Single-Leg Hop Test Performance and Isokinetic Knee Strength After Anterior Cruciate Ligament Reconstruction in Athletes

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Background: Isokinetic strength and hop tests are commonly used to assess athletes' readiness to return to sport after knee surgery.

Purpose/Hypothesis: The purpose of this study was to investigate the results of single-leg hop and isokinetic knee strength testing in athletes who underwent anterior cruciate ligament reconstruction (ACLR) upon returning to sport participation as well as to study the correlation between these 2 test batteries. The secondary purpose was to compare the test results by graft type (patellar tendon or hamstring). It was hypothesized that there would be no statistically significant limb difference in either isokinetic knee strength or single-leg hop tests, that there would be a moderate to strong correlation between the 2 test batteries, and that there would be no significant difference between graft types.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Twenty-nine high school and collegiate athletes who underwent ACLR participated in this study. At the time of return to full sport participation, a series of hop tests and knee extension/flexion isokinetic strength measurements were conducted. The results were analyzed using analysis of variance and Pearson correlation (*r*).

Results: The timed 6-m hop test was the only hop test that showed a significant difference between the involved and uninvolved limbs (2.3 and 2.2 seconds, respectively; $P = .02$). A significant difference between limbs in knee strength was found for flexion peak torque/body weight at 180 deg/s ($P = .03$), flexion total work/body weight at 180 deg/s ($P = .04$), and flexion peak torque/body weight at 300 deg/s ($P = .03$). The strongest correlation between the hop tests and knee strength was found between the total distance of the hop tests and flexion total work/body weight at 300 deg/s ($r = 0.69$) and between the timed 6-m hop test and flexion peak torque/body weight at 300 deg/s ($r = -0.54$). There was no statistically significant difference in hop test performance or isokinetic knee strength between graft types.

Conclusion: The single-leg hop tests and isokinetic strength measurements were both useful for a bilateral comparison of knee functional performance and strength. Knee flexion strength deficits and flexion-to-extension ratios seemed to be correlated with single-leg hop test performance. There was no difference in postoperative hop test performance or knee strength according to graft type.

Keywords: hop test; isokinetic strength; knee rehabilitation; knee arthroscopic surgery

Rehabilitation after knee surgery before returning to sport participation is intensive, especially after anterior cruciate ligament reconstruction (ACLR). Postoperative rehabilitation after ACLR has been an area of interest to many health care professionals. However, there is no established method to successfully assess an athlete's readiness to play.[1] Although there is no universal test battery to assess an athlete's readiness to return to sport, various methods to objectively measure the athlete's function have been used including isokinetic and isometric strength tests, single-leg hop tests, and multiple hop tests, among others.[3,4,6,27] There are multiple research studies that have investigated many single-leg hop tests with strong reliability and validity[4,6,9,14,20] and their correlation to knee strength.[2,8,28] Logerstedt et al[17] conducted a study on patients undergoing ACLR and suggested that single-leg hop tests conducted after 6 months postoperatively could predict the outcomes of patients' self-reported function a year after ACLR.

The limb symmetry index (LSI) is a commonly used concept to assess limb asymmetry/symmetry of strength and

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functional tests.[6] Several studies in the past have suggested that both limbs in healthy participants are relatively symmetrical in functional tests and strength, with an LSI of 90% to 95%.[5,10,22,26] Also, a past study reported that patients who underwent ACLR still had a lower LSI with single-leg hop tests than healthy control participants even 1.5 to 2 years after surgery.[2]

Even though isokinetic strength and single-leg hop tests seem to be common test batteries to assess an athlete's readiness and function before returning to sport participation, an isokinetic testing machine is not readily available to health care professionals primarily because of its cost. Also, the correlation between the 2 test batteries varies from one study to another and has not been well established.[7,8] Thus, we decided to investigate the isokinetic strength and hop test profiles of athletes at the time of their return to full sport participation and whether the single-leg hop test results correlate with isokinetic knee strength and to what degree and with which parameters they correlate. The primary purpose of our investigation was to (1) conduct a bilateral comparison of single-leg hop tests and isokinetic knee strength measurements at the time of return to full sport participation in athletes who underwent ACLR and (2) study the correlation between these 2 test batteries. The secondary purpose of this study was to investigate whether there would be a significant difference in hop test or isokinetic strength results between graft types (patellar tendon or hamstring). It was hypothesized that (1) there would be no significant limb difference in either the single-leg hop tests or isokinetic knee strength test, (2) there would be a statistically significant correlation between the hop tests and isokinetic knee strength, and (3) there would be no statistically significant difference between graft types.

METHODS

The study participants consisted of 29 high school and collegiate athletes (12 male and 17 female) who underwent ACLR at Emoto Knee and Sport Clinic. Ten of 29 participants underwent ACLR with a hamstring graft; the other 19 participants underwent ACLR with a patellar tendon graft. All patients had injured their knee during sport participation and had successfully returned to full sport activities after reconstructive surgery. All participants were operated on by 2 authors (G.E. and T.Y.). Those with a history of knee surgery on either limb and those who underwent bilateral procedures were excluded from this study. This study was approved by the Institutional Review Board of Emoto Knee and Sport Clinic, and all participants provided signed informed consent before the study's commencement (signed by a parent or legal guardian if the participant was a minor).

At the time of return to sport participation, the patients were assessed with a series of 4 single-leg hop tests as well as isokinetic knee extension and flexion strength testing using a NORM isokinetic machine (Cybex). The single-leg hop tests included the single hop for distance, triple hop for distance, timed 6-m hop, and crossover triple hop for distance over a single line with maximum effort.[17,23] The participants were required to stick their landing to be successful in all tests except for the timed 6-m hop. All hop tests were measured bilaterally. The LSI was calculated for all hop tests as well as the total distance of the 3 hop tests (LSI = injured leg/uninjured leg × 100). Isokinetic testing included strength measurements during knee extension and flexion, also measured bilaterally. The strength test was conducted at 180 and 300 deg/s with 5 repetitions at each speed with maximum effort. Peak torque, peak torque/body weight (PTBW), total work, total work/body weight (TWBW), and flexion-to-extension ratio for peak torque and for total work at each speed were recorded. The LSIs were also calculated. In addition, hop test and isokinetic strength outcomes were compared between patients who received a patellar tendon graft and those who received a hamstring graft.

Analysis of variance was used for all data analyses and Pearson *r* also calculated using SPSS software.

TABLE 1
Procedures Undertaken by Study Participants[a]

	No. of Participants
ACLR only	16
LMR or PLM	11
MMR + LMR	1
PMM + PLM	1

[a]ACLR, anterior cruciate ligament reconstruction; LMR, lateral meniscus repair; MMR, medial meniscus repair; PLM, partial lateral meniscectomy; PMM, partial medial meniscectomy.

RESULTS

The mean age of the 29 participants was 16.1 ± 1.3 years, with a mean height and weight of 166.0 ± 7.6 cm and 60.4 ± 11.2 kg, respectively. In addition to the primary ACLR procedure, 13 of 29 participants also had a concomitant meniscus injury and had it partially removed or repaired. The surgical procedures undertaken by the participants are listed in Table 1. The patients participated in the following sports: basketball (n = 20), soccer (n = 3), judo/karate (n = 2), rugby (n = 2), gymnastics (n = 1), and baseball (n = 1). The mean time from surgery to return to sport was 26.4 ± 6.0 weeks. There was no statistically significant correlation between return to sport and either the hop tests or isokinetic test.

The only hop test that showed a statistically significant limb difference was the 6-m hop. The mean lapsed time was 2.3 ± 0.2 seconds and 2.2 ± 0.2 seconds for the injured and uninjured leg, respectively ($P = .02$) (Table 2). A statistically significant between-limb difference in isokinetic knee strength was found during flexion for PTBW at 180 deg/s ($P = .03$), TWBW at 180 deg/s ($P = .04$), and PTBW at 300 deg/s ($P = .03$) (Table 3). The strongest positive correlation was found between the total distance of the 3 hop tests and TWBW during flexion at 300 deg/s ($r = 0.69$, $P < .05$). The strongest negative correlation was found between the 6-m hop and PTBW during flexion at

TABLE 2
Single-Leg Hop Test Results[a]

	Injured Leg		Uninjured Leg		
	Mean ± SD	95% CI	Mean ± SD	95% CI	LSI (%)
Single hop, cm	157.4 ± 17.0	151.6-163.2	164.1 ± 19.3	158.0-170.2	95.9 (6.8)
Triple hop, cm	444.6 ± 61.3	424.0-465.2	468.0 ± 67.0	445.4-490.6	95.0 (8.1)
Crossover hop, cm	400.0 ± 65.1	377.9-422.1	414.6 ± 66.0	393.5-435.7	96.4 (7.2)
Total distance, cm	1002.6 ± 131.7	958.5-1006.7	1031.0 ± 163.8	975.0-1087.0	97.2 (12.5)
6-m hop, s	2.3 ± 0.2[b]	2.24-2.36	2.2 ± 0.2[b]	2.15-2.25	106.2 (9.7)

[a]LSI, limb symmetry index (injured leg/uninjured leg × 100).
[b]Statistically significant difference between limbs ($P < .05$).

TABLE 3
Isokinetic Knee Strength Test Results[a]

	Injured Knee		Uninjured Knee		
	Mean ± SD	95% CI	Mean ± SD	95% CI	LSI (%)
At 180 deg/s					
Extension, N·m					
PT	99.1 ± 22.0	91.5-106.7	106.4 ± 35.1	94.4-118.4	93.1 (14.6)
PTBW	164.2 ± 19.1	158.0-170.4	174.5 ± 32.5	163.4-185.6	94.0 (14.8)
TW	125.6 ± 31.9	114.8-136.4	136.0 ± 42.1	121.4-150.6	92.3 (14.9)
TWBW	211.2 ± 37.5	198.5-223.9	229.8 ± 47.6	213.6-246.0	91.9 (15.1)
Flexion, N·m					
PT	54.6 ± 19.3	48.0-61.2	61.6 ± 17.1	55.8-67.4	88.6 (18.1)
PTBW	90.4 ± 24.0[b]	82.0-98.8	101.4 ± 23.0[b]	93.6-109.2	89.1 (17.4)
TW	71.1 ± 30.6	60.8-81.4	82.0 ± 25.8	73.2-90.8	86.7 (21.1)
TWBW	120.1 ± 43.2[b]	105.5-134.7	138.3 ± 35.2[b]	126.5-150.1	86.8 (21.6)
FLX/EXT, %					
PT	54.0 ± 11.6	50.1-57.9	58.6 ± 10.3	55.2-62.0	92.1 (22.0)
TW	55.1 ± 12.6	50.8-59.4	60.6 ± 9.8	57.4-63.8	90.9 (21.1)
At 300 deg/s					
Extension, N·m					
PT	79.1 ± 17.5	73.3-84.9	83.6 ± 26.6	74.6-92.6	94.6 (12.2)
PTBW	131.4 ± 18.0	125.4-137.4	137.6 ± 26.8	128.5-146.7	95.4 (11.8)
TW	102.6 ± 24.3	94.4-110.8	111.1 ± 31.6	100.4-121.8	92.3 (12.0)
TWBW	172.0 ± 30.2	161.7-182.3	184.1 ± 36.6	171.9-196.3	93.4 (12.8)
Flexion, N·m					
PT	46.7 ± 14.0	41.9-51.5	51.8 ± 15.0	46.7-56.9	90.1 (13.2)
PTBW	78.0 ± 18.1[b]	71.8-84.2	86.8 ± 16.7[b]	81.2-92.4	89.8 (13.6)
TW	59.4 ± 23.7	51.3-67.5	67.1 ± 22.2	59.6-74.6	88.6 (18.2)
TWBW	99.2 ± 33.5	87.8-110.6	111.8 ± 30.6	101.4-122.2	88.7 (18.0)
FLX/EXT, %					
PT	59.1 ± 12.2	54.9-63.3	62.2 ± 9.4	59.0-65.4	95.0 (18.7)
TW	57.8 ± 13.3	53.2-62.4	61.2 ± 8.9	58.2-64.2	94.4 (21.3)

[a]FLX/EXT, flexion-to-extension ratio; LSI, limb symmetry index (injured leg/uninjured leg × 100); PT, peak torque; PTBW, peak torque/body weight; TW, total work; TWBW, total work/body weight.
[b]Statistically significant difference between limbs ($P < .05$).

300 deg/s ($r = -0.54$, $P < .05$) (Table 4). The LSIs of the hop tests did not show a statistically significant correlation with any of the LSIs of the isokinetic strength measurements.

Patellar Tendon Graft Versus Hamstring Graft

For the 19 patients who underwent ACLR with a patellar tendon graft and the 10 patients with a hamstring graft, the mean age was 16.2 ± 1.2 years and 15.8 ± 1.3 years, respectively; the mean height was 166.4 ± 7.8 cm and 165.1 ± 7.9 cm, respectively; and the mean weight was 61.1 ± 10.0 kg and 59.0 ± 11.8 kg, respectively. None of these demographic data reached statistical significance ($P < .05$).

The hop test results showed that there was no statistically significant difference between the patellar tendon graft and hamstring graft in the reconstructed knee of the

TABLE 4
Pearson *r* Values[a]

	r Value	95% CI
Single hop vs isokinetic knee strength ($r > 0.4$, $P < .05$)		
Flexion PTBW at 180 deg/s	0.58	0.29 to 0.76
Flexion TW at 180 deg/s	0.55	0.25 to 0.75
Flexion PTBW at 300 deg/s	0.54	0.25 to 0.75
Flexion PT at 180 deg/s	0.54	0.24 to 0.74
Flexion TWBW at 180 deg/s	0.53	0.22 to 0.73
Flexion PT at 300 deg/s	0.53	0.22 to 0.73
FLX/EXT TW at 180 deg/s	0.52	0.21 to 0.73
FLX/EXT PT at 180 deg/s	0.51	0.20 to 0.72
Flexion TW at 300 deg/s	0.49	0.17 to 0.71
FLX/EXT TW at 300 deg/s	0.48	0.16 to 0.70
Flexion TWBW at 300 deg/s	0.45	0.12 to 0.8
Extension PTBW at 180 deg/s	0.42	0.09 to 0.66
Extension TW at 180 deg/s	0.42	0.09 to 0.66
Extension TWBW at 180 deg/s	0.41	0.07 to 0.66
Triple hop vs isokinetic knee strength ($r > 0.4$, $P < .05$)		
Flexion TWBW at 300 deg/s	0.65	0.39 to 0.81
Flexion PTBW at 300 deg/s	0.60	0.31 to 0.77
Flexion TWBW at 180 deg/s	0.57	0.28 to 0.76
FLX/EXT TW at 300 deg/s	0.57	0.28 to 0.76
Flexion TW at 300 deg/s	0.54	0.24 to 0.74
FLX/EXT PT at 300 deg/s	0.52	0.21 to 0.73
Extension TWBW at 180 deg/s	0.51	0.20 to 0.72
Flexion PTBW at 180 deg/s	0.50	0.19 to 0.71
Flexion TW at 180 deg/s	0.47	0.15 to 0.70
FLX/EXT TW at 180 deg/s	0.46	0.12 to 0.68
Extension TWBW at 300 deg/s	0.45	0.12 to 0.68
FLX/EXT PT at 180 deg/s	0.45	0.12 to 0.68
Flexion PT at 300 deg/s	0.42	0.09 to 0.66

	r Value	95% CI
Crossover hop vs isokinetic knee strength ($r > 0.4$, $P < .05$)		
Flexion TWBW at 300 deg/s	0.64	0.38 to 0.80
Flexion PTBW at 300 deg/s	0.61	0.33 to 0.78
FLX/EXT TW at 300 deg/s	0.60	0.31 to 0.77
FLX/EXT PT at 300 deg/s	0.58	0.29 to 0.76
Flexion TWBW at 180 deg/s	0.53	0.22 to 0.73
FLX/EXT TW at 180 deg/s	0.48	0.16 to 0.70
FLX/EXT PT at 180 deg/s	0.47	0.15 to 0.70
Flexion PTBW at 180 deg/s	0.46	0.13 to 0.69
Extension TWBW at 300 deg/s	0.41	0.07 to 0.66
Flexion TW at 300 deg/s	0.40	0.06 to 0.65
Extension TWBW at 180 deg/s	0.40	0.06 to 0.65
6-m hop vs isokinetic knee strength ($r < -0.40$, $P < .05$)		
Flexion PTBW at 300 deg/s	–0.54	–0.74 to –0.24
FLX/EXT PT at 180 deg/s	–0.46	–0.69 to –0.13
FLX/EXT TW at 300 deg/s	–0.46	–0.68 to –0.12
Flexion PTBW at 180 deg/s	–0.43	–0.67 to –0.10
Flexion TWBW at 300 deg/s	–0.41	–0.66 to –0.07
FLX/EXT PT at 300 deg/s	–0.41	–0.66 to –0.07
Total distance vs isokinetic knee strength ($r > 0.40$, $P < .05$)		
Flexion TWBW at 300 deg/s	0.69	0.45 to 0.83
Flexion PTBW at 300 deg/s	0.67	0.41 to 0.81
FLX/EXT TW at 300 deg/s	0.63	0.36 to 0.80
Flexion TWBW at 180 deg/s	0.60	0.32 to 0.78
FLX/EXT PT at 300 deg/s	0.59	0.31 to 0.77
Flexion PTBW at 180 deg/s	0.54	0.24 to 0.74
FLX/EXT TW at 180 deg/s	0.52	0.21 to 0.73
Flexion TW at 300 deg/s	0.52	0.21 to 0.73
Extension TWBW at 180 deg/s	0.50	0.17 to 0.71
Flexion TW at 180 deg/s	0.45	0.12 to 0.68
Extension TWBW at 300 deg/s	0.41	0.07 to 0.66
Flexion PT at 300 deg/s	0.41	0.07 to 0.66

[a]FLX/EXT, flexion-to-extension ratio; PT, peak torque; PTBW, peak torque/body weight; TW, total work; TWBW, total work/body weight.

study participants. There was also no statistically significant between-group difference in isokinetic quadriceps strength or hamstring strength. The results of the hop tests and isokinetic strength testing by graft type are summarized in Table 5.

DISCUSSION

The results of our study supported our hypotheses that (1) there would be no significant limb difference in both single-leg hop tests and isokinetic knee strength testing, (2) there would be a statistically significant correlation between hop tests and isokinetic knee strength, and (3) there would be no statistically significant difference between graft types. The patients achieved desired limb symmetry[10,22] in single-leg hop test performance and isokinetic quadriceps strength upon returning to full sport participation. The only single-leg hop test that showed a significant limb difference was the timed 6-m hop. Also, the only isokinetic strength test parameters that showed a significant limb difference were PTBW during flexion at 180 deg/s and 300 deg/s and TWBW during flexion at 180 deg/s. The participants achieved the suggested LSI of better than 90% to 95%[10,22] in all single-leg hop tests and all isokinetic knee extension strength measurements. Lower LSIs were observed in isokinetic flexion strength. One can argue that the lower LSIs might be a result of the graft location in patients who underwent ALCR. However, the past literature has suggested that patients who underwent ACLR with a hamstring graft had symmetrical hamstring strength when compared with the contralateral side.[11,16,19] Also, only 10 of a total of 29 participants in this study had undergone ACLR with a hamstring graft.

On the other hand, according to a study by Karasel et al,[13] patients who underwent ACLR with a patellar tendon graft had significantly decreased quadriceps strength in their surgical side at a slower speed (60 deg/s) measured isokinetically. Their patients also had significantly lower flexion-to-extension ratios on the surgical knee compared with the healthy knee. However, the participants in our study achieved desired LSIs in all quadriceps strength parameters including flexion-to-extension ratios measured at higher speeds.

TABLE 5
Hop Test and Isokinetic Strength Test Results by Graft Type[a]

	Patellar Tendon Graft	Hamstring Graft
Hop test		
Single hop, cm	156.7 ± 16.7	158.6 ± 17.1
Triple hop, cm	443.4 ± 21.1	446.8 ± 23.0
Crossover hop, cm	398.8 ± 66.4	402.2 ± 68.9
Total distance, cm	1000.1 ± 134.1	1005.8 ± 141.0
6-m hop, s	2.3 ± 0.2	2.3 ± 0.4
Isokinetic strength test		
At 180 deg/s		
Extension PT, N·m	99.6 ± 21.0	98.0 ± 23.8
Extension PTBW, N·m	164.7 ± 20.8	163.1 ± 22.6
Flexion PT, N·m	55.1 ± 19.1	53.6 ± 21.8
Flexion PTBW, N·m	91.0 ± 24.8	89.1 ± 22.0
FLX/EXT PT, %	55.3 ± 12.6	54.6 ± 14.0
At 300 deg/s		
Extension PT, N·m	78.5 ± 18.2	80.1 ± 20.1
Extension PTBW, N·m	130.5 ± 19.1	133.1 ± 19.8
Flexion PT, N·m	47.5 ± 14.4	45.0 ± 16.0
Flexion PTBW, N·m	78.5 ± 18.0	76.9 ± 20.2
FLX/EXT PT, %	60.5 ± 11.1	56.1 ± 12.0

[a]Data are shown as mean ± SD. FLX/EXT, flexion-to-extension ratio; PT, peak torque; PTBW, peak torque/body weight; TW, total work; TWBW, total work/body weight.

Additionally, our investigation showed that there was no statistically significant difference in hop test performance or isokinetic knee strength of the reconstructed knee between the patellar tendon graft and hamstring graft. The results are consistent with those of past studies suggesting that graft type does not affect knee strength measured isokinetically.[11,16,19]

As mentioned above, the timed 6-m hop was the only hop test that resulted in a statistically significant limb difference. However, we are not sure whether a 0.1-second difference between the surgical knee and healthy knee is clinically significant. This difference could be a result of limb dominance or a measurement error. Even though we did not record participants' limb dominance, Newton et al[21] suggested that even healthy patients have limb asymmetry in hop test performance.

Several past studies have suggested that quadriceps strength correlates with hop test results.[2,8,25,28] Schmitt et al[25] conducted a study on adolescent participants and concluded that quadriceps deficits could predict hop test performance regardless of the graft type, presence of a meniscus injury, or presence of symptoms including knee pain. However, our current study showed that there was a stronger correlation between flexion strength and hop test performance. One reason may be that the participants in our study did not differ in quadriceps strength when we compared the surgical side to the healthy knee, and the only statistically significant limb difference was seen in knee flexion strength. Also, some of the past studies included nonathletic populations, but our study only included competitive athletes who successfully returned to full sport participation.

Past studies that have investigated hop tests and knee strength do not always agree.[7,12,15] Fitzgerald et al[7] reviewed studies to establish a correlation between hop tests and knee strength but were not able to do so and suggested that the correlation between the 2 test batteries varied among studies. Inconsistency in study results may also be caused by the different hop tests used. The hop tests used in these past studies varied, and this could be one of the factors why past studies failed to establish a correlation between hop tests and knee strength.

There are studies that have tried to establish a correlation between knee strength and hop tests to other objective and subjective measures. Mizner et al[18] studied muscle strength and its role in predicting landing patterns of female athletes and concluded that muscle strength was not a good predictor of improvement. Also, Reinke et al[24] investigated the correlation between hop tests and the International Knee Documentation Committee (IKDC) and Knee injury and Osteoarthritis Outcome Score (KOOS) after ACLR and suggested that hop test results correlated with IKDC and KOOS values.

Our current investigation studied a broad range of isokinetic strength parameters, as past research has not investigated this as extensively as we have, to our knowledge. The only isokinetic test parameters that showed a statistically significant limb difference (PTBW during flexion at 180 and 300 deg/s and TWBW during flexion at 180 deg/s) resulted in relatively stronger correlations to all hop test measures. Hamstring strength deficits seemed to be better correlated with hop test performance in adolescent athletes who returned to sport after ACLR.

There are several limitations in our study. We included patients who underwent ACLR using different graft types and locations as well as those who underwent concomitant procedures such as meniscus repair and meniscectomy. This could potentially have affected our results, according to past research.[11,13,16,19] Also, a graft from the contralateral limb was used in some, but not all, of our patients, which was not recorded; this might have affected our results. Moreover, we were not able to conclude whether the statistically significant difference in hamstring strength was caused by the graft location or rehabilitation outcome. Our participants did not have a significant limb difference in quadriceps strength measured isokinetically. Thus, we were not able to assess whether quadriceps strength deficits would have correlated with hop test performance. Further prospective studies are needed to assist clinicians in making decisions on when to return athletes to their sport after knee surgery, especially to assist those who do not have access to an isokinetic machine.

In conclusion, isokinetic knee extension and flexion strength testing as well as hop tests are useful tools for a bilateral comparison of knee strength and function when returning athletes to their sport. Also, isokinetic flexion strength deficits and flexion-to-extension ratios may correlate better with hop test performance after knee arthroscopic surgery. Harvested graft types, that is, the patellar tendon graft or hamstring graft, did not affect hop test performance or isokinetic quadriceps and hamstring strength at the time of return to sport. Further research is necessary to better understand the correlation between the 2 test batteries and to assist clinicians without access to an isokinetic testing machine in evidence-based decision making as to when athletes can return to sport after ACLR.

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