

Evaluation and comparison of the results between two different fixation methods results in arthroscopic anterior cruciate ligament reconstruction

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Abstract. We aimed to compare results obtaining from this study related to functional status and activity level of individuals who underwent anterior cruciate ligament (ACL) reconstructive surgery using by two different fixation methods. *Material and Method:* In this retrospective study, 40 patients undergoing surgery with Ziploop fixation technique (n = 20; mean age = 30.3 yrs.) and Aperfix fixation technique (n = 20, mean age: 32.2 yrs.) were evaluated. All patients were evaluated in the second year of the operation. Muscle strength of the knee muscles, range of motion of knee joint, and thigh circumference were measured. Pain was also assessed using by a visual analogue scale. Lysholm Knee Score form, International Knee Documentation Committee (IKDC) 2000 subjective knee evaluation form, Tegner activity level assessment were used. *Results.* There were no significant difference between two terms of hamstring and quadriceps muscle strength, range of motion, pain and circumference results, Lysholm knee score form, IKD and Tegner results ($p>0.05$). *Conclusion.* The results indicate that there is no superiority between the two methods in terms of recovery and functional level of the knee joint.

Key words: hamstring graft, anterior cruciate ligament, femoral fixation, functional level.

Introduction

Anterior cruciate ligament (ACL) injuries are common in active adults. Injuries frequently occur during sports activities. ACL is an important ligament which is responsible for knee stabilization. This stabilization is achieved by anterior-posterior and rotational stability of knee. Therefore, instability may occurs, with ACL injury (1). Daily living activities of the people who have ACL injury are greatly affected depending on knee instability. Over time, meniscal and chondral damage occur in instable knee joint. This post-injury situation leads to the need for treatment in ACL injuries. The concept of treatment includes both conservative and surgical treatment. It is aimed to increase muscle strength around knee and to gain proprioception in knee joint in conservative treatment. Because of conservative treatment requires activity restriction and daily life changes especially in active and young patients, surgical treatment becomes a priority (2). In addition, the structure and anatomy of the ACL are better understood by recent studies and surgical treatment success is gradually increasing.

In surgical treatment, a new ligament is made by using another structure substituted for the fractured ACL. Due to increase in success of arthroscopic surgery associated with increase in number of surgical techniques, ACL surgery is performed arthroscopically (3).

A wide variety of autografts, allografts and synthetic grafts are used for ACL surgery. In recent years the most commonly used graft is hamstring tendon graft (4-5). Many fixation methods and materials are used to fix tendon grafts. The endobutton fixation (Ziploop) technique is the technique that is fixed to the lateral cortex of the femur and in the femoral fixation (Aperfix) technique fixation remains within the femur (6).

There are a number of studies in the literature regarding the position of the femoral and tibial tunnels to be used in reconstruction, the fixation methods of the graft in the femoral and tibial tunnels, timing of the surgery, rehabilitation after surgery and the assessment of results after surgical treatment. There is still no clear consensus on the mentioned items yet, and the studies in the field continues. The aim of surgical treatment is to remove the limitation of movement and the instability that occurs in the knee.

By this way, the graft and fixation method to be applied must be strong enough to allow early rehabilitation until the healing process is realized (7).

Aim of this study is to investigate the clinical success of surgical treatment after anterior cruciate ligament injury and to compare clinical outcomes of reconstructions with different femoral fixation methods.

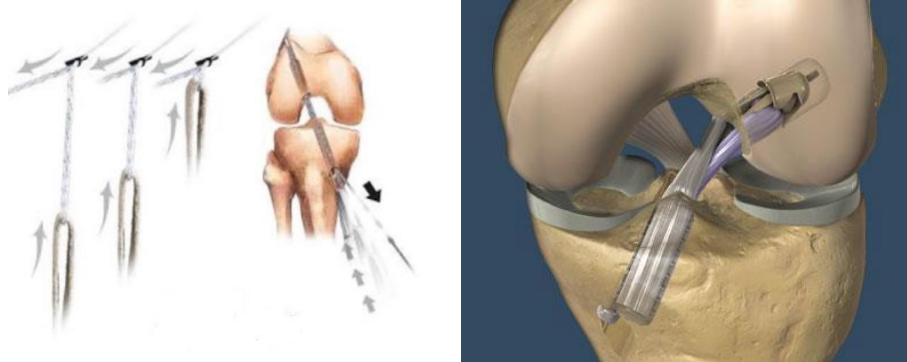


Figure 1. Endobutton (Ziploop) technique **Figure 2.** Femoral Fixation (Aperfix) technique

Material and method

This retrospective study include 40 patients who underwent arthroscopic anterior cruciate ligament reconstruction in Sani Konukoğlu Hospital Department of Orthopedics and Traumatology. Prior to the commencement of the study, this research carried out on humans has been in compliance with the Helsinki Declaration, adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964 and all participants signed an informed consent form prior to participation. Patients who exercised the rehabilitation program which recommended after surgery, were able to follow up, had no additional problems that would affect the success of the treatment, and had no severe trauma after reconstruction surgery are accepted for study. Patients were divided into two groups according to surgical fixation method; as 'Aperfix' fixation technique and 'Ziploop' fixation technique. The evaluation were made between these two groups' results.

Endobutton (Ziploop) technique. In the button technique, a narrower canal is opened before the graft is deployed to allow passage of the anterolateral cortical knuckle through the opened femoral tunnel (tunnel which allows to pass the knuckle through the opened femoral tunnel to antero-lateral cortex). Then, the tunnel is opened at a length of 25-30 mm, and width of measured graft thickness. The button implant which is passed through the tibial and femoral tunnel fits into the anterolateral cortex of femur with the help of hand feeling. The rope which pull the graft up is pulled in direction of femoral tunnel axis by taking the rope out from antero-medial portal. The movement of the graft in the joint to femoral tunnel and getting into the tunnel to the sign on the graft is observe with the arthroscope. After the stability check, the lift rope is cut and the fixation is completed. In this fixation the portion of this fixation graft which is leaved back within the femoral tunnel is 25-30 mm.

Femoral Fixation (Aperfix) technique. A femoral tunnel is opened with a guide wire length of 25 mm and a thickness of 9, 10 or 11 mm according to the measured graft diameter thickness (for 7 and 8 mm graft thickness 9, for 9 mm graft thickness 10, for 10 and 11 mm graft thickness 11 mm width femoral tunnel is opened). Graft is hung on the Aperfix implant and the implant is placed in the tunnel with graft on the end and secured with the help of a screwdriver by opening the wings in the tunnel. Stability is observed with arthroscopy. In this fixation, 10 mm graft remains within the femoral tunnel.

Postoperative Rehabilitation. Both groups started the rehabilitation program in the first week after surgery. In the first 4-week period, the target was to reduce pain and gain range of motion. For this goal, knee flexion within the pain limit, straight leg raise for quadriceps control, isometric quadriceps exercises and hip abduction- adduction exercises were performed. After discharge, the patient continued the same program as home exercise. All patients were called to the polyclinic follow ups at 4th, and 8th week after surgery. After the 4th week follow up, strengthening exercises, the different ground walking exercises to improve balance and coordination, the mini squatting exercise for quadriceps control were added in the home rehabilitation program. After 8th week, resistive knee extensor and flexion exercises were put in home rehabilitation programs.

Measurements. At the end of the second year, patients were summoned for evaluations. Hamstrings and quadriceps strength were measured by manual muscle test and knee joint range of motion by goniometer. Patients' pain was assessed by visual analogue scale. Thigh circumference measurement was done for atrophy evaluation. Lysholm Knee Score form, International Knee Documentation Committee (IKDC) 2000 subjective knee evaluation form, Tegner activity level were recorded.



Figure 3. Post-op MR views of Aperfıx (3a) and Ziploop (3b) Fixation Methods

Results

The normality hypothesis of the data extracted from the patients analysed by Shapiro Wilk test, and the analysis of the differences between the two independent groups' measures was assessed by the Mann-Whitney U test. $p < 0.05$ for differentiation level. 40 patients participated in the study, 28 were males and 12 were females. In the Aperfıx group 15 male and 5 female patients, in the Ziploop group 13 male and 7 female patients were evaluated. The mean age of the patients was recorded as 30.3 in the Ziploop group and 32.2 in the Aperfıx group (Table I). As a result, there was no statistical significance between the two groups, although the extremity of the surgically treated extremity quadriceps and hamstring manual muscle strength, flexion limit, pain level, and thigh circumference were different ($p > 0.05$) (Table II). However the Lysholm score, IKDC values and Tegner activity level were significantly lower in the Ziploop group than in the Aperfıx group, there was no statistically significant difference between the two groups ($p > 0.05$) (Table III; Fig. 4).

Table I. Number of patients and age groups in terms of affected side and gender according to femoral fixation method

Femoral Fixation Method		Hamstring		Quadriceps		Differences between operated side and non-operated side		Differences between operated side and non-operated side		Differences between operated side and non-operated side	VAS
		Operated side	Non-operated side	Operated side	Non-operated side	Active flexion	Passive flexion	Active extension	Passive extension	Thigh circumference	
Aperfıx	Mean	3.7	4.6	4.5	5	14.5	8.5	0	0	2.1	1.66
	N	10	10	10	10	10	10	10	10	10	10
	SD	0.483	0.516	0.527	0	10.916	7.091	0	0	2.1318	1.0135
	Median	4	5	4.5	5	15	10	0	0	2	1.95
Ziploop	Mean	3.3	4.4	4.2	4.8	16.5	10	0	0	0.85	3.16
	N	10	10	10	10	10	10	10	10	10	10
	SD	0.483	0.699	0.632	0.422	10.014	8.819	0	0	1.1068	2.8044
	Median	3	4.5	4	5	15	7.5	0	0	0.5	2.7
Total	Mean	3.5	4.5	4.35	4.9	15.5	9.25	0	0	1.475	2.41
	N	20	20	20	20	20	20	20	20	20	20
	SD	0.513	0.607	0.587	0.308	10.247	7.826	0	0	1.7732	2.1918
	Median	3.5	5	4	5	15	10	0	0	1	2.05

Table II. Results of Femoral Fixation Method by Lower Extremities Differences

Femoral Fixation Method	Number of patients (n)	Side		Gender		Mean age
		Right(n)	Left (n)	Man (n)	Woman(n)	
Endobutton (Ziploop)	20	12	8	13	7	30,3
Femoral Fixation (Aperfix)	20	11	9	15	5	32,2

Table III. Knee scores by groups

Femoral Fixation Method		LYSCHOLM	TEGNER	IKDC
Aperfix	Mean	87.2	5.5	60.76
	N	10	10	10
	SD	8.08	1.269	11.474
	Median	84,5	5	65.5
	Mean	81.4	4.5	52.72
Ziploop	N	10	10	10
	SD	16,501	1.08	15.7603
	Median	84	5	55.7
	Mean	84.3	5	56.74
	N	20	20	20
Total	SD	12.99	1.257	14.0368
	Median	84	5	58.6

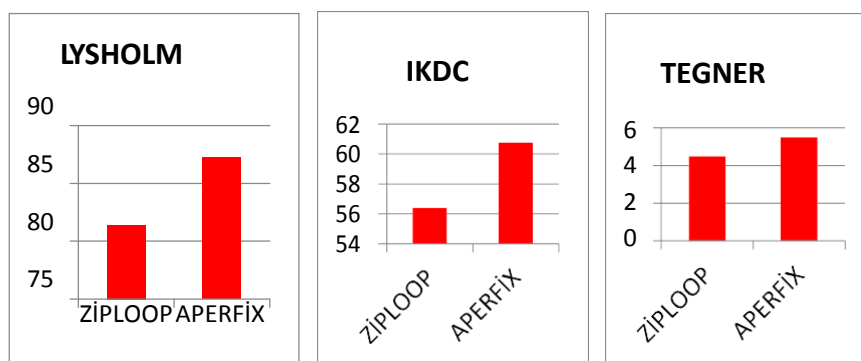


Figure 4. Comparison of fixation methods

Discussion and Conclusion

In active adults, the most common problem in sports injuries is ACL injuries. Along with the development of technology, different surgical techniques have begun to be used. The extent to which these techniques affect clinical outcomes has been the subject of many researches. There are many factors that can affect these clinical outcomes. When literature studies are examined, patient selection, type of graft used, position of tibial and femoral tunnels, graft tibial and femoral fixation technique, experience of the surgeon, rehabilitation program after surgery are shown to be variables are the main ones (8).

In this retrospective study, the results of femoral fixation methods in arthroscopic anterior cruciate reconstruction were evaluated and compared. Analysis of the 2 year data from the patients indicates that there is no difference between groups in terms of muscle strength, range of motion and pain. These results are in line with the results of the different fixation methods used in the ACL reconstruction in the literature (9).

Yosmaoğlu et al. didn't find any significant difference in quadriceps and hamstring isokinetic muscle strength of patients who had anterior cruciate ligament reconstruction with hamstring tendon graft (10). Studies examining the long-term outcome of reconstructed muscle strength showed that deficits decreased and remained normal at the second postoperative year (11-12). In our study, although it was not statistically significant, it was found that the affected extremity muscle strength was lower than the healthy side. The implementation of the rehabilitation program in the form of a home program, the program has not been continued for a long time, may be due to the fact that results.

The rate of male patients in our study was found to be higher than female patients. Literature studies on ACL reconstruction indicated that the number of males was higher than females. Ahlden et al. observed that there was no difference in clinical outcomes and functional scoring between women and men (13). This result indicates that gender difference is not a factor to affect the results.

In our study, we evaluated the effect of two different fixation methods on the long-term activity level with the Tegner activity scale. We identified Aperfix group Tegner activity level of 5.5, Ziploop group as 4.5. In a study of 117 patients by Choi and colleagues in 2016, they determined the level of activity by the Tegner activity scale and found no statistical difference (14).

In literature one of the most commonly used scoring methods for knee evaluation studies is the Lysholm score. Postoperative 2nd year, according to the results of Lysholm Knee Score, our average score was 87.2 (good) in the Aperfix group and 81.4 (good) in the Ziploop group. In a study comparing femoral fixation methods in 2016 by Wise et al., no significant difference was found in terms of Lysholm score. The results of our study were parallel to the literature findings (15-18). According to the IKDC scoring system, the Aperfix group score was 60.76 and the Ziploop group was 56.41.

There was no significant difference between the postoperative evaluations of the patients who were reconstructed with Ziploop and Aperfix fixation surgery in our study. The surgery is shorter with the Aperfix method and the cost of the surgeon is lower with the Ziploop method. The results indicate that there is no superiority between the two methods in terms of recovery and functional level of the knee joint.

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