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Return to sports activity in the revision of anterior cruciate ligament reconstruction: A 2–6 Year follow-up study

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ABSTRACT

Introduction: and Objective: The risk of an anterior cruciate ligament (ACL) injury in young patients and those with sports activity is increasing. Regarding the need of athletes with ACL re-rupture to return to sports, ACL revision surgery has received great importance. This study was conducted to evaluate the outcome of ACL reconstruction revision surgery in athletes.

Method: In general, 62 patients with primary surgery and 62 patients with revision ACL surgery were investigated in this study. The study subjects were matched in terms of age, gender, involved leg, injury mechanism, sports group, time of surgery, and the degree of cartilage injury and ankle meniscus rupture. The studied variables included age, gender, body mass index (BMI), sports group, infection, meniscus injuries, chondral lesion, time to return to sports, quality of return to sports, range of motion, Lachman's test, and knee injury and osteoarthritis outcome score (KOOS), International Knee Documentation Committee score, Lysholm, and Marx scores. They were obtained through the information in the patients' medical records and the questionnaire filled out by the participants and the examiner's physician through the follow-ups. Then, the collected data were imported into the SPSS software and underwent analysis.

Results: The mean follow-up of patients was 49 months (in the range of 2–6 years). None of the patients had a chronic infection. The mean time to return to sports was 29.2 ± 3.2 and 35.3 ± 4.3 weeks in the primary surgery and revision surgery groups, respectively. In addition, 34 (54.8%) and 25 (40.3%) patients of the primary surgery and the revision surgery groups returned to the same level before injury, respectively. On the latest follow-up, the results of the Lachman test showed no significant difference between the two groups ($P = 0.222$) whereas Lysholm, IKDC, MARX, and KOOS scores on the latest follow-up in primary surgery were significantly higher than those of revision surgery ($P < 0.001$).

Conclusion: The rate of return to sports in revision surgery was 14.5% lower than that of primary surgery, and the average time of return to sports was six weeks. The rate of return to sports, similar to before the injury, was significantly lower in the revision group, females, the age group of over 25 years, and contact sports activity, and patients with a chondral lesion. All knee performance scores were also poorer in the revision surgery.

1. Introduction

The incidence of anterior cruciate ligament (ACL) injury, which affects between 80,000 and 250,000 patients, has been annually reported 10 times more in athletes compared to the general population.[1] ACL reconstruction surgery is associated with the desired outcome in 75–97% of patients.[2,3] However, studies have shown that the risk of ACL re-rupture is increasing in a significant number of young patients and those with regular sports activity. In various studies, this probability has been reported 3% in a 2-year follow-up[4] and 4% in a 5-year follow-up.[5] Given that a major part of ACL re-rupture occurs within the first two years after the primary surgery, the return to sports may be delayed by 12–24 months.[6] Other risk factors for ACL re-rupture have been reported as young

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age, body mass index (BMI) ≥ 25, overweight women, tobacco use, and sports activity.[6] Further, ACL revision surgery is crucial since athletes with ACL re-rupture need to return to sports. Notably, the orthopedic surgeon must inform his patients on the probability of return to sports after revision surgery. The rate of graft re-injuries after revision surgery has been reported by 3.3%[7] and 4.3%[8] in a two-year follow-up. Revision surgery is technically more difficult than primary surgery for some reasons such as limitations in the selection of graft material, difficulty in tunneling, and access to appropriate graft fixation.[8] Furthermore, the simultaneous presence of meniscus rupture and chondral lesions, the use of the previous bone tunnel (rather than the creation of a new bone tunnel), and then return to high-risk sports activities lead to poorer outcomes.[9] Although the outcomes of primary ACL surgery have been widely reported, few studies have examined the outcomes of ACL revision surgery and compared it with the primary surgery outcomes. Therefore, the present study aimed to evaluate the outcome of ACL reconstruction surgery in athletes.

2. Patients and methods

2.1. Study protocol

This comparative cross-sectional descriptive study was conducted on athlete patients undergoing ACL revision surgery during 2009–2015. The study subjects were those who had passed at least two years since their surgery. The protocol of this study was approved by the Institutional Review Board (IRB no: 3210) and the study was conducted in accordance with the Helsinki Declaration. Patients signed an informed consent form and were ensured of the confidentiality of their personal information.

2.2. Patient selection and matching

First, the medical records of all 93 athlete patients undergoing revision surgery in our university hospital during 2009–2015 were included in this study. The results of revision surgery were compared with the primary reconstruction results. Our training center is a referral center where many ACL surgeries are performed daily. Using the matching method for all patients undergoing revision surgery, one patient undergoing the primary surgery was selected as the control (matched in terms of demographic characteristics including age, gender, involved leg, injury mechanism, sports group, time of surgery, degree of cartilage injury, and meniscus rupture) and analyzed, and then the results were compared in each of the two groups. All patients underwent surgery by an orthopedic surgeon, who is the first author of this research.

2.3. Subjects

Inclusion Criteria.

- In this study, the patient was considered as ACL injury who had a 3+ Lachman test, and complete ACL rupture was confirmed by magnetic resonance imaging;
- People aged 18–50 years;
- Regular sports activity (exercising three times a week or more often for at least 20 min);
- Willingness to participate in the study;

Exclusion Criteria

- History of any knee surgery;
- History of ACL ruptures at the contralateral knee;
- Injury of other ligaments (except for medial and lateral meniscus);
- Abnormal knee radiography;
- Hip or ankle surgery history;
- ACL injuries that have a non-sport mechanism;
- Multiple ligament injuries.

2.4. Formulation of the questionnaire

The studied variables included age, gender, BMI, sports group (i.e., soccer, other ball sports, basketball, volleyball, handball, and martial arts), infection, simultaneous medial and lateral meniscus injuries, cartilage injury (0–4 based on Noyes classification), time of return to sports, quality of return to sports (similar to before the injury, weaker, unable to exercise), range of motion, and Lachman test, along with knee injury and osteoarthritis outcome *score* (KOOS), International Knee Documentation Committee score, Lysholm, and Marx scores. They were obtained through the information inserted in the patients' medical records and the questionnaire filled out by the participants and the examiner's physician in the follow-ups. Out of 1378 patients with ACL rupture referring to our academic center during 2009–2015, 876 cases were eligible to participate in this study, of whom 783 and 93 patients underwent primary and revision surgery, respectively. Then, 93 patients undergoing primary surgery were matched with 93 patients who underwent revision surgery. However, 124 patients (62 and 62 patients in the primary surgery and revision surgery groups, respectively) were matched in terms of age, gender, involved leg, injury mechanism, sports group, time of surgery, and the degree of cartilage injury, and ankle meniscus rupture. The participants completed the questionnaire and their follow-up time was complete.

2.5. Surgery technique

2.5.1. Primary reconstruction surgery procedure

A 4-cm anteromedial incision was made on the tibia approximately 4 cm distal to the articular surface and 3 cm medial to the tibial tuberosity, and Pes anserine appeared with subcutaneous dissection. Subperiosteal dissection was performed up to the tendon incision site on the tibia crest in order to maintain the maximum length. Next, semitendinosus and gracilis tendons were separated from the muscle in proximal with a 10 mm stripper tendon, and a four-layer graft was used to reconstruct the ACL. The femoral tunnel was reamed using the arthroscopic method and the anteromedial portal technique. Then, the tibial tunnel was embedded in the tibia at the ACL footprint site. Then, the femoral side fixation was performed by the endo-button (Orthomed Mark), followed by performing tibial side fixation by an absorptive interference screw (Orthomed Mark) in the same size of tibial tunnel diameter.

2.5.2. Revision surgery procedure

It was similar to the primary surgery although the Achilles' allograft tendon was used in a new tunnel in the tibia and femur in the revision surgery. All patients underwent single-stage revision surgery. In three patients, ACL revision was performed in two stages. In the first stage, the large tibial defect was grafted and ACL reconstruction was performed three months later. Three cases were excluded from the study due to insufficient follow-ups.

2.6. Statistical analysis

The collected data were recorded through SPSS, version 21. The statistical analysis was performed using appropriate statistical tests to compare the results of the two groups at a 95% confidence level

($P < 0.05$) with a clinical difference of 50% of the standard deviation (SD). The percentage (ratio) and Chi-square test (K–S) were used to report the results of qualitative data. The mean (±SD) was employed to analyze continuous quantitative data. Finally, *t*-test, Mann-Whitney, and repeated-measure ANOVA tests were applied to compare the continuous variables after data distribution.

3. Results

In this study, 124 patients with ACL rupture undergoing primary and revision ACL reconstruction surgery at our academic orthopedic center during 2009–2015 were evaluated and then followed up for at least two years. A total of 124 patients were studied in the primary and revision surgery groups each containing 62 cases. The mean follow-up was 49 months (in the range of 2–6 years). Out of 124 studied patients, 71.7 and 28.2% were males and females. The mean age of patients was 29.4 ± 8.1. Nearly 25% of patients had grades 1 to 4 of the chondral lesion in the medial condyle, lateral condyle, inner plateau, and patella while 58.8% of them had medial and lateral meniscus rupture. There was no significant difference between the two groups in terms of gender, age, BMI, level and type of sports, and degree of cartilage injury and meniscus rupture since they were previously matched in this regard. The demographic characteristics of the studied patients are presented in Table 1.

Acute infection was found in only two patients (one patient in each group) who received appropriate treatment and achieved complete recovery. None of the patients had a chronic infection. The mean time to return to sports was 29.2 ± 3.2 and 35.3 ± 4.3 weeks in the primary and revision surgery groups, respectively. Moreover, 34 (54.8%) and 25 (40.3%) patients of the primary and revision surgery groups returned to sports at the same level before the injury, respectively (Table 2).

The results of the Lachman test showed no statistically significant difference between the two groups ($P = 0.229$) on the latest follow-up (Table 3) whereas Lysholm and IKDC scores (Tables 4 and 5) on the latest follow-up in primary surgery were significantly higher than those of revision surgery ($P < 0.001$).

The mean of MARX and KOOS scores in the latest follow-up group was significantly different between the two groups, and all cases represented a higher score in primary surgery (Table 6). Additionally, all patients reached the full range of motion (ROM) before the surgery and then underwent surgery. After the surgery, 61 out of 62 patients reached full flection in the primary surgery group and only one patient had about 10-degree flexion restriction. In terms of extension, one patient had a 10-degree extension and two patients had a five-degree extension lack. In the revision group, one patient had a five-degree flexion restriction and three of them had about five-degree extension lack, which was not significantly different between the two groups. Table 7 provides data on the relationship between demographic factors, cartilage lesions, and meniscal rupture, and the rate of return to sports in the two groups.

4. Discussion

Certainly, return to sports following ACL surgery is one of the most challenging issues in athletes. In this study, the rate of return to sports at the same level before the injury was more acceptable in the primary surgery group as compared to the revision surgery (54.8 vs. 40.3%). In two similar studies, the rate of return to sports after revision surgery was 44[10] and 46%.[11] In addition, the same period of return to sports in the contact, pivoting, and jumping sports were found in these two studies, which is in line with the results of the current study. Notably, almost all athletes participating in this study belonged to these sports. Moreover, the average time to return to sports was lower in the primary surgery group compared to the revision surgery group (29 vs. 35 weeks). Previous research revealed that meniscus and articular cartilage status are the most important determinants of ACL surgical outcomes.[12] In addition, it was reported that patients with intra-articular pathologies achieve poorer surgical outcomes in comparison to patients with meniscus and intact cartilage.[13] For this reason, patients in both groups were matched in terms of meniscus rupture and cartilage injuries in order to eliminate the effect of these factors on the results of this study. However, the results of another study showed that surgery, by itself, can be considered a trauma.[14] Considering that the surgical treatment due to tunnels created by drilling can damage the knee cartilage, it causes inflammatory mediators and invades healthy tissues. Therefore, it makes the knee

Table 1
Demographic characteristics of all patients.

Number of patients		all patients	Primary	Revision	P
		n (%)	n (%)	n (%)	
		124 (100)	62 (100)	62 (100)	
Sex	male	89 (71.7)	43 (69.3)	46 ((74.1)	0.692*
	female	35 (28.2)	19 (30.6)	16 (25.8)	
Age (years)	≤25	38 (30.6)	20 (32.2)	18 (29.0)	0.952**
	26–35	55 (44.3)	26 (41.9)	29 (30.6)	
	36–45	24 (19.3)	12 (19.3)	12 (19.3)	
	46 ≤	7 (5.6)	4 (6.4)	3 (4.8)	
Mean age		29.4 ± 8.1	29.4 ± 7.9	29.5 ± 8.4	0.913***
BMI	≤20	4 (3.2)	2 (3.2)	2 (3.2)	0.896**
	21–25	68 (54.8)	32 (51.6)	36 (58.0)	
	26–30	47 (37.9)	25 (40.3)	22 (35.4)	
	30 ≤	5 (4.0)	3 (4.8)	2 (3.2)	
Type of sports group	Soccer	73 (58.8)	38 (61.2)	35 (56.4)	0.985**
	Basketball, volleyball, and Handball	24 (19.3)	11 (17.7)	13 (20.9)	
	Martial Arts	15 (12.0)	7 (11.2)	8 (12.9)	
	wrestling	6 (4.8)	3 (2.4)	3 (2.4)	
	Other	6 (4.8)	3 (2.4)	3 (2.4)	
Chondral lesion	YES	31 (25.0)	14 (22.5)	17 (27.4)	0.412**
	NO	93 (75.0)	48 (77.4)	45 (72.5)	
Rupture of meniscus	Yes	73 (58.8)	35 (56.4)	38 (61.2)	0.584*
	No	51 (41.1)	27 (43.5)	24 (38.7)	

*Chi-Squared Test, **Fisher's exact test, ***Independent Test.

Table 2
The incidence of infection and the rate of return to sport status between primary and revision surgery groups on the latest follow-up.

Number of patients		all patients	Primary	Revision	P
		n (%)	n (%)	n (%)	
		124	62	62	
Infection	Yes	2 (1.6)	1 (1.6)	1 (1.6)	0.999[a]
	No	122 (98.4)	61 (98.4)	61 (98.4)	
Return to Sports status	Similar to preinjury level	59 (47.6)	34 (54.8)	25 (40.3)	0.266[a]
	Lower level	41 (33.1)	18 (29)	23 (37.1)	
	Stopped	24 (19.4)	10 (16.1)	14 (22.6)	
Average time to return to sports (week)		32.3 ± 4.9	29.2 ± 3.2	35.3 ± 4.3	0.001[a]

[a] Fisher's exact test.

Table 3
Comparison of Lachman test between primary and revision surgery groups before surgery and on the latest follow-up.

Lachman Test	Preoperative		on the latest follow-up	
	primary	revision	primary	revision
	n (%)	n (%)	n (%)	n (%)
0	12 (19.3)	9 (14.5)	52 (83.8)	45 (72.5)
1	22 (35.4)	27 (43.5)	7 (11.2)	12 (19.3)
2	23 (37.0)	21 (33.8)	2 (3.2)	3 (4.8)
3	5 (8.0)	5 (8.0)	1 (1.6)	2 (3.2)
Mean Rank	62.4	62.6	58.5	66.4
P	0.975*		0.091*	

*Mann Whitney u test.

Table 4
Comparison of Lysholm score between the two primary and revision surgery groups before surgery and on the latest follow-up.

Lysholm score	Preoperative		On the latest follow-up	
	primary	revision	primary	revision
	n (%)	n (%)	n (%)	n (%)
<64 (Poor)	51 (82.2)	42 (67.7)	0	0
65-83 (fair)	11 (17.7)	17 (27.4)	3 (4.8)	5 (8.0)
84-94 (good)	1 (1.6)	2 (3.2)	25 (40.3)	35 (56.4)
95-100 (excellent)	0	0	34 (54.8)	22 (35.4)
Mean Rank	55.9	69.0	69.06	55.94
P	0.043[a]		0.042[a]	

[a] Mann Whitney u test.

more prone to osteoarthritis after the surgery and the recovery time, and subsequently, the time to return to sports will be longer.[15,16] In other words, the incidence of these intra-articular injuries increases in knee surgery compared to primary knee surgery, and a major part of poorer outcomes in revision surgery may be attributed to the probabilities of intra-articular cartilage after revision surgery.[12,16]

The lack of adequate rehabilitation after ACL surgery is another important reason for not returning to sports. Despite the regular follow-ups in our patients, it was impossible to evaluate the nature of postoperative physiotherapy in this study. The lack of risk-taking and fear of injury are other reasons in this regard. Psychological factors are one of the factors affecting the return-to-sport rate (RTS) following the ACL reconstruction.[17] Psychological factors and negative emotions such as anxiety and fear can affect patients' return to sports not only during an injury but also throughout the rehabilitation period.[17] In addition, psychological readiness is one of the psychological factors discussed with regard to RTS after ACL reconstruction. Further, psychological readiness testing can be an important element for optimizing RTS.[18] However, it was not investigated in our study, which can be considered as one of the limitations of this study. The present study used the Lachman test and ROM for detailed knee evaluations. According to our results, the Lachman test as the most sensitive diagnostic test for ACL rupture demonstrated no significant difference between the two groups. Similar results were reported in the study conducted by Giftsad et al.[19] Further, in investigating the ROM, one patient in the primary surgery group had a 10-degree flexion lack and one patient in the revision group had a 5 degree lack of flexion. The extension

Table 5
International Knee Documentation Committee (IKDC) between the primary and revision surgery groups before surgery and on the latest follow-up.

IKDC		Grade				Mean Rank	P
		Normal (90–100)	Nearly Normal (80–89)	Abnormal (70–79)	Severely Abnormal (70>)		
		n (%)	n (%)	n (%)	n (%)		
Preoperatively	**primary**	0	7 (11.2)	14 (22.5)	41 (66.1))	63.23	0.247[a]
	revision	0	4 (6.4)	11 (17.7)	47 (75.8)	58.8	
on the latest follow-up	**primary**	45 (72.5)	12 (19.3)	5 (8.0)	0	91.5	<0.001[a]
	revision	33 (53.2)	17 (27.4)	12 (19.3)	0	33.5	

[a] Mann Whitney u test.

Table 6
Comparison of MARX and KOOS Scorers between the two groups of primary and revision surgery before surgery and on the latest follow-up fallopian.

	Preoperatively			on the latest follow-up		
	primary	Revision	P	primary	revision	P
MARX Score (mean ± SD)	4.1 ± 1.3	4.7 ± 1.6	0.027	14.5 ± 0.6	11.5 ± 0.6	0.001
KOOS scores (mean ± SD)	52.9 ± 4.4	52.9 ± 53.4	0.854	95.2 ± 2.6	77.1 ± 3.2	0.001

Table 7
Relationship between demographic factors (sex, age group, and BMI), cartilage lesions and meniscal rupture, and rate of return to the sport in the two groups.

			group							
			primary				revision			
			quality. Sport				quality. Sport			
			Similar	Weaker	stop	P	Similar	Weaker	stop	P
sex	male	N (%)	24 (55.8)	14 (32.6)	5 (11.6)	0.303	22 (48.9)	19 (42.2)	4 (8.9)	0.001
	female	N (%)	10 (52.6)	4 (21.1)	5 (26.3)		3 (17.6)	4 (23.5)	10 (58.8)	
age. Group	≤25	N (%)	18 (90.0)	1 (5.0)	1 (5.0)	0.001	13 (72.2)	4 (22.2)	1 (5.6)	0.001
	26–35	N (%)	14 (53.8)	11 (42.3)	1 (3.8)		9 (31.0)	17 (58.6)	3 (10.3)	
	36–45	N (%)	2 (16.7)	5 (41.7)	5 (41.7)		3 (25.0)	2 (16.7)	7 (58.3)	
	46 ≤	N (%)	0	1 (25.0)	3 (75.0)		0	0	3 (100)	
BMI	≤20	N (%)	2 (100.0)	0	0	0.568	1 (50.0)	1 (50.0)	0	0.877
	21–25	N (%)	15 (46.9)	10 (31.3)	7 (21.9)		13 (36.1)	15 (41.7)	8 (22.2)	
	26–30	N (%)	16 (64.0)	6 (24.0)	3 (12.0)		10 (45.5)	7 (31.8)	5 (22.7)	
	30 ≤	N (%)	1 (33.3)	2 (66.7)	0		1 (50.0)	0	1 (50.0)	
Type of sports group	Soccer	N (%)	28 (73.6)	8 (21.0)	2 (5.2)	0.744	18 (51.4)	13 (37.1)	4 (11.4)	0.764
	Basketball, volleyball and …	N (%)	5 (45.4)	4 (36.3)	2 (18.1)		5 (38.4)	6 (46.1)	2 (15.3)	
	material Arts	N (%)	1 (14.2)	3 (42.8)	3 (42.8)		2 (25)	2 (25)	4 (50)	
	wrestling	N (%)	–	1 (33.3)	2 (66.6)		–	1 (33.3)	2 (66.6)	
	Other	N (%)	–	2 (66.6)	1 (33.3)		–	1 (33.3)	2 (66.6)	
Meniscus	yes	N (%)	21 (60.0)	7 (20.0)	7 (20.0)	0.088	3 (21.4)	7 (50.0)	4 (28.6)	0.481
	no	N (%)	13 (48.1)	11 (40.7)	3 (11.1)		22 (45.8)	16 (33.3)	10 (20.8)	
Chondral lesion	yes	N %	4 (28.6)	4 (28.6)	6 (42.9)	0.006	1 (5.6)	8 (44.4)	9 (50.0)	0.001
	no	N %	30 (62.5)	14 (29.2)	4 (8.3)		24 (54.5)	15 (34.1)	5 (11.4)	

Mann Whitney *U* Test.

lack also occurred in three patients in the primary group (One patient had a 10-degree and two patients had a five-degree extension lack) and three patients in the revision group showed a 5-degree extension lack. These differences are not statistically significant between the two groups. Knee joint performance was evaluated in the KOOS, IKDC, Lysholm, and Marx scan in primary and revision surgery groups. Based on the investigation of all scores, the mean score in primary surgery was significantly higher than that of revision surgery.

Therefore, a decrease in knee performance would be probably observed following revision surgery. In the study by Gifstad et al., 56 patients undergoing ACL revision surgery were compared with 52 patients who underwent primary ACL surgery. The Lysholm and KOSS scores in this study were significantly lower in the revision group as compared to the primary surgery group. In another study, poorer results were reported in the revision group in the subsets of the KOSS tool although no significant difference was found in the Lachman test.[20] Given that demographic factors can lead to different outcomes regarding return to sports, the rate of return to sports was examined in terms of age, gender, BMI, type of sport, meniscus rupture, and chondral lesion in both primary and revision groups. According to our results, the rate of return to sports in the primary surgery group was not significantly different between males and females whereas its rate in males was 2.7 times higher than females in the revision group (48.9 vs. 17.6%). In other words, females with revision surgery were 2.2 times more likely to stop sports activity in comparison to males (58.8 vs. 26.35%).

In the study by Gifstad et al. gender showed no effect on primary and revision surgery outcomes,[19] which contradicts the findings of the present study. Patients in both primary and surgical surgery groups had the highest rate of return to sports similar to before injury in the age group below 25 years. As a result, 90 and 72.2% of subjects aged below 25 years in the primary surgery and the revision group returned to sports at the same level before the injury, respectively, and the rate of return to sports decreased by increasing age in both groups. Certainly, young age and greater motivation for sports activities can be the most important factors in this regard.

Additionally, although most patients in this study had a BMI of 21–25 (54.8%) and 26–30 (37.9%), the rate of return to sports in different BMI categories was not significantly different in either group. Based on the results of our study, the type of sports was also effective in the rate of return to sports. As a result, the rate of return to sports in athletes with contact sports (e.g., wrestling and martial arts) was significantly lower compared to both noncontact sports (ball sports such as basketball, volleyball, and the like) in both primary and revision groups. Furthermore, the highest rate of return to sports at the same level before the injury in both groups belonged to football, followed by other sports. On the other hand, the lower rate of return to sports in contact sports is because most of these athletes prefer not to return to sports due to fear of a re-rupture in ACL if they are not a professional athlete. Based on the findings, no significant difference was observed between patients with and without meniscus rupture in terms of returning to sports. However, in the primary surgery group, the majority of patients with meniscus rupture were able to return to the same level before the injury (60%) although this rate was 21.4% in the revision group so that 10 and 50% of patients in the primary surgery and revision groups returned to sports, respectively, which was lower than the pre-injury level. Likewise, 57.2% of patients with chondral lesions returned to sports in the primary surgery group, of whom half of the cases were at the pre-injury level (28.6%) and half of them were lower than the pre-injury level (28.6%). The rate of return to sports was 50% in patients with a chondral lesion in the revision group, in which the majority (44.4%) of patients were lesser than the pre-injury level and only 5.6% returned to the pre-injury level. The most important advantage of our study is the matching of patients in terms of age, gender, the involved leg, mechanism of injury, sports group, time of surgery, and the degree of cartilage injury and meniscus rupture. However, the lack of evaluating patients in terms of postoperative physiotherapy and relatively small groups may be the most important limitations of this study.

5. Conclusion

In our study, the rate of return to sports in the revision surgery was lower by 14.5% compared to primary ACL reconstruction surgery, and the average time of return to sports was more by six

weeks. All knee performance scores were also poorer in the revision surgery group. The rate of return to sports at the same level before the injury was significantly lower in the women of revision group, subjects aged below 25 years, those performing contact sports, and patients with the chondral lesion.

Declaration of competing interest

"All named authors hereby declare that they have no conflicts of interest to disclose".

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