

Effect of Leg Dominance on Medium- to Long-Term Functional Outcomes, Quality of Life, and Revision Rates After Isolated ACL Reconstruction

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Background: The effect of leg dominance on short-term functional outcomes and return to sports after arthroscopic anterior cruciate ligament reconstruction (ACLR) has been evaluated. However, postoperative medium- to long-term recovery and revision rates are not well known.

Purpose: To investigate whether leg dominance affects medium- to long-term clinical and functional scores and revision rates after ACLR.

Study Design: Cohort study; Level of evidence, 3.

Methods: Included in this study were 235 patients (205 male and 30 female) who underwent isolated arthroscopic ACLR. Patients were divided according to the leg dominance status of their injured limb into 2 groups: dominant leg injured (120 patients) and nondominant leg injured (115 patients). Preoperative and postoperative functional outcomes and health-related quality of life (HRQoL) were evaluated using the visual analog scale for pain, Tegner activity scale, Lysholm knee score, International Knee Documentation Committee (IKDC) subjective knee evaluation form, 36-Item Short Form Health Survey (SF-36), and overall patient satisfaction. Moreover, the revision rates of the 2 groups were compared according to leg dominance, patient characteristics, and operative features.

Results: The mean follow-up period was 8.0 ± 2.3 years (range, 5-13 years). A significant preoperative to postoperative improvement in range of motion and functional scores was noticed in both groups ($P < .001$ for all). However, the improvement was significantly higher in the dominant leg group for the Tegner ($P = .001$), Lysholm ($P = .006$), and IKDC ($P < .001$) scores as well as for the SF-36 domain scores for general health ($P = .009$), social role ($P = .048$), and emotional role ($P = .032$). Also, patient satisfaction was significantly higher in the dominant leg group ($P = .007$). The dominant leg group was associated with a lower revision rate compared with the nondominant leg group (5.8% vs 15.7%, respectively; $P = .015$).

Conclusion: High recovery rates were seen after arthroscopic ACLR, regardless of leg dominance. However, leg dominance had a significant effect on postoperative medium- to long-term functional outcomes, HRQoL, and revision rates.

Keywords: anterior cruciate ligament; reconstruction; revision; dominance; outcome; quality of life

An anterior cruciate ligament (ACL) rupture is a common sports-related knee injury and is often managed using surgical reconstruction in active patients.¹⁷ Numerous factors have been reported to affect the outcomes of arthroscopic ACL reconstruction (ACLR).^{16,17,19,27} Leg dominance is described in the literature as the leg used to manipulate an object or to lead in movement, the standing leg in unilateral stabilizing tasks, or the leg used to kick a ball while standing in bilateral mobilizing tasks.^{11,24} Leg dominance has been reported to be associated with ACL injuries.^{3,13,18} Ruedl et al¹⁸ revealed that leg dominance was a risk factor

for noncontact ACL injuries in female recreational skiers. However, Brophy et al³ found that female patients were more likely to injure the ACL in their supporting leg (nondominant leg), whereas male patients tended to injure their kicking leg (dominant leg) while playing soccer. In various studies, return to sports,^{1,4} graft failure,^{7,17} functional scores,^{6,28} and revision rates^{17,19} have been among the outcomes evaluated after arthroscopic ACLR.

The rate of revision ACLR has been reported to be 34% after primary reconstruction.⁸ Recently, the effect of leg dominance on short-term functional outcomes and return to sports after ACLR has been evaluated, and leg dominance has been reported not to have a significant effect on functional outcomes and return to sports. Additionally, the results have revealed a comparable rate of limb

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strength recovery.^{2,20} However, the effect on medium- to long-term recovery and revision rates is not well known.

This study aimed to investigate whether leg dominance affects medium- to long-term functional outcomes and health-related quality of life (HRQoL) as well as revision and return-to-sports rates after arthroscopic ACLR. The hypothesis was that the dominant limb, having better muscle tone and power, would have a lower revision rate, higher functional and HRQoL scores, and a better return-to-sports rate compared with the nondominant limb at medium- to long-term follow-up.

METHODS

Patients

A total of 618 patients who had an ACL rupture and failed nonoperative management underwent arthroscopic ACLR between 2007 and 2015 in a clinic by the same surgeon. The inclusion criteria were an ACL tear due to trauma or a sports injury, ACLR using an ipsilateral hamstring tendon autograft, single-bundle ACLR, age ≥ 18 years, and a minimum follow-up of 5 years. Patients were excluded if they had a history of knee surgery (18 patients), underwent concomitant meniscal repair or meniscectomy (238 patients), had multiligamentous injuries (27 patients), underwent ACLR using a graft other than a hamstring tendon autograft (21 patients), had additional cartilage defects of grade ≥ 2 according to the Outerbridge classification¹⁴ (17 patients), had a lower limb coronal- or sagittal-plane deformity or patellofemoral joint instability (15 patients), and had a rheumatologic disease or diabetes (11 patients), considering the possible effects on functional and clinical outcomes, quality of life, and revision rates. Patients who did not adhere to the rehabilitation program (16 patients) or did not undergo ≥ 5 -year follow-up assessments (20 patients) were also excluded from the study. Ultimately, 235 patients were included in the study. This study was approved by an institutional review board, and informed consent was obtained from all participants.

Patients were divided into 2 groups: group 1 included 120 patients (103 male, 17 female) with a dominant leg injury, and group 2 included 115 patients (102 male, 13 female) with a nondominant leg injury. The study flowchart and patient exclusion details are summarized in Figure 1.

Surgical Technique

All procedures were performed under regional anesthesia by an experienced orthopaedic surgeon (A.G.) specializing

in arthroscopic surgery. Routine anterolateral and anteromedial portals were used. All knee compartments, meniscal tears, and other intra-articular abnormalities were examined. Single-bundle ACLR with semitendinosus and gracilis tendons was performed using a 4-strand technique. A standard guide (Smith & Nephew) was used in the measurement of the graft diameter (the smallest calibrated size through which the graft could pass).¹² An endobutton (Endobutton CL Ultra; Smith & Nephew) was used for femoral fixation. Tibial fixation was achieved using an appropriately sized bioabsorbable screw (Biosure HA; Smith & Nephew) and a staple (Smith & Nephew) when the knee was in full extension.

Postoperative Rehabilitation

Isometric quadriceps, patellar mobilization, and hamstring exercises were commenced on postoperative day 1. Moreover, range of motion (ROM) exercises were started on postoperative day 1 using a continuous passive motion device for 10 minutes per session, 4 to 6 times a day. The goal in the first postoperative week was to obtain a ROM of 0° to 90°. Partial load bearing was permitted with crutches and a hinged knee brace at 0° if pain and swelling were controlled and a voluntary quadriceps contraction was demonstrated. Closed chain exercises, muscle conditioning, and balance training were started at postoperative week 2. At postoperative week 3, quadriceps exercises with weights were initiated. Full weightbearing was allowed if the ROM was 0° to 100° and muscle control throughout ROM was achieved. The resumption of sports activities was permitted at the end of 6 months if full ROM was achieved on the operated side, knee effusion was absent, full balance and coordination were obtained, and muscle strength reached 80% compared with the healthy side.²⁶

Assessments

Leg dominance was preoperatively determined based on a questionnaire on the use of the preferred limb to execute an action as previously reported (eg, the leg used to kick a ball and the preferred leg for standing on 1 leg).²⁴ Clinical knee laxity was examined in all patients using anterior drawer, pivot-shift, and Lachman tests. Positive findings on ≥ 1 of these tests indicated clinical knee laxity. Patient characteristics and activity levels (recreational, competitive, and elite) were recorded from patient files. Type of injury, smoking habit, cartilage degeneration, time from injury to surgery, graft diameter, time to failure, and revision rates were evaluated according to leg dominance. The visual analog scale (VAS; 0 = no pain, 10 = worst pain) for pain,

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Ethical approval for this study was obtained from Erciyes University.

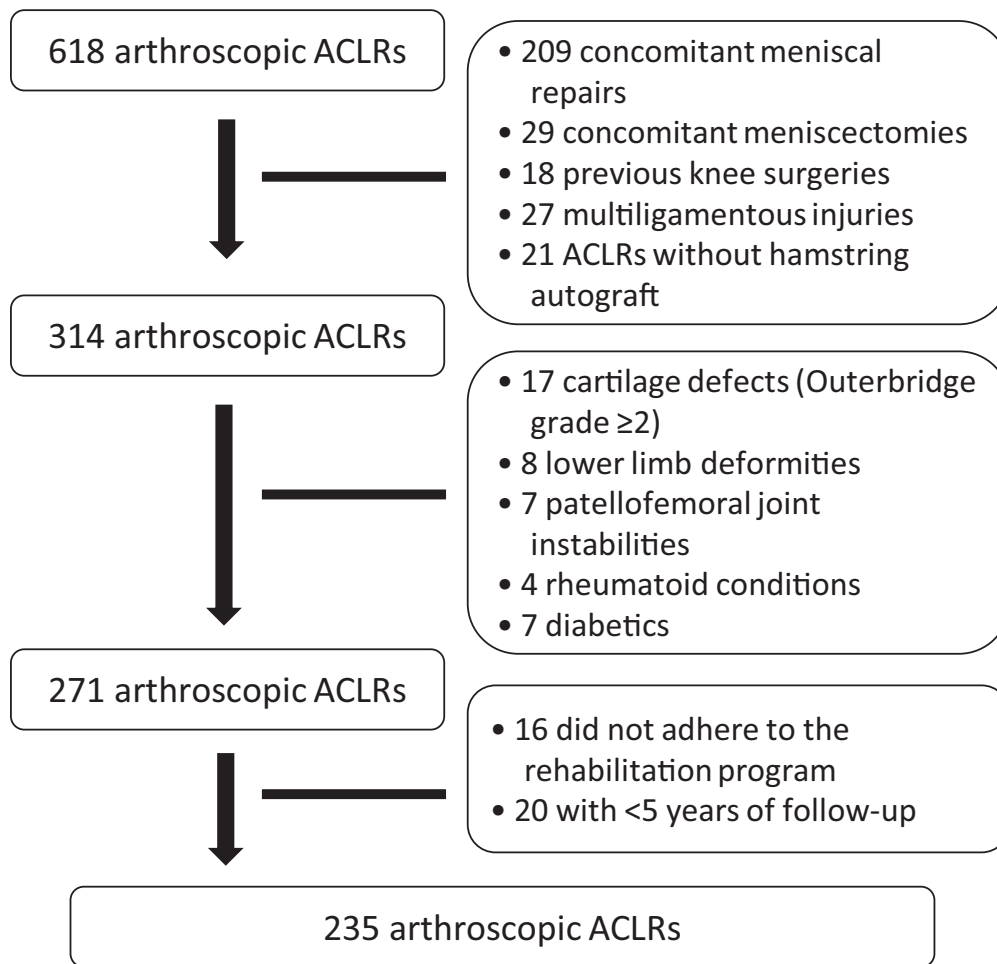


Figure 1. Study flowchart and patient exclusion details. ACLR, anterior cruciate ligament reconstruction.

Lysholm knee score,²³ Tegner activity scale,²² International Knee Documentation Committee (IKDC) subjective knee evaluation form,⁹ 36-Item Short Form Health Survey (SF-36),²⁵ patient satisfaction (0 = not satisfied, 10 = fully satisfied), and ROM were used in the evaluation of clinical and functional outcomes. Comprehensive clinical and functional evaluations were performed preoperatively and at the last follow-up. Outcome measures at the follow-up visits were used to consider clinical failures. A radiologic evaluation was performed using magnetic resonance imaging if ≥ 1 of the test findings (persistent knee laxity with anterior drawer, pivot-shift, and Lachman tests) were positive. Patients with clinical findings and radiologically evaluated ACL ruptures on magnetic resonance imaging scans were considered to have failures, and ACLR was recommended. The time to failure after surgery was noted. Anteroposterior laxity of the knee joint was documented using a KT-2000 arthrometer (MEDmetric). All patients with failure underwent arthroscopic revision ACLR using a bone–patellar tendon–bone graft. Patient characteristics and operative features were also evaluated in terms of the revision status. Return to sports was recorded.

Statistical Analysis

Descriptive data were presented as mean \pm SD or median (interquartile range) according to the distribution of the data or the frequency. Distribution variables were assessed using the Shapiro-Wilk test. The Mann-Whitney *U* test or Kruskal-Wallis test was used for intergroup comparisons of continuous variables depending on the number of groups compared. The Wilcoxon signed rank test was used for intragroup comparisons. The chi-square test or Fisher exact test was used for comparing categorical data. Statistical significance was set at a *P* value $< .05$. SPSS Statistics Version 22.0 (IBM Corp) was used in statistical analyses.

RESULTS

The mean follow-up period was 8.0 ± 2.3 years (range, 5–13 years). Of the 235 patients, 120 (51.1%) and 115 (48.9%) had injuries on the dominant and nondominant legs, respectively. Compared with the nondominant leg group, the dominant leg group had significantly more injuries to the right leg ($P = .001$), more contact injuries

TABLE 1
Patient and Operative Characteristics According to Study Group^a

	All (N = 235)	Dominant Leg Group (n = 120)	Nondominant Leg Group (n = 115)	P Value
Age, mean ± SD, y	27.5 ± 7.1	27.1 ± 7.1	27.8 ± 7.1	.442
Body mass index, mean ± SD	25.9 ± 2.9	26.1 ± 3.1	25.7 ± 2.6	.311
Sex				.323
Female	30 (12.8)	17 (14.2)	13 (11.3)	
Male	205 (87.2)	103 (85.8)	102 (88.7)	
Affected side				.001
Right	134 (57.0)	81 (67.5)	53 (46.1)	
Left	101 (43.0)	39 (32.5)	62 (53.9)	
Type of injury				.002
Contact	75 (31.9)	49 (40.8)	26 (22.6)	
Noncontact	160 (68.1)	71 (59.2)	89 (77.4)	
Smoking habit				.282
Nonsmoker	169 (71.9)	90 (75.0)	79 (68.7)	
Smoker	66 (28.1)	30 (25.0)	36 (31.3)	
Grade 1 cartilage degeneration				.621
No	195 (83.0)	101 (84.2)	94 (81.7)	
Yes	40 (17.0)	19 (15.8)	21 (18.3)	
Time from injury to surgery				.286
≤3 mo	163 (69.4)	87 (72.5)	76 (66.1)	
>3 mo	72 (30.6)	33 (27.5)	39 (33.9)	
Activity level				.003
Recreational	137 (58.3)	59 (49.2)	78 (67.8)	
Competitive	39 (16.6)	20 (16.7)	19 (16.5)	
Elite	59 (25.1)	41 (34.2)	18 (15.7)	
Sport at injury				.249
Soccer	150 (63.8)	70 (58.3)	80 (69.6)	
Volleyball	14 (6.0)	7 (5.8)	7 (6.1)	
Basketball	24 (10.2)	17 (14.2)	7 (6.1)	
Skiing	26 (11.1)	15 (12.5)	11 (9.6)	
Other ^b	21 (8.9)	11 (9.2)	10 (8.7)	
Operative time, mean ± SD, min	60.8 ± 7.1	60.4 ± 7.2	61.2 ± 7.0	.418
Graft diameter, mean ± SD, mm	8.3 ± 0.4	8.4 ± 0.5	8.2 ± 0.4	.013
Time to failure, mean ± SD, y	4.0 ± 2.8	3.2 ± 2.1	4.2 ± 3.0	.465
Revision ACLR	25 (10.6)	7 (5.8)	18 (15.7)	.015
Follow-up time, mean ± SD, y	8.0 ± 2.3	7.8 ± 2.1	8.1 ± 2.4	.236

^aData are presented as n (%) unless otherwise specified. Bolded *P* values indicate a statistically significant difference between groups (*P* < .05). ACLR, anterior cruciate ligament reconstruction.

^bHandball, gymnastics, tennis, running, and cycling.

(*P* = .002), more elite athletes (ie, professional sports participation; *P* = .003), and larger graft diameters (*P* = .013). Patient characteristics and operative features are shown in Table 1.

A significant preoperative to postoperative improvement in functional outcome scores was noticed in both groups (*P* < .001 for all). However, the improvement was significantly higher in the dominant leg group for the Tegner score (*P* = .001), Lysholm score (*P* = .006), IKDC score (*P* < .001), and patient satisfaction (*P* = .007). The overall rate of return to preinjury sports activity was not significantly different between the groups; however, it was higher in recreational athletes in both groups, and this difference was statistically significant in the dominant leg group (*P* = .033). In addition, the return-to-sports rate of recreational athletes was significantly higher in the dominant versus nondominant leg group (*P* = .039). Functional outcome scores are shown in Table 2.

Regarding HRQoL, the improvement in some SF-36 domains was significantly higher in the dominant compared with the nondominant leg group (general health: *P* = .009; social role: *P* = .048; and emotional role: *P* = .032) (Table 3).

Medium- and long-term results were evaluated separately, and patient satisfaction was found to be significantly higher in the dominant than the nondominant leg group for long-term results, while it was not statistically significant for medium-term results. However, Tegner and IKDC scores were significantly higher in the dominant leg group at both time intervals. A comparison of medium- (<10 years) and long-term (≥10 years) postoperative outcomes between groups is summarized in Table 4.

There were 7 (5.8%) patients who underwent arthroscopic revision ACLR in the dominant leg group, whereas arthroscopic revision ACLR was performed in 18 (15.7%) patients in the nondominant leg group (*P* = .015). Other

TABLE 2
Preoperative and Postoperative Outcome Scores^a

	All (N = 235)	Dominant Leg Group (n = 120)	Nondominant Leg Group (n = 115)	P Value
Patient satisfaction (0-10)	8.6 ± 2.4	9.1 ± 2.1	8.2 ± 2.6	.007
ROM, deg				
Preoperative	126.2 ± 5.1	126.2 ± 5.5	126.3 ± 4.5	.784
Postoperative	131.3 ± 3.3	131.5 ± 3.3	131.1 ± 3.4	.463
Difference	5.0 ± 6.0	5.2 ± 6.6	4.7 ± 5.3	.522
P value (difference)	<.001	<.001	<.001	
VAS pain score				
Preoperative	4.0 ± 1.9	3.8 ± 1.8	4.1 ± 1.9	.219
Postoperative	1.9 ± 2.2	1.7 ± 2.0	2.2 ± 2.4	.093
Difference	-2.0 ± 2.0	-2.1 ± 2.0	-1.9 ± 2.0	.488
P value (difference)	<.001	<.001	<.001	
Tegner score				
Preoperative	3.7 ± 1.3	3.7 ± 1.3	3.8 ± 1.3	.279
Postoperative	8.3 ± 2.1	8.8 ± 1.9	7.9 ± 2.3	.001
Difference	4.6 ± 2.5	5.1 ± 2.2	4.0 ± 2.7	.001
P value (difference)	<.001	<.001	<.001	
Lysholm score				
Preoperative	49.1 ± 8.7	48.6 ± 8.3	49.7 ± 9.0	.336
Postoperative	85.4 ± 17.0	88.1 ± 15.4	82.5 ± 18.0	.011
Difference	36.2 ± 18.9	39.5 ± 17.4	32.7 ± 19.9	.006
P value (difference)	<.001	<.001	<.001	
IKDC score, median (interquartile range)				
Preoperative	4 (2 to 4)	4 (2 to 4)	4 (2 to 4)	.126
Postoperative	1 (1 to 4)	1 (1 to 4)	1 (1 to 4)	<.001
Difference	-2 (-3 to 1)	-2 (-3 to 1)	-2 (-3 to 1)	<.001
P value (difference)	<.001	<.001	<.001	
Return to sports, n (%)				
Recreational	196 (83.4)	104 (86.7)	92 (80.0)	.085
Competitive	121 (61.7)	62 (59.6)	59 (64.1)	.039
Elite	31 (15.8)	16 (15.4)	15 (16.3)	.622
P value	44 (22.4)	26 (25.0)	18 (19.6)	.568
P value	.098	.033	.763	

^aData are presented as mean ± SD unless otherwise specified. Bolded P values indicate a statistically significant difference between groups (P < .05). IKDC, International Knee Documentation Committee; ROM, range of motion; VAS, visual analog scale.

patient characteristics and operative features were not found to be associated with the revision status (Table 5).

DISCUSSION

The most important findings of this study were that leg dominance had a significant effect on medium- to long-term functional outcomes, HRQoL, and revision rates after arthroscopic ACLR.

Leg dominance is described using different methods among different task types in the literature as the leg used to manipulate an object or to lead in movement, the standing leg in unilateral stabilizing tasks, or the leg used to kick a ball while standing in bilateral mobilizing tasks.^{11,24} However, an ideal method is still lacking. A recent study declared that “the leg used to kick a ball” had 100% agreement between the self-reported and observed dominant leg for both men and women.²⁵ In this study, a subjective evaluation method was used based on a questionnaire on the preferred limb to execute an action such as the “leg used to kick a ball and the preferred leg for standing on one leg.”²⁴ The method in this study was

highly effective in determining leg dominance, although any neurologic evaluation could not be performed on the patients.

Leg dominance is one of the numerous factors that seem to play a role in the cause of ACL injuries.²⁴ Ruedl et al¹⁸ reported that a risk factor for noncontact ACL injuries in female recreational skiers was leg dominance. However, Brophy et al³ observed that female patients were more likely to injure the ACL in their nondominant (supporting) leg, and male patients were more likely to injure their dominant (kicking) leg while playing soccer. In another study by Chomiak et al,⁵ no effect of limb dominance was found in noncontact knee injuries of male soccer players; however, contact knee injuries were significantly more common in the dominant leg. Negrete et al¹³ declared a strong trend toward female patients tearing their left ACLs more often than their right ACLs, with no significant relationship between lower limb dominance and noncontact ACL tears. In the patient cohort of this study, male sex, right-sided involvement, noncontact injuries, and recreational activity level were predominant. In addition, the patient cohort in this study consisted of male and recreational patients, which can be attributed to the prevalence

TABLE 3
Preoperative and Postoperative SF-36 Domain Scores^a

	Total (N = 235)	Dominant Leg Group (n = 120)	Nondominant Leg Group (n = 115)	P Value
Physical functioning				
Preoperative	35 (15 to 75)	40 (15 to 70)	35 (15 to 65)	.030
Postoperative	75 (20 to 100)	75 (20 to 100)	75 (35 to 100)	.029
Difference	35 (-25 to 80)	35 (-25 to 80)	35 (-20 to 75)	.532
P value (difference)	<.001	<.001	<.001	
Bodily pain				
Preoperative	77.5 (35 to 100)	87.5 (35 to 100)	77.5 (45 to 100)	.879
Postoperative	45 (10 to 90)	35 (10 to 90)	45 (10 to 87)	.084
Difference	-32.5 (-90 to 22.5)	-35.0 (-90 to 10)	-32.5 (-90 to 22.5)	.159
P value (difference)	<.001	<.001	<.001	
Physical role				
Preoperative	25 (0 to 75)	25 (0 to 75)	25 (0 to 75)	.517
Postoperative	75 (0 to 100)	75 (25 to 100)	75 (0 to 100)	.013
Difference	50 (-50 to 100)	50 (-50 to 100)	50 (-25 to 100)	.154
P value (difference)	<.001	<.001	<.001	
General health				
Preoperative	40 (25 to 75)	40 (25 to 75)	40 (25 to 75)	.775
Postoperative	60 (25 to 100)	60 (25 to 100)	60 (25 to 100)	.005
Difference	20 (-50 to 70)	30 (-50 to 70)	20 (-25 to 60)	.009
P value (difference)	<.001	<.001	<.001	
Vitality				
Preoperative	30 (15 to 60)	30 (15 to 60)	30 (15 to 60)	.021
Postoperative	75 (15 to 100)	77.5 (15 to 100)	75 (25 to 100)	.007
Difference	45 (-15 to 85)	45 (-15 to 85)	45 (-10 to 75)	.189
P value (difference)	<.001	<.001	<.001	
Social role				
Preoperative	75 (37.5 to 100)	75 (37.5 to 100)	75 (37.5 to 100)	.202
Postoperative	25 (0 to 100)	25 (0 to 100)	25 (0 to 100)	.144
Difference	-50 (-100 to 37.5)	-50 (-100 to 37.5)	-50 (-100 to 37.5)	.048
P value (difference)	<.001	<.001	<.001	
Emotional role				
Preoperative	0 (0 to 66.6)	0 (0 to 66.6)	0 (0 to 66.6)	.608
Postoperative	100 (0 to 100)	0 (0 to 100)	100 (0 to 100)	.026
Difference	66.6 (-66.6 to 100)	66.6 (-66.6 to 100)	66.6 (-66.6 to 100)	.032
P value (difference)	<.001	<.001	<.001	
Mental health				
Preoperative	44 (20 to 84)	42 (20 to 84)	44 (20 to 84)	.464
Postoperative	60 (12 to 96)	60 (12 to 96)	56 (12 to 96)	.776
Difference	8 (-60 to 68)	8 (-60 to 60)	8 (-60 to 68)	.615
P value (difference)	<.001	<.001	<.001	

^aData are presented as median (interquartile range). Bolded P values indicate a statistically significant difference between groups ($P < .05$). SF-36, 36-Item Short Form Health Survey.

of playing soccer among men in the region. In addition, in the present study, no difference in sports played during an injury in terms of side dominance was noticed. With the available data, side dominance did not seem to affect the likelihood of a sports injury. Right-side injuries were significantly more common in the dominant leg group, and noncontact injuries were more common in the nondominant leg group, unlike the findings of Chomiak et al. Right-side injuries were more common, but that was solely because of their frequency in the dominant leg group. Dominant and nondominant leg injuries were more common in elite and recreational athletes, respectively. The findings of this cohort suggest that the more competitive the sport and the higher the activity level, the higher the likelihood of the dominant side's being affected.

Recently, some authors were interested in finding out the effect of leg dominance on postoperative recovery after arthroscopic ACLR. Boo et al² demonstrated that leg dominance did not significantly improve knee objective (KT-1000 arthrometer, hop distance, or Biodex measurements) and functional outcome scores (Tegner, Lysholm, or IKDC) postoperatively for ACLR and that the absolute improvement in these scores was similar in both subgroups at both the 6-month and the 1-year postoperative time points. In addition, Boo et al declared that patients continued to improve from 6 to 12 months postoperatively. In line with these short-term results, a significant improvement in clinical scores was observed in both groups in the current study, regardless of leg dominance, at a mean 8.0 years' follow-up. The improvement in KT-

TABLE 4
Medium- (<10 y) and Long-Term (≥10 y)
Postoperative Outcomes^a

	Dominant Leg Group	Nondominant Leg Group	P Value
Patient satisfaction			
<10 y	9.3 ± 1.8	8.9 ± 2.0	.259
≥10 y	8.4 ± 2.6	7.0 ± 3.1	.044
ROM, deg			
<10 y	131.5 ± 3.3	130.9 ± 3.5	.228
≥10 y	131.2 ± 3.4	131.5 ± 3.3	.706
VAS pain score			
<10 y	1.4 ± 1.8	1.5 ± 1.9	.822
≥10 y	2.3 ± 2.3	3.2 ± 2.7	.141
Tegner score			
<10 y	9.0 ± 1.7	8.4 ± 1.8	.049
≥10 y	8.3 ± 2.2	7.0 ± 2.8	.040
Lysholm score			
<10 y	89.7 ± 13.6	87.1 ± 14.8	.256
≥10 y	83.6 ± 19.3	75.0 ± 20.3	.070
IKDC score, median (interquartile range)			
<10 y	1 (1-4)	2 (1-4)	.001
≥10 y	2 (1-4)	3 (1-4)	.028

^aData are presented as mean ± SD unless otherwise specified. Bolded P values indicate a statistically significant difference between groups (P < .05). IKDC, International Knee Documentation Committee; ROM, range of motion; VAS, visual analog scale.

2000 arthrometer measurements, ROM values, and VAS for pain scores was similar between groups. However, the improvement in Tegner, Lysholm, and IKDC scores as well as some of the SF-36 domain scores (general health, social role, and emotional role) was found to be significantly higher in the dominant leg group in the long term. In addition, patient satisfaction was significantly higher in the dominant leg group. Medium- and long-term results were evaluated separately, and the increase in patient satisfaction on the dominant side reached a significant difference for long-term results. However, it was not statistically significant in the medium term. Tegner and IKDC scores were significantly higher in the dominant leg group at both time intervals. The results of the current study suggest that leg dominance may be important in the long term in maximizing postoperative function and reducing the risk of reinjuries, possibly contributing to the restoration of normal neuromuscular patterns. Consistent with the literature, rates of return to preinjury sports activity (86.7% vs 80.0% in the dominant and nondominant leg groups, respectively) were similar between the 2 groups.^{1,2} The return-to-sports rate was higher in recreational athletes in both groups, especially in the dominant leg group. With these results, it is suggested that the rate of return to sports can be quite high in nonprofessional athletes with less need for competitive sports, especially in dominant-side injuries.

As a common primary outcome measure, revision rates have been reported up to 34% after primary arthroscopic

TABLE 5
Patient and Operative Characteristics According to
Revision Status^a

	No Revision (n = 210)	Revision (n = 25)	P Value
Age, mean ± SD, y	27.2 ± 7.2	29.4 ± 6.0	.148
Body mass index, mean ± SD	26.0 ± 2.8	24.9 ± 3.2	.064
Sex			.450
Female	28 (13.3)	2 (8.0)	
Male	182 (86.7)	23 (92.0)	
Leg dominance			.015
Dominant	113 (53.8)	7 (28.0)	
Nondominant	97 (46.2)	18 (72.0)	
Affected side			.592
Right	121 (57.6)	13 (52.0)	
Left	89 (42.4)	12 (48.0)	
Dominant side			.068
Right	132 (62.9)	11 (44.0)	
Left	78 (37.1)	14 (56.0)	
Type of injury			.657
Contact	68 (32.4)	7 (28.0)	
Noncontact	142 (67.6)	18 (72.0)	
Smoking habit			.645
Nonsmoker	152 (72.4)	17 (68.0)	
Smoker	58 (27.6)	8 (32.0)	
Grade 1 cartilage degeneration			.675
No	175 (83.3)	20 (80.0)	
Yes	35 (16.7)	5 (20.0)	
Time from injury to surgery			.762
≤3 mo	145 (69.0)	18 (72.0)	
>3 mo	65 (31.0)	7 (28.0)	
Activity level			.891
Recreational	123 (58.6)	14 (56.0)	
Competitive	34 (16.2)	5 (20.0)	
Elite	53 (25.2)	6 (24.0)	
Operative time, mean ± SD, min	60.9 ± 7.1	60.2 ± 7.5	.643
Graft diameter, mean ± SD, mm	8.2 ± 0.4	8.2 ± 0.3	.384

^aData are presented as n (%) unless otherwise specified. Bolded P values indicate a statistically significant difference between groups (P < .05).

ACLR.⁸ Although with no complete agreement, various patient factors such as age, sex, activity at the time of injury, and accompanying injuries have been associated with rerupture after arthroscopic ACLR.^{16,17,19,27} Recently, Rahardja et al¹⁷ reported a 2.4% revision rate at a nearly 2-year follow-up after primary arthroscopic ACLR in a multicenter study. Age <18 years, male sex, and a shorter time from injury to surgery (within 6 months) were found to increase the risk of revision. Similarly, Sutherland et al²¹ found that younger age, male sex, and a shorter time from injury to primary surgery were associated with the risk of revision surgery, with a 5-year ACL graft survival rate of 95.5%. In contrast, in a long-term study, Grassi et al⁷ could not identify any significant predictors for ipsilateral revision ACLR. In the present study, 25 of 235 patients (10.6%) underwent arthroscopic revision ACLR. The high revision rates can be attributed to the relatively long follow-up period. Leg dominance was found to be negatively associated with

revision (7 patients in the dominant leg group [5.8%] vs 18 patients in the nondominant leg group [15.7%]). However, age, sex, body mass index, affected side, type of injury, smoking habit, cartilage degeneration, tear chronicity, and activity level were not found to affect the revision status. Unlike the findings of Pinheiro et al,¹⁵ although we found a significantly larger graft diameter on the dominant leg side, there did not appear to be a clinically significant effect of graft diameter on the revision status. In this study, leg dominance appeared to be the only patient characteristic that had an effect on revision after arthroscopic ACLR. This may be attributed to the protective effect of improved knee kinematics and higher muscle output on the dominant side.¹⁰

The strength of this study is that it is the first to evaluate the effect of leg dominance on medium- to long-term functional outcome and HRQoL scores as well as revision rates after arthroscopic ACLR.

Several limitations should be acknowledged. First, it was a retrospective study. Second, the size of the study cohort and the number of revision cases were relatively small. More accurate results may be obtained via prospective controlled studies, which would include a larger number of patients. Third, the subgroups were not homogeneous in the patient population. For example, recreational athletes (58.3%) represented a significantly greater proportion of the cohort compared with other activity levels, and 87.2% of the patients were male, which is a potential limitation when applying the findings to female populations. An evaluation of the effect of leg dominance on outcomes after ACLR may provide more accurate results in more homogeneous patient groups. Fourth, any neurologic or proprioception evaluations that could be objective in assessing leg dominance were not performed; instead, a subjective questionnaire was used. Although an ideal method is still lacking, a recent study reported that the method used in this study was found to be quite effective in subjective evaluations, with 100% agreement between the self-reported and observed dominant leg for both men and women.²⁴

CONCLUSION

Arthroscopic ACLR, whether performed on the dominant side or not, resulted in high recovery and return-to-sports rates. However, leg dominance had a significant effect on postoperative medium- to long-term functional outcomes, HRQoL scores, and revision rates after ACLR.

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