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Reconstruction of Anterior Cruciate Ligament Over 50 Years Old? Yes, or No

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Abstract

Background: The aim of the study is to compare the results of anterior cruciate ligament reconstruction (ACL-R) in people aged more than 50 and under 30 years of age.

Methods: A total of 64 patients with ACL rupture were evaluated for eligibility. Thirty-two patients with ACL rupture, aged more than 50 years (54.38 $\pm$ 1.26) were matched in all of the background factors, with 32 patients suffering from ACL rupture under 30 years old. They were followed for clinical and functional results at six and on average 45.58 months after surgery. These evaluations included the Lachman test, KT-1000, International Knee Documentation Committee (IKDC) score, Lysholm knee score (LKS), return to exercise activity, post-operative satisfaction rate, and pain intensity based on Visual Analogue Scale (VAS) and rates of extension and flexion loss.

Results: Our findings indicated that knee stability, return to exercise activity, LKS and IKDC scores, as well as pain intensity and satisfaction were significantly improved in both groups. Indeed, the satisfaction rate of patients over 50 years at six months after surgery was less than those under 30 years ($P < 0.001$); however, it was approximately similar to the group under 30 years of age in the final follow-up ($P > 0.05$). The rate of return to sports activity was also lower in patients over 50 years.

Conclusions: The comparable results at the patients with < 30 years demonstrated that arthroscopic ACL-R in patients over 50 years of age with no or mild DJD has good results.

Keywords: ACL Reconstruction, Arthroscopy, 50 Years Old

1. Background

Rupture of anterior cruciate ligament (ACL) is one of the most common knee injuries during exercise activities that can lead to instability and weakness of the knee (1). According to the previous reports, the prevalence of ACL rupture has increased by 2.3% over the past two years, with an annual incidence of 68.6 per 100,000 people (2). The return rate of patients with ACL rupture to pre-injury conditions after arthroscopic surgery varies among studies (2). Most studies have been conducted with young people, but patients aged 40 years and older who have ACL lesions are increasing dramatically (3). Previously, arthroscopic ACL-R was performed mostly for young and active patients. Nowadays, it seems that middle-aged people with ACL rupture can also experience improvement in performance and stability after reconstruction and return to daily activities and even sports due to increasing awareness about joint damage, improved surgical techniques, and the availability of precise and developed instruments in anesthesia and rehabilitation (1). On the other hand, certain studies have shown that ACL-R is associated with higher prevalence of arthrofibrosis in older patients and provides weaker results compared to younger patients with knee cartilage injuries (4).

2. Objectives

Based on this difference in the treatment of ACL rupture in middle-aged people and over that, this study aimed to investigate the results of ACL-R in people over 50 and under 30 years old.

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3. Methods

3.1. Study Design

This study was approved by the University's Ethics Committee. All patients signed the provided consent form, and their personal information was kept confidential. In this longitudinally retrospective cohort study, patients who had been admitted for ACL rupture in an orthopedic academic center from 2012 to 2016 were enrolled. First, the medical files of patients with ACL rupture were evaluated. Since most of the patients were male and for the highest similarity between the two groups, only men entered the study. Among 41 male patients aged more than 50 years, 34 patients with degenerative joint diseases (DJD) score of 0 and 1 according to the Kellgren Lawrence classification and with sufficient information were included. But in the end, 32 patients were studied in this research (2 failures due to loss of follow-up). Subsequently, by evaluation of medical files of 760 patients with an age lower than 30 years during the past 5 years, 32 patients who had surgery in the same week as the first group were selected. Background variables such as chondral lesions, the presence of meniscus rupture and its side as well as the side of the injury, the duration of the follow-up, and the time interval between injury and surgery were matched between two groups. The locations of the cartilage lesions were medial and lateral femur, patella, and tibial plateau. In addition, five grades (0 - 4) were categorized as normal, near normal, abnormal (lesions extending down to < 50%), medium abnormal (cartilage defects > 50%), and severely abnormal based on the International Cartilage Repair Society (ICRS) grading system.

3.2. Surgical Technique

All patients in both groups underwent arthroscopic surgery by the orthopedic specialist (the first author) after general anesthesia. In all patients, any intra-articular injuries, including chondral lesions and meniscus ruptures were corrected by arthroscopic methods with the help of anterolateral and anteromedial portals. Also, the four-layer hamstring tendon autograft was applied for all patients. The standard protocol with the quadrant method suggested by Bernard and Herte (5) was used to determine the position of the femoral tunnel. Then, with the help of the anteromedial portal (AMP) technique, while the knee was flexed between 120 and 135 degrees, the femoral tunnel portal was positioned between 9 to 10 clocks for right knee and 2 to 3 clocks for the left knee. Then, the femoral tunnel was reamed with a 4 mm drill and again was drilled to fit the size, thickness, and diameter of the graft. Then, the knee was flexed to 110 degrees, and the size and diameter of the tibial tunnel graft were set by inserting the tibial jig through an anteromedial portal on the tibial portal with a guide pin and reamer. Finally, an endobutton fixation (Orthomed) on the femoral side and a bioabsorbable interference screw on the tibial side were used to fix the autograft tendon.

3.3. Follow-up

To determine the rate of improvement after surgery, a Visual Analogue Scale (VAS) was used to evaluate pain intensity and satisfaction (0 - 10). The Lachman test and KT-1000 measurement tool were utilized to assess knee stability. In addition, the return rate to sports activities and the knee function were measured using International Knee Documentation Committee (IKDC) score and Lysholm knee score (LKS), respectively. Moreover, the presence or absence of extension and flexion losses were evaluated. The abovementioned variables were evaluated again after 6 months' post-operation and at the final follow up with the average follow up duration of 45.58 months (range 24 - 61).

3.4. Post-operative Treatment

After surgery, all patients followed the same post-operative rehabilitation protocol. Partial weight bearing with crutches and no knee brace was allowed for the first 3 weeks. Range of motion from 0 to 90 of flexion and muscle strength enhancement was recommended for the first 6 weeks protocol. More active muscle strengthening and return to full daily activities were advised in 6th to 12th post-operative weeks. In addition, return to previous sports activities was allowed after 6 months, and a standard physiotherapy rehabilitation was arranged for all patients during the first six post-operative weeks.

3.5. Statistical Analysis

Collected data were analyzed using SPSS version 21. The relationship between the variables was evaluated using chi-square and Fisher's exact test. Independent *t*-test for comparing two groups and one-way ANOVA test for comparison between more than two groups were used. The difference was significant when the P-value was lesser than 0.05.

4. Results

The mean age of patients in group 1 (more than 50 years old) and group 2 (under 30) was 53.38 $\pm$ 1.26 years and 25.41 $\pm$ 1.12 years, respectively. The mean time interval between injury and surgery was 2.2 $\pm$ 1.45 and 2.3 $\pm$ 1.39 month in groups 1 and 2, respectively. In addition, the background variables and preoperative criteria were matched between two groups (Table 1).

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Table 1. Matching Factors [a]

Underlying Factors	> 50 years	< 30 years	Total
Age, mean ± SD	54.38 ± 1.26	25.41 ± 1.12	-
Affected site			
Left	14 (43.75)	14 (43.75)	28 (43.75)
Right	18 (56.25)	18 (56.25)	36 (56.25)
The level of chondral lesion			
Grade 0	23 (71.87)	23 (71.87)	46 (71.87)
Grade 1			
Patellae	1 (3.12)	1 (3.12)	2 (3.12)
Grade 2			
Medial Femur	2 (6.25)	2 (6.25)	4 (6.25)
Patellae	1 (3.12)	1 (3.12)	2 (3.12)
Grade 3			
Lateral femur	3 (9.37)	3 (9.37)	6 (9.37)
Medial Femur	1 (3.12)	1 (3.12)	2 (3.12)
Tibia Plateau	1 (3.12)	1 (3.12)	2 (3.12)
Grade 4	0 (0)	0 (0)	0 (0)
Meniscus tear			
Lateral	7 (21.87)	7 (21.87)	14 (21.87)
Medial	10 (31.25)	10 (31.25)	20 (31.25)
both	4 (12.5)	4 (12.5)	8 (12.5)
Intact meniscus	11 (34.37)	11 (34.37)	22 (34.37)

[a] Values are expressed as No. (%) unless otherwise indicated.

According to Table 2 and using repeated measurement, it was found that both groups achieved a significant improvement in LKS and IKDC scores as knee functional indices at six-month post-operation and in the final follow up (P = 0.0001). In terms of objective criteria for knee laxity that were evaluated by Lachman test and KT-1000 measurement, acceptable results were found in both groups (P = 0.0001). However, the difference in the mean KT-1000 measurement, IKDC score, LKS and Lachman test before surgery, 6 months post-operation, and in the final follow up did not show any significant statistical differences.

In addition, in assessing the exercise level before ACL rupture, it was found that in patients under the age of 30 years, 23 patients had regular activities (regular sports activity: exercising three times a week or more often for at least 20 min.) (6), 6 individuals had irregular activity, and 3 persons were inactive. In the > 50 years age group, 14, patients had regular activities, 10 individuals had irregular activity and 8 cases were inactive before the ACL tear, respectively. In the final follow up, 20 out of 23 patients with the regular activities in groups of patients under 30 years old continued to exercise at the same level. However, in patients over the age of 50 years, 8 out of 14 patients had a regular level of exercise at the same level. Other patients continued to perform sports at an irregular level or had become inactivate (Table 3). The mean time to return to sports was 43 ± 4.2 and 31 ± 2.3 weeks in the > 50 years and under the 30 years age groups, respectively.

It was found that the mean VAS score and pain severity at 6 months' post-operation and in the final follow up were decreased in both groups (P = 0.0001), but the comparison between the two groups showed that there were no significant differences in severity of pain based on VAS score. In addition, the comparison of the individuals' satisfaction based on the VAS score showed that patients over the age of 50 years had lower satisfaction compared with those under 30 years of age at 6 months after reconstruction of ACL rupture (P = 0.001). In the final follow up, no significant difference was detected in satisfaction rate (VAS score) between the two groups.

No significant difference was detected in knee range of motion between the two groups at 6 months after ACL-R and final follow up (degree of extension lack (Mean ± standard deviation): 0.31 ± 0.5 and 0.16 ± 0.28 in the group of over 50 and under 30 years of age, respectively). Furthermore, there was no significant difference in the mean change of knee range of motion (ROM) (extension lack). 0.16-degree reduction of extension in the group with age less than 30 years old and 0.5 degrees' lack of extension in the group older than 50 years were seen at 6 months after surgery which decreased to zero in both groups at the final follow up. In addition, in both groups, 6 months after the surgery, as well as in the final follow up, no cases were found with a loss of the range of motion in the degree of flexion. Also, acute infection was found in only three patients (two patients in the over 50 years old group and one patient in the under 30 years old group) who received appropriate treatment and achieved complete recovery. None of the patients had a chronic infection.

5. Discussion

The present study was designed to evaluate and compare the outcomes of patients with ACL rupture in two groups of under 30 years and over 50 years old who had undergone ACL-R by orthopedic surgery. Although ACL-R is rarely performed in old-aged people, the results of this study demonstrated that old-aged people may also experience an improvement after an ACL rupture.

In this study, knee stability based on KT-1000 test was not significantly different between the two groups at different times during follow-up. A study by Brandsson and

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Table 2. Objective and Subjective Analysis

Time	Group	KT1000 (mm)	P	Lachman (No.) (0, +1, +2, +3)	P	Intensity of Pain* (VAS)	P	Satisfaction* (VAS)	P	IKDC (%)	P	LKS (%)	P
Before	< 30	1.1 ± .5.5	0.33	(0,0,6,26)	0.77	2.35 ± 1.38	0.85	2.73 ± 1.57	0.68	56.8 ± 2.58	0.55	57.46 ± 1.55	0.42
	> 50	1.9 ± 6.03		(0,0,4,28)		2.78 ± 1.47		2.9 ± 1.59		54.83 ± 1.15		55.7 ± 1.7	
Six months after surgery	< 30	0.64 ± 2.9	0.09	(27,3,2,0)	0.55	1.1 ± 1.21	0.24	8.06 ± 1.45	0.001	81.93 ± 5.82	0.06	84.13 ± 6.5	0.51
	> 50	0.9 ± 3.01		(25,5,2,0)		1.34 ± 1.38		5.75 ± 1.54		79.25 ± 5.63		82.46 ± 5.09	
Last follow up	< 30	1.1 ± 2.02	0.18	(29,3,0 ,0)	0.17	0.53 ± 0.78	0.07	9.33 ± 0.75	0.1	94.62 ± 3.9	0.15	92.26 ± 3.5	0.15
	> 50	1.15 ± 2.21		(27,5,0,0)		0.71 ± 0.75		8.86 ± 0.73		92.96 ± 5.1		88.8 ± 3.6	

Table 3. The Rate of Return to Sport [a]

Category	Under 30		Over 50		P
	Before	After	Before	After	
Sport activity level					0.286
Regular sports activities	23 (71.87)	20 (62.5)	14 (43.75)	8 (25)	
Irregular sports activities	6 (18.75)	8 (25)	10 (31.25)	13 (40.62)	
Sports inactivity	3 (9.37)	4 (12.5)	8 (25)	11 (34.37)	
Type of sports group					
Soccer	18 (62.06)	14 (58.33)			
Basketball, volleyball, handball	5 (17.24)	4 (16.66)			
Martial arts	3 (10.34)	2 (8.33)			
Wrestling	2 (6.89)	3 (12.5)			
Other	1 (3.44)	1 (4.16)			

[a] Values are expressed as No. (%) unless otherwise indicated.

colleagues found similar results in terms of knee stability. In a comparison of two of 20 - 24 and > 40 years old groups, they found the mean laxity of 2 mm (7). Moreover, Conteduca et al. (3) reported ACL-R level based on the KT-1000 test in three groups > 40 years, 30 - 40 years and < 30 years as 1.8, 2.7, and 2.6 mm, respectively without no between group significant difference. Therefore, they stated that ACL-R is an appropriate option for patients of all age groups, even in patients over 40 years of age (3). In another study on the assessment of knee stability in the ACL-R, Osti et al. found that knee stability was significantly improved in people older than 50 years of age (5).

Also, the Lachman test, which is another indicator for assessing knee stability in our study, showed that knee stability was improved in both groups and there was no significant difference between the two groups. However, this improvement has been more effective in people under 30 years of age. Evaluation of knee function by LKS and IKDC scores showed that the knee function improved significantly after six months and in the final follow up in both groups. Our results about knee function based on LKS and IKDC scores after surgery are consistent with the results of Cinque et al. They found an obvious improvement in the knee function based on LKS and IKDC score after ACL-R in both younger (20 - 30 years) and older (50 - 75 years) patients (8). Also, in a study by Khan on the ACL-R in patients over 40 years, the mean LKS and IKDC scores were 83 and 92, respectively (9). While in this study, the mean of these scores in patients over 50 years was 88.88 and 92.96 respectively in the final follow-up; which indicates the effective outcomes similar to the previous studies. These similar results can be due to the application of the same and correct arthroscopic technique. Also, in the study of Toanen et al. on the ACL-R in patients over 60 years old, LKS and IKDC scores showed a remarkable improvement in these individuals and 83% of patients with ACL damage had returned to their daily and exercise activities six months after surgery (1).

Return to sports activities was another variable which was studied. Based on our results, a lower percentage of pa-

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tients over 50 years old (25%) compared with the group under 30 years old (62.5%) returned to normal regular sports activities in the final follow up. It seems that patients older than 50 years cannot return to their initial level of sport as a result of aging or even psychological reasons such as fear of returning to sports activities and injury (10). Also, patients over 50 years of age at six months after arthroscopic surgery had lower satisfaction based on VAS score compared to younger patients with ACL rupture. Satisfaction level seems to depend on their level of activity and their performance and older patients have muscle atrophy and lower activity levels. However, our results showed that four years after surgery and in the final follow up, the satisfaction level in patients over 50 years was as favorable as that of young people.

In this study, the patients' pain before surgery, six months after surgery and in the final follow up was evaluated using the VAS score. Our findings showed an improvement in pain intensity in the final follow up in both groups. These results are comparable with the study of Wierer et al. who showed that the pain levels in the two groups of 18 - 40 year and 40 - 60 years old did not significantly differ and the pain was decreased based on the VAS score in both groups (11).

Extension and flexion of knee joints were also studied in this study. No cases of flexion reduction were found in both groups. On the other hand, 0.16 degree extension in the group with age less than 30 years old and 0.5 degrees' extension in the group older than 50 years were seen at 6 months after surgery which decreased to zero in both groups at the final follow up. Our results are consistent with those reported by Dahm and coworkers. They evaluated the ACL-R in patients older than 50 years of age. They found an increase in the flexion rate from 129 to 135 degrees and a decrease in the extension rate from 1 degree to zero in the final follow up at 72 months, which is similar to our results (12).

The overall results of the present study indicate that ACL-R in both young patients (< 30 years) and old-aged patients (> 50 years) provided satisfactory outcomes. According to the present study, people over 50 years of age do not have contraindications for ACL-R, and in case of ACL injury, they can undergo arthroscopic ACL surgery similar to young people. Also, our patients significantly regained their activity with the help of physiotherapy. The physiological age, life expectancy and knee related activities are probably more important than the individuals' age. Based on this study, age alone cannot be considered as a preventive factor to perform ACL-R with arthroscopic methods, and other factors such as DJD, functional level of patient's knee etc. can play a remarkable role.

5.1. Conclusions

The comparable results at the patients with < 30 years demonstrated that arthroscopic ACL-R in patients over 50 years of age with no or mild DJD has good results. However, studies with longer follow-ups are still needed to confirm this conclusion.

Footnotes

Authors' Contribution: M.MK and Z.HL participated in study design, and M.MK performed all the surgeries. E. KL and M.MK and Z. A and A.S Participated in data collection and evaluation, drafting and statistical analysis, and Z.A and Z.HL and E.KL contributed extensively in interpretation of the data and the conclusion. All authors performed editing and approving the final version of this paper for submission, also participated in the finalization of the manuscript and approved the final draft.

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Informed Consent: Informed consent was obtained from all individual participants included in the study.

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