective fixation methods.

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1. Introduction

Anterior Cruciate ligament (ACL) is the most commonly injured ligament.¹ More than 1,00,000 ACL reconstruction are performed annually as described by Allen et al.² The goal of treatment for an ACL rupture is to prevent the progression of intra-articular damage by restoring the stability of the knee.³ The management of the anterior cruciate ligament deficient knee has developed dramatically during the past decades. Intra-articular reconstruction with a biologic graft is currently the procedure of choice for the treatment of a ruptured ACL. Many factors influence the clinical success of the ACL reconstruction, including the graft material itself, the fixation of the graft, the placement of the graft, and the rehabilitation after the reconstruction.^{3–5}

The improvements in the fixation methods, enabling the use of multiple strand hamstring grafts and the relatively low donor-site morbidity have resulted in the increased popularity of the hamstring graft.^{6–9} Optimal initial ACL graft fixation requires not only sufficient initial strength to avoid fixation failure, but also sufficient stiffness to restore the stability of the knee and to minimize graft-tunnel motion, as well as sufficient resistance to slippage under cyclic loading conditions to avoid gradual loosening in the early postoperative period after ACL reconstruction.^{5,10–13}

Various graft fixation devices have been developed to be used with the soft tissue grafts. Because of the reported suboptimal fixation of previous devices, newer devices have been developed for femoral fixation of soft tissue grafts, including cortical suspension devices, suture suspension techniques, transfixation devices, and cross screw devices. Every method of suspensory device has its advantages and disadvantages.¹⁴ The reviews of literature suggest that there is lack of data on use of fixed suspension device and adjustable Suspensory Fixation Device.

The purpose of this study was to compare outcomes of arthroscopic ACL reconstruction using Fixed Versus Adjustable

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Suspensory Fixation Device for intratunnel femoral side graft fixation.

2. Material and methods

We conducted a prospective study of sixty two patients with ACL deficient knees treated with arthroscopic ACL reconstruction. Patients who were admitted with ACL injury confirmed by clinical records and MRI scan during the period June 2013 to June 2014 were included in the study based on inclusion criterion. Indications for surgery were clinically and radiologically confirmed cases of anterior cruciate ligament deficient knees.

The inclusion criterion were

1. Age between 18 and 55 years.
2. Clinically ACL deficient knee examined by single surgeon.
3. Radiological ACL deficient knee confirmed by MRI.
4. Complete ACL tear associated with MCL, LCL grade 1 or 2.
5. ACL injuries associated with meniscal/chondral lesions.

The exclusion criterion were

1. Multiligament injury including MCL, LCL gr. 3.
2. PCL injury, Posterolateral corner injury.
3. ACL injuries associated with avulsion fractures.
4. Osteochondral defect.
5. Patients suffering from diagnosed prior knee pathology e.g., stiffness, osteoarthritis, synovitis, infection.
6. Associated with polytrauma cases.
7. Bilateral involvement.
8. Revision ACL.

62 suitable patients were identified for inclusion in the study. Acute cases are initially treated with medicines, long leg knee brace till subsidence of edema, inflammation and healing of any bone bruise.

Preoperatively all patients were screened with X rays of the knee – AP and lateral, MRI and Pre-operative routine laboratory investigations. Consecutively patients were operated with fixed loop and adjustable loop suspensory devices for femoral side graft fixation. No randomization were done. Group I are the patients operated with fixed loop suspension devices (ENDOBUTTON). Group II patients are operated with adjustable loop suspension devices (TIGHTROPE). All patients underwent ACL reconstruction with 4 strand, autologous hamstring grafts and fixed on the tibial side with a bio-degradable interference screw.

Regional anesthesia, tourniquet control and leg positioning in a leg holder were followed for all the patients. All the steps of surgery are same except femoral tunnel preparation. Patients were evaluated preoperatively and postoperatively for pain, range of motion (ROM), pivot shift test, lachman test, anterior drawer test, International Knee Documentation Committee (IKDC) and lyshlom knee scoring system.

Patients were allowed to walk with crutch/walker on second post op day, discharged on day three with physiotherapy recommendation at home. Post operatively patient were given long leg knee brace for three weeks and then hinge knee brace for the next two months. Patients were allowed to resume their normal sports activity after six to eight months. Patients were examined at the end of two weeks, six weeks, three months, six months and then at the end of one year.

Once the data sheets were completed, data were classified for analysis. Statistical analysis was performed on SPSS statistical software (version 17.0). sample *t*-test, 2 sample proportion test, Fisher's exact test *p*-value and Mann-Whitney *U* were utilized to

compare variables between the groups. *P*-value < 0.05 was considered significant.

3. Result

In our study total 62 patients participated, 31 patients in each groups. The demographic data of the study patients was analyzed. (Table 1). Group 1 (fixed loop) consist 25 male and 6 female with mean age 30.06 ± 8.91 years and Group 2 (adjustable loop) consist 24 male and 7 female with mean age 30.84 ± 6.89 years. No significant difference observed among the groups ($P > 0.05$) with regards to gender distribution and age in both groups. Mode of injury in both group include RTA, twisting injury, trauma and slip-fall. Among all these twisting injury includes maximum 16 patients in each group. *p* value for mode of injury in both group was 0.209 (> 0.05), so difference was insignificant. The duration of time from the knee injury to ACL reconstruction ranged from 1 to 84 months, with no significant difference observed among the groups ($P > 0.05$).

All the patients were examined clinically pre operatively and postoperatively, which includes Lachman test, anterior drawer test and pivot shift test. There was no significant difference in clinical assessment pre operatively and postoperatively in both groups (Table 2).

There was significant improvement in stability of knee assessed by Lachman's test, anterior drawer test, and Pivot shift's test in both group with difference in both group was insignificant. So both method of fixation provide stability to knee.

In addition, we evaluated Functional assessment by using VAS score, IKDC score and Lyshom score before and after surgery in different groups of ACL reconstruction. The results are presented in which indicate that there were no significant differences between the groups (Tables 3 and 4) (Fig. 1). VAS in fixed loop group improved from score of 5–3, while in adjustable loop group from

Table 1
Demographic data of patients.

		Group 1	Group 2
Gender distribution	Male	25	24
	Female	6	7
Mean age of patients (Years)		30.06 ± 8.9	30.84 ± 6.89
Time from injury to surgery (Months)		8.71 ± 15.1	5.97 ± 6.27

Table 2
Postoperative clinical assessment of study patients.

Clinical assesment		Group 1	Group 2
Lachman's test	Present	2	3
	Absent	29	28
Anterior Drawer test	Present	3	4
	Absent	28	27
Pivot Shift's test	Present	4	9
	Absent	27	22

Table 3
Functional assessment of patients.

		Group 1	Group 2	P-value
Lyshom score	Pre operative	34.48 ± 5.38	35.53 ± 5.23	N.S
	Post operative	94.23 ± 2.47	94.32 ± 2.1	N.S.
IKDC score	Pre operative	33.45 ± 2.81	33.26 ± 3.43	N.S.
	Post operative	92.03 ± 1.91	92.16 ± 2.07	N.S.

Table 4

Femoral tunnel diameter and associated factors.

Femoral Tunnel Length (mm)	ACL Laxity		Associated lesions	Graft diameter (mm)
	PRE	Post at 1 Year		
23	Positive	Positive	med meniscal injury,mcl grade 2 injury	8
	Positive	Negative		7
20	Positive	Negative		7
21	Positive	Positive		9
21	Positive	Negative	medial meniscal injury	8
23	Positive	Negative		8
25	Positive	Negative		8
24	Positive	Negative		9
20	Positive	Negative	lateral meniscal injury,grade 1 mcl injury	9
20	Positive	Negative		8
21	Positive	Negative		8
20	Positive	Negative		7
22	Positive	Negative	medial meniscal injury,lcl grade 1 injury	8
22	Positive	Negative		8
23	Positive	Negative	medial meniscal injury	9
24	Positive	Negative		9
25	Positive	Negative		8
24	Positive	Negative		8
23	Positive	Negative	lateral meniscal injury	9
22	Positive	Negative		7
20	Positive	Positive		7
21	Positive	Negative	medial meniscal injury,mcl grade 1 injury	8
21	Positive	Negative		8
20	Positive	Negative		9
22	Positive	Negative		8
22	Positive	Negative		8
21	Positive	Negative		9
24	Positive	Negative		7
23	Positive	Negative		7
23	Positive	Negative		9
21	Positive	Negative		8
22	Positive	Negative		7
21	Positive	Negative		7
24	Positive	Negative	medial meniscal injury,mcl grade 1 injury	8
23	Positive	Negative		8
23	Positive	Negative		9
25	Positive	Negative		10
22	Positive	Positive		7
21	Positive	Positive		9
23	Positive	Negative		8
22	Positive	Negative	lateral meniscal injury	8
21	Positive	Negative		8
24	Positive	Negative		9
23	Positive	Negative		8
22	Positive	Positive		9
21	Positive	Negative		8
25	Positive	Negative		9
24	Positive	Positive		8
24	Positive	Negative		8
21	Positive	Negative		9
22	Positive	Negative		7
23	Positive	Negative	medial meniscal injury	8
25	Positive	Negative		9
22	Positive	Negative		9
24	Positive	Negative		10
23	Positive	Negative		8
23	Positive	Negative		8
21	Positive	Negative	lateral meniscal injury	8
22	Positive	Negative		9
24	Positive	Negative		10
22	Positive	Negative		7
21	Positive	Negative		8

score of 4–3. There was considerable improvement in both groups. The complications included; restriction of terminal flexion in 12 patients: 6 in each group. Postoperative synovitis at 3rd month was seen in 1 patient and postoperative effusion in 2 patients. Superficial fungal infection was seen in 1 patient and was treated with conservative management. There was no implant breakage in both groups.

4. Discussion

ACL rupture is one of the most common knee pathologies. ACL reconstruction is of major importance as it maintains knee stability and prevents osteoarthritic alterations which can develop rapidly. Various grafts and approaches are being utilized for ACL reconstruction in modern surgery.

Fig. 1. Functional assessment of patients using Lyshom score.
(Group 1: fixed loop, Group 2: adjustable loop).

The improvements in the fixation methods, enabling the use of multiple strand hamstring grafts and the relatively low donor-site morbidity have resulted in the increased popularity of the hamstring graft.^{20–23} Successful clinical outcomes following anterior cruciate ligament reconstruction with a hamstring graft has been reported by many authors.^{24,25}

Suspensory fixation devices capable of maximizing the amount of graft in the femoral tunnel, thereby improving the outcome of ACL reconstruction. Suspensory devices commonly feature a button that rests on the cortex of the femur, and a loop that holds the folded soft tissue ACL graft in position until healing can occur.^{15–18}

The ACL TightRope RT (Arthrex, Naples, FL) is a newer fixation device that makes ligament fixation fast, easy, and secure. The TightRope button is attached to graft through a loop that can be tightened even after insertion into the canal. The adjustable loop allows the surgeon some freedom in terms of the length of the femoral socket, eliminates the need for bothersome intraoperative calculations for selecting loop length, ensures that the socket is completely filled with graft, and provides the possibility of tensioning the graft even after graft fixation.¹⁹

The choice of fixation method in ACL reconstruction is a debatable question for arthroscopic surgeons. Many devices are available for fixation of graft at femoral site including screws, staples, loop (adjustable and fixed) transosseous pins. Due to less chances of intra-articular damage, cortical suspensory loop system become popular.

Eguchi et al. and Barrow et al. concluded fixed loop group mechanically better than adjustable loop group in form of bearing cyclic loading forces. Our results are not matching with these studies. These studies are in vitro study to assess mechanical

strength. Our study is in vivo study to assess functional outcome between groups.^{26,27}

The outcomes of current study shows that both modes of suspension devices in ACL reconstruction were associated with improved function and satisfaction of patients as demonstrated by the increase in Lysholm score, IKDC score and VAS score. The differences among both modes of femoral fixation are not statistically significant.

Boyle et al. concluded that, no significant difference in postoperative knee stability or graft failure rate between adjustable-loop and fixed-loop femoral cortical suspension in patients undergoing primary ACL reconstruction.²⁸ Results of current study were comparable with outcomes of Boyle et al.²⁸ We observed some complications after surgery like restriction of terminal flexion in 12 patients: 6 in each group, postoperative synovitis at 3rd month in 1 patient, postoperative effusion in 2 patients, superficial fungal infection in 1 patient but there were no functional restriction in these patients. They successfully returned to their pre injury activities.

There was few limitation of the study. The clinical test of stability was performed by investigators by subjective method and arthrometer was not used for assessment. Patient was consecutively selected and no randomization was done. Follow up period was to evaluate and comment of knee osteoarthritis. Also there was lack of in vivo study to compare our results.

5. Conclusion

Arthroscopic ACL reconstruction using fixed loop or adjustable loop suspensory devices are equally effective fixation alternatives for femoral side graft fixation in patient with ACL deficient knee. It

gives equal outcome in both cases, in terms of knee stability, IKDC score and Lysholm score.

Conflict of interest

Nil.

Financial disclosure

Nil.

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