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Original Article

A survey on prognosis of anterior cruciate ligament (ACL) reconstruction surgeries following fixed loop and adjustable loop methods

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Abstract: Background: Anterior cruciate ligament (ACL) rupture is an important disease in the younger population and especially professional athletes followed by trauma. There are different surgical methods for repairing ACL rupture each having their own prognosis rates. Here in this study, we investigated and compared results of ACL reconstruction after the fixed loop and adjustable loop surgical procedure in patients with ACL rupture. Methods: In this study, we evaluated 60 patients with ACL rupture and divided them into two groups each containing 30 patients. Fixed loop and adjustable loop ACL repair were performed for each group. Data regarding knee society score, static laxity, and joint range of motion (ROM), patient's satisfaction and returning to normal daily activities were collected and compared between two groups after 6 months follow up using SPSS software. Results: We showed that there was no significant difference between two groups of patients regarding investigated factors (P>0.05). No surgical site infections were also observed during the study. Conclusion: Both fixed loop and adjustable loop grafting procedures for ACL repair indicate beneficial results and are effective in patients with ACL rupture. We suggest that orthopedic surgeons could use each of these methods according to their own experience and the patient's condition. There are no significant differences between these two methods in the prognosis of patients.

Keywords: Anterior cruciate ligament, fixed loop, adjustable loop, tendon repair, laxity

Introduction

Rupture in anterior cruciate ligament (ACL) is one of the most common complications of exercise and sport and also the most important cause of knee surgery especially in the younger population [1]. ACL rupture is followed by knee instability and also further exercise limitations in patients [2]. Evidence also indicates that this issue increases not only the risks of injuries to meniscuses but also risks of knee joint degeneration [3]. Diagnosis of ACL rupture is mostly by clinical manifestations and also imaging studies but the history of patients has high diagnostic value [4-6]. ACL rupture is divided based on the severity of injuries into 3 types. Type 1 is a mild injury with no joint instability and bleeding in low amounts. In type 2 the rupture is present and bleeding is medium and some joint instability could be observed. In type 3 the ligaments face full rupture and joint instability is the most [7, 8]. ACL rupture is treated by both surgical and medical procedures which should be followed by physiotherapy in both methods [9, 10]. Evidence showed that physiotherapy plays a pivotal role in the prognosis of patients and increases the quality of treatments and accelerates progression procedure. On the other hand, surgical methods have shown the most effective results compared with medical therapies.

The most important goal of ACL reconstruction surgeries is providing the highest stability in the knee. Different surgical methods have been performed for ACL repairing. These methods are variable in properties such as complications and prognosis. ACL repair using intraarticular method has been used in different patients with joint laxity which was associated with good to excellent results. Autologous tendon grafts are nowadays the most common kind of grafts and are performed using plantar tendon, semitendinosus tendon, and gracilis

tendon [11, 12]. All of these surgical approaches are associated with different advantages and limitations, this should be considered when making decisions about patient care.

Numerous studies have evaluated different surgical methods for ACL repairing but so far, no specific method has been introduced as the best. There are still controversial results evaluating different surgical methods for ACL reconstruction. Fixed loop and adjustable loop are also two surgical methods for this issue [13]. Fixed loop ACL repair is performed by attaching the graft to a continuous suture loop connected to a button. This graft is then flipped and fixed at the distal femoral cortex. In this procedure, no implants are used. Instead, the tunnel is filled with the graft. Using this procedure, the graft is fully fixed which indeed, limits the graft slippage. Furthermore, fixed loop ACL repair also provides sufficient graft strength [13]. There are also some concerns about this surgical technique which are mostly due to the requirement of drilling the femoral socket to a specific tunnel depth to flip a button. Studies believe that bone preservation, the stability of the tendon graft, and tendon-bone healing could be endangered in cases of insufficient graft length [14]. Adjustable loop ACL repair also has a button attached to the graft through the adjustable loop. In this procedure, the loop eliminates the additional tunnel length required to flip the button which in turn, is tightened to pull the graft through to the top of the femoral tunnel. The main advantage of this method is that the surgeon is allowed to adapt to different tunnel lengths intraoperatively, thereby avoiding the necessity for drilling a longer tunnel. So far, very few studies have compared these two surgical methods [15]. Here in this article, we aimed to evaluate and compare different surgical results following ACL repairing using the adjustable loop and fixed loop methods.

Methods and material

This clinical trial was performed in Kashani hospital, Isfahan in 2017-2018 on 60 patients with ACL rupture which were candidates for ACL reconstruction. The current study was approved by the ethical committee of Isfahan University of Medical Sciences.

Our inclusion criteria were: diagnosis of ACL rupture based on clinical assessment by an opthopedic surgeon, confirmed using magnetic resonance imaging (MRI), being a candidate for adjusted loop or fixed loop method for ACL reconstruction. Our exclusion criteria were: patient's refusal or lack of regular follow-ups, any congenital, developmental or acquired bone disease, having a history of previous fractures or surgeries in the knee region, having a special medical condition which could interact with our treatments including joint rheumatism or previous deformities in the knee and a systemic disease or obesity in patients.

Patients were divided into two groups of adjusted loop and fixed loop each containing 30 patients. Patients were recruited until the study population completed. The study procedure was explained to all patients and blinding process was as following: patients were unaware of their surgical group and surgery procedure. The researchers who conducted the postoperative assessments were also unaware of the allocation.

Demographic data of patients were collected by the time of entrance to the study. These data were: age, sex, cause of injury and other injuries in the other extremity. Patients were randomly divided into two groups: the first group were allocated to fixed loop surgery and the second group were allocated to adjustable loop surgery. **Figure 1** indicates the CONSORT diagram of the patients.

All patients were visited and examined once before surgeries and weekly after operations until 6 months by a single expert orthopedic surgeon. Data regarding the duration of hospitalizations, hospitalization costs, postoperative complications, need for analgesics, operation site infection and swelling, patient's activities, patient's satisfaction, type of joint alignment (varus, valgus and neutral), static laxity using Lachman's test (after the second month), joint ROM, patient's pain (using the visual score (VAS)) and joint stability were also collected using clinical examinations and special checklists. We also used checklist of knee society score [16]. This score rates from 0 to 100. 50 scores are related to patient's pain, 25 scores are related to the stability of joint and 25 scores are related to joint ROM.

Data were collected and analyzed using SPSS software version 20. We used independent

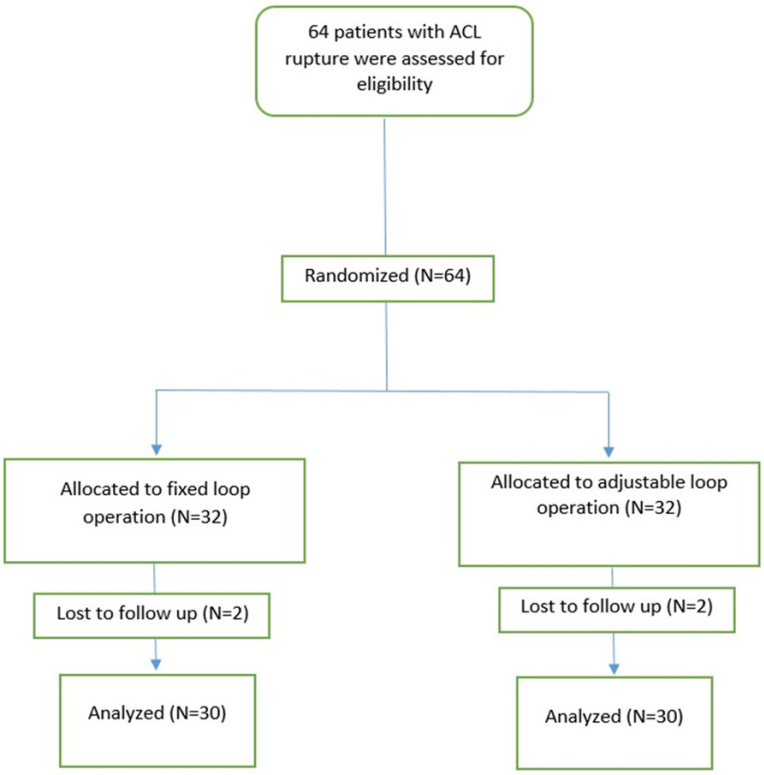

Figure 1. CONSORT flow diagram of the study.

t-test (Mann Whitney), chi-square and paired samples t-test for data analysis. A threshold of 0.05 was considered as the significance threshold.

Results

In this study, 64 patients entered the study. Four patients were excluded due to lack of regular follow-ups. Patients were recruited and divided into two groups. The first group contained 30 males operating by fixed loop procedure and the other group had 30 males operating using adjustable loop method. There was no significant difference between the two groups regarding sex and age (P>0.05). There was also no significant difference between two groups of patients in the frequency of under 8-millimeter static laxity (P=0.37). This frequency was 83.3% in fixed loop group and 76.7% in adjustable group. Our results also showed no surgical site infection in both groups. Using parried samples t-test, we indicated that changes in ROM and knee society score before and after surgeries were significant in both groups (P<0.001 in both groups). There was also no significant difference between the two groups in changes in ROM and knee society score (P>0.05).

We showed that 96.7% of patients in the fixed loop group and 86.7% of patients in the adjustable loop group returned to normal daily activities and no significant difference was observed between two groups (P>0.05). These data are summarized in **Table 1**.

Discussion

Here we indicated that there were no significant differences between the fixed loop and the adjustable loop methods regarding to static laxity, returning normal daily activity, patient satisfaction, ROM and knee society score. Both methods were shown to be efficient and effective in patients with ACL rupture. We also reported no surgical site infection in both groups.

Different surgical methods have been utilized in repairing the ACL rupture. In the study by Sharma and Parmar, they compared two grafting methods (closed-loop fixation and adjustable loop fixation) in 40 patients with ACL rupture. They indicated that both closed-loop and adjustable loop fixation methods are efficient and could provide reduced laxity of grafts with the same results [17]. In another study by Nye and others, they indicated that both fixed loop and adjustable loop fixation bring the same biodynamic results in patients. These results are in line with the results of our study. Here we indicated that more than 70% of patients had static laxity under 8 mm [13].

In a study by Choi and colleagues, they compared fixed loop and adjustable loop methods and reported no significant difference between these two operation procedures in laxity. Furthermore, they reported not reduce tunnel widening after hamstring ACL reconstructions [18]. These results are also in line with the results of our study. Here we indicated no differences in two groups regarding joint laxity.

Table 1. Different variables in the study groups

Variable		Group		*P*-value
		Fixed loop	Adjustable loop	
Age		25.66±5.58	26.16±5.03	0.71
Static laxity	Under 8 mm	25 (83.3%)	23 (76.7%)	0.37
	More than 8 mm	5 (16.7%)	7 (23.3%)	
Infection		0	0	-
ROM	Before surgeries	90.16±8.44	92.60±6.37	0.21
	After surgeries	125.33±12.86	128.83±9.53	0.23
knee society score	Before surgeries	50.30±15.28	47.16±17.02	0.45
	After surgeries	79.27±14.47	76.03±16.14	0.42
Returning to normal daily activities		29 (96.7%)	26 (86.7%)	0.17
Patient's satisfaction	Low	1 (3.35%)	4 (13.3%)	0.25
	Medium	11 (36.7%)	7 (23.3%)	
	High	18 (60%)	19 (63.3%)	

In another comparison between these two methods, Ranjan and others indicated that the adjustable loop method had better results in the knee society score compared with fixed loop in the first 6 months. But in long term follow-ups until 2 years after operations, these factors were the same between two groups and no significant difference was reported [19]. Firat and others also evaluated and compared fixed loop and adjustable loop methods and reported no significant difference after 12 months between these two methods [20]. These reports are also in line with what we indicated. We evaluated and compared 60 patients 6 months after ACL repair operations and showed that both procedures are effective and there is no significant difference between them.

Gamboa and colleagues put emphasis on the effectiveness of adjustable loop method and reported that this procedure leads to better stability and fixation in the knee joint [21]. Another study was performed by Pokharel and others in 2018. In this study, they evaluated 60 patients and compared fixed loop and adjustable loop and reported that both methods are efficient and effective in ACL reconstruction [22]. Furthermore, an important point of our study was that we evaluated our patients by knee society score and also their ROM changes and required time to return to normal daily activities. We also evaluated the patient's satisfaction after surgeries.

Taken together, our results were in line with previous studies and we showed that both adjustable loop and fixed loop methods are effective in ACL repair and no significant differences were found between the two methods. Our study limitations were our small study population, lack of our ability in assessing other effective factors and limited follow-up time.

Conclusion

Here we indicated that both fixed loop and adjustable loop surgical methods are efficient in ACL repair and can contribute to returning to normal daily activities. Our results along with the results of previous studies showed that there is no significant difference between two methods and we suggest that orthopedic surgeons should choose between these methods based on their personal experience and also patient's situations. Further studies on larger populations with longer follow up times could also emphasize on these results.

Disclosure of conflict of interest

None.

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References

[1] Stojmenovic T, Malic T, Vukasinovic-Vesic M, Andjelkovic M and Dikic N. Overtraining as a risk factor for anterior cruciate ligament rupture in female basketball players. Br J Sports Med 2017; 51: 392-393.

[2] Pfeiffer TR, Burnham JM, Kanakamedala AC, Hughes JD, Zlotnicki J, Popchak A, Debski RE and Musahl V. Distal femur morphology affects rotatory knee instability in patients with anterior cruciate ligament ruptures. Knee Surg Sports Traumatol Arthrosc 2019; 27: 1514-1519.
[3] Signorelli C, Filardo G, Bonanzinga T, Grassi A, Zaffagnini S and Marcacci M. ACL rupture and joint laxity progression: a quantitative in vivo analysis. Knee Surg Sports Traumatol Arthrosc 2016; 24: 3605-3611.
[4] Lelli A, Di Turi RP, Spenciner DB and Dòmini M. The "Lever Sign": a new clinical test for the diagnosis of anterior cruciate ligament rupture. Knee Surg Sports Traumatol Arthrosc 2016; 24: 2794-2797.
[5] Huang W, Zhang Y, Yao Z and Ma L. Clinical examination of anterior cruciate ligament rupture: a systematic review and meta-analysis. Acta Orthop Traumatol Turc 2016; 50: 22-31.
[6] Makhni MC, Makhni EC, Swart EF and Day CS. ACL rupture. Orthopedic Emergencies. Springer; 2017. pp. 251-252.
[7] Capin JJ, Khandha A, Zarzycki R, Manal K, Buchanan TS and Snyder-Mackler L. Gait mechanics and second ACL rupture: implications for delaying return-to-sport. J Orthop Res 2017; 35: 1894-1901.
[8] Kösters C, Glasbrenner J, Raschke MJ, Lenschow S, Herbort M and Schliemann B. Clinical outcome 5 years after dynamic intraligamentary stabilization of acute ACL ruptures. Orthop J Sports Med 2019; 7: 2325967119S23259-00239.
[9] Harris KP, Driban JB, Sitler MR, Cattano NM, Balasubramanian E and Hootman JM. Tibiofemoral osteoarthritis after surgical or nonsurgical treatment of anterior cruciate ligament rupture: a systematic review. J Athl Train 2017; 52: 507-517.
[10] Fauset W, Wilkins F, Reid D, Larmer P and Potts G. Physiotherapy treatment and rehabilitation following anterior cruciate ligament injury in New Zealand: are we doing enough? New Zealand Journal of Physiotherapy 2019; 47.
[11] Tanaka Y, Kita K, Takao R, Amano H, Uchida R, Shiozaki Y, Yonetani Y, Kinugasa K, Mae T and Horibe S. Chronicity of anterior cruciate ligament deficiency, part 1: effects on the tibiofemoral relationship before and immediately after anatomic ACL reconstruction with autologous hamstring grafts. Orthop J Sports Med 2018; 6: 2325967117750813.
[12] Patinharayil G. Future trends in ACL rupture management. J Orthop 2017; 14: A1.
[13] Nye DD, Mitchell WR, Liu W and Ostrander RV. Biomechanical comparison of fixed-loop and adjustable-loop cortical suspensory devices for metaphyseal femoral-sided soft tissue graft fixation in anatomic anterior cruciate ligament reconstruction using a porcine model. Arthroscopy 2017; 33: 1225-1232, e1221.
[14] Singh S, Shaunak S, Shaw SC, Anderson JL and Mandalia V. Adjustable loop femoral cortical suspension devices for anterior cruciate ligament reconstruction: a systematic review. Indian J Orthop 2020; 54: 426-443.
[15] Houck DA, Kraeutler MJ, McCarty EC and Bravman JT. Fixed-versus adjustable-loop femoral cortical suspension devices for anterior cruciate ligament reconstruction: a systematic review and meta-analysis of biomechanical studies. Orthop J Sports Med 2018; 6: 23259-67118801762.
[16] Scuderi GR, Bourne RB, Noble PC, Benjamin JB, Lonner JH and Scott W. The new knee society knee scoring system. Clin Orthop Relat Res 2012; 470: 3-19.
[17] Sharma B and Parmar RS. Early outcome analysis of arthroscopic anterior cruciate ligament reconstruction using fixed closed loop and adjustable loop techniques: a prospective case series. Journal of Orthopaedics and Allied Sciences 2018; 6: 74.
[18] Choi NH, Yang BS and Victoroff BN. Clinical and radiological outcomes after hamstring anterior cruciate ligament reconstructions: comparison between fixed-loop and adjustable-loop cortical suspension devices. Am J Sports Med 2017; 45: 826-831.
[19] Ranjan R, Gaba S, Goel L, Asif N, Kalra M, Kumar R and Kumar A. In vivo comparison of a fixed loop (EndoButton CL) with an adjustable loop (TightRope RT) device for femoral fixation of the graft in ACL reconstruction: a prospective randomized study and a literature review. J Orthop Surg (Hong Kong) 2018; 26: 2309-499018799787.
[20] Firat A, Catma F, Tunc B, Hacihafizoglu C, Altay M, Bozkurt M and Kapicioglu MI. The attic of the femoral tunnel in anterior cruciate ligament reconstruction: a comparison of outcomes of two suspensory femoral fixation systems. Knee Surg Sports Traumatol Arthrosc 2014; 22: 1097-1105.
[21] Gamboa JT, Shin EC, Pathare NP, McGahan PJ and Chen JL. Graft retensioning technique using an adjustable-loop fixation device in arthroscopic anterior cruciate ligament reconstruction. Arthrosc Tech 2018; 7: e185-e191.
[22] Pokharel B, Bhalodia M, Raut A and Gajjar S. Comparative study on fixed versus adjustable-length loop device for femoral fixation of graft in anterior cruciate ligament reconstruction. Int J Orthop (Hong Kong) 2018; 4: 889-892.