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Objectively Measured Physical Activity in Patients After Anterior Cruciate Ligament Reconstruction

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Abstract

Background—Returning to a healthy level of physical activity is among the most commonly discussed clinical goals for patients recovering from anterior cruciate ligament reconstruction (ACLR). However, physical activity has not been objectively measured in this population.

Purpose—To investigate differences in the mean time (min/d) spent in moderate-to-vigorous physical activity (MVPA) as well as the daily step count (steps/d) between patients who underwent ACLR and matched controls. A second purpose was to investigate relationships between MVPA and objective assessments of the daily step count and Tegner and Marx activity scales.

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

Methods—Physical activity was assessed using ActiGraph accelerometers in 33 participants with a history of primary unilateral or bilateral ACLR (mean time from surgery, 27.8 ± 17.5 months; range, 6–67 months) as well as in 33 healthy controls (matched on age, sex, and activity level). Participants wore the accelerometer for 7 days and completed the International Knee Documentation Committee subjective form and the Tegner and Marx activity scales. Independent *t* tests were used to determine differences in each dependent variable per group.

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Results—Patients who underwent ACLR spent less time in MVPA (ACLR: 79.37 ± 23.95 min/d; control: 93.12 ± 23.94 min/d; $P = .02$) and had a lower daily step count (ACLR: 8158 ± 2780 steps/d; control: 9769 ± 2785 steps/d; $P = .02$) compared with healthy matched controls. However, the Marx (ACLR median: 11.0 [interquartile range (IQR), 7–14]; control median: 12.0 [IQR, 8–13]; $P = .85$) and Tegner (ACLR median: 6.0 [IQR, 5–8]; control median: 7.0 [IQR, 6–8]; $P = .12$) scores did not differ between the groups, and no relationships were observed between objectively measured physical activity and scale measures ($P > .05$), except for a moderate relationship between the Tegner score and daily step count in the ACLR group ($r = 0.36$, $P = .04$). Only 24% of patients who underwent ACLR met the guideline of 10,000 steps per day compared with 42% of controls.

Conclusion—Patients who underwent ACLR spent less time in MVPA and had a lower daily step count compared with highly matched controls (age, sex, and activity level) with no history of knee injuries. This was true despite being similar in activity levels, which brings into question the utility of the Tegner and Marx activity scales.

Keywords

musculoskeletal; activity level; accelerometry; exercise

Physical inactivity is a national epidemic. In 2008, less than 10% of American adults met current guidelines for aerobic physical activity.⁵⁰ Physical inactivity has been recognized as an independent risk factor for mortality and morbidity for various diseases.⁴² Lee et al³⁴ estimated that physical inactivity is independently responsible for, on average, 6% of the disease burden from coronary heart disease, 7% from type 2 diabetes, 10% from breast cancer, and 10% from colon cancer worldwide. Additionally, inactivity causes 9% of premature mortality.³⁴ If instead of eradicating physical inactivity, the prevalence was decreased by 10% or 25%, upwards of 533,000 and more than 1.3 million deaths, respectively, could be averted every year.³⁴ In terms of the economic cost, in the United States, it was estimated in 2006 that the cost of physical inactivity and excess weight nationwide was approximately \$507 billion, with projected costs of greater than \$708 billion in 2008.^{13,16,42} A musculoskeletal injury has been identified as a primary cause for reduced participation in physical activity.^{2,10,11} While the direct effect of a musculoskeletal injury on the risk of mortality has not been clearly established, developing a clear understanding of the effect of a common musculoskeletal injury and treatment, such as an anterior cruciate ligament (ACL) rupture and subsequent ACL reconstruction (ACLR), respectively, on physical activity may provide clinicians with a clear pathway toward reducing physical inactivity, the risk of chronic disease, and the risk of mortality.

Physical activity is defined as “any bodily movement produced by skeletal muscles that requires energy expenditure.”¹⁵ Current aerobic physical activity recommendations are based on minutes per week of moderate-to-vigorous physical activity (MVPA).²⁶ The guidelines for adults (age 18–65 years) state that they should be participating in a minimum of 150 minutes per week of MVPA. Moderate physical activity includes brisk walking, cycling, mowing the lawn, weight training, and yoga.¹ Some examples of vigorous activity include jogging, cycling (>10 mi/h or on steep uphill terrain), circuit weight training, and most competitive sports.¹ Successful compliance with these recommendations has been

linked to reduced adiposity and improved health-related quality of life among a diverse complement of age groups and patient populations.^{7,39}

Rates of ACLR have increased over 60% in the past 20 years.^{22,36} Despite significant ACL injury prevention efforts over the past 20 years, there are still a tremendous number of ACLRs taking place each year in young populations that must deal with the lingering results of this surgery for the rest of their lives. This is particularly concerning because ACL injuries and reconstruction have been linked with decreased health-related quality of life²³ and chronic diseases (such as osteoarthritis).³⁵ However, links between ACLR and other health behaviors, such as participation in physical activity, are currently unknown. While patient-reported physical activity and rates of return to sport have been reported, these data do not objectively assess the volume and intensity of physical activity, nor do they allow for a comparison to current national standards. Ceasing participation in physical activity at an early age, similar to when the risk of ACLR is greatest, could negatively influence physical activity across the life span.^{20,31,48} Thus, significant long-term monetary and social costs may result from ACLR.

Returning to a healthy level of physical activity is among the most commonly discussed clinical goals for patients recovering from ACLR.^{3,18,19,23,47,49} Unfortunately, objectively measured physical activity has not been utilized as an outcome measure in this population, despite the potential role that physical activity has in the prevention of chronic diseases as well as improving health-related quality of life.³ While aspects of physical activity such as return to sport^{22,23,42} or peak current physical activity level^{3,47} have been prospectively described in patients with a history of ACLR, these outcome measures are not structured appropriately to objectively assess the critical characteristics of physical activity as presented in the FITT (frequency, intensity, time, and type) principle, which is the current gold-standard approach for the quantification of physical activity.^{20,32} Furthermore, current recommendations from a number of national organizations^{14,24} for maintaining a physically active lifestyle or a healthy level of physical activity include frequency, time, and intensity components, which are not sufficiently assessed using traditional measures in the ACLR literature such as the Marx activity rating scale or the Tegner activity level scale.^{12,37}

The use of accelerometer-based physical activity monitors represents a key advance in the area of assessment of physical activity after ACLR. Accelerometry offers 2 key advantages over self-reported measures. First, accelerometers provide far more detailed data about the intensity and pattern of activity than can be directly reported by participants. Second, they eliminate recall errors, which are key sources of measurement error in physical activity questionnaires. Despite these advantages, to our knowledge, no investigations have utilized accelerometer-based assessments of physical activity in patients after ACLR. Therefore, the primary purpose of the current study was to investigate differences in the mean time (min/d) spent in MVPA as well as the daily step count (steps/d) between patients who underwent ACLR and matched controls. It was hypothesized that patients who underwent ACLR would exhibit less time spent in MVPA and fewer daily steps. A second purpose of this study was to determine whether scale-based physical activity assessments (Tegner and Marx) and injury characteristics (time since surgery and subjective knee function) were correlated with objective activity measurements (MVPA and daily step count). It was hypothesized that

scale-based measures would not be correlated with objective measures of physical activity. If our hypotheses are supported, then these data would provide important insight into the physical activity profiles of patients who have undergone ACLR. Care providers could develop strategies and provide education to increase moderate-to-vigorous forms of physical activity that can be performed safely as an adjunct to rehabilitation and developing/maintaining physical fitness for health.

METHODS

This was an observational cross-sectional study in which the objectively measured physical activity of patients with a history of ACLR was compared with that of healthy matched control participants. All participants attended a single study visit, during which they provided informed written consent, completed patient-reported outcome measures, and received instruction on the appropriate use of the physical activity monitor, which they subsequently wore during typical daily activity. This study was approved by the institutional review boards of both participating institutions.

Participants

Thirty-three patients with a history of primary unilateral ACLR as well as 33 healthy matched control participants were enrolled in this investigation at 2 research sites within the same geographic region (Table 1). Thirty-three participants (13 ACLR and 20 control) were enrolled at research site 1, and 33 participants (17 ACLR and 16 control) were enrolled at research site 2. All participants were 18 to 35 years old and free of chronic or acute neurological disorders, cardiopulmonary disease, or any other medical condition that may limit the ability to participate in MVPA. Patients in the ACLR group had undergone surgery within the past 5 years and had been fully cleared to return to physical activity by a medical professional (physician, physical therapist, or athletic trainer). Participants with a medial collateral ligament injury at the time of the initial ACL injury as well as participants who underwent meniscal repair or partial meniscectomy at the time of ACLR were included, but participants who experienced significant surgical complications resulting in extended medical care or a second surgical procedure after ACLR were excluded. In addition, participants were excluded if posterior cruciate ligament or posterolateral corner reconstruction occurred at the time of ACLR. Healthy control participants were excluded if they had a history of significant lower extremity injuries that resulted in surgery. Participants in the healthy control cohort were matched to those in the ACLR cohort based on age (± 4 years), sex, and peak physical activity level over the previous 12 months as measured by the Tegner score (± 1 activity level). Participants were recruited from both participating universities and surrounding communities using approved advertisements such as posted flyers and emails.

Multisite Data Collection Training

All members of the study team were trained in data acquisition and processing via a video conference between research sites. Study team members received training from the content experts of the study team in each methodological area including the collection and processing of patient-reported outcomes as well as objective measures of physical activity.

Data were stored separately at each data collection site, and databases were combined at the completion of the study protocol. In addition to direct training, a study manual was generated and followed to standardize the methodology between research sites.

Patient-Reported Outcomes

The International Knee Documentation Committee (IKDC) form was used to quantify the effect of knee injuries on lower extremity function and activities of daily living.^{28,44} The IKDC includes 18 total items regarding symptoms, general function, and sport activities.²⁸ In addition, participants completed the Tegner activity level scale to quantify their peak physical activity level and to enable the matching of a patient who underwent ACLR with a healthy control participant with a similar physical activity profile.

Objective Physical Activity Measurement

During the study visit, participants were outfitted with an ActiGraph wGT3X-BT accelerometer.⁴⁰ The ActiGraph wGT3X-BT accelerometer has been shown to be a valid and reliable tool for the objective assessment of MVPA in young and active populations.^{40,41,43} Participants wore the accelerometer over the right anterior superior iliac spine for a period of 7 days immediately after the study visit. A valid data collection period was considered to be a minimum of 4 days (3 weekdays and 1 weekend day) of wear of no less than 10 hours per day. Participants removed the monitor for bathing and sleeping and recorded their periods of wear and nonwear in a diary. The participants returned the monitor after the wear period, at which time the data were assessed for fidelity and consistency with wear guidelines. In the case of insufficient or corrupted data, the participant was asked to rewear the monitor for a subsequent 7 days.

The primary variables assessed in this investigation were the time spent in MVPA (min/d) as well as the daily step count (steps/d) completed by the participants during the course of the wear period.⁴³ The ActiGraph monitors collected data in raw acquisition mode, after which the data were processed and analyzed using ActiLife software, which is the proprietary software associated with ActiGraph wGT3X-BT accelerometers. The total wear time was estimated and validated using the recommendations of Choi et al.¹⁷ Briefly, the count and frequency of triaxial accelerations were utilized to discriminate between periods of wear and nonwear. This enabled the study team to assess whether the participant had been compliant with the previously established standards (4 days of 10 hours) for a successful wear period. A multiple-day wear period is recommended because it reduces variability and improves reliability.^{25,51} Freedson Adult VM3 cut points were then utilized to categorize physical activity as light, moderate, vigorous, or very vigorous based on the number of activity counts that occurred per minute during periods of wear time.⁴⁵ On the basis of these cut points, we were able to calculate the amount of time (min/d) spent in MVPA. In addition, the number of steps was assessed using vertical acceleration data measured with the ActiGraph monitor. Variables associated with the accelerometer were normalized to the number of wear days (total time spent in MVPA or total number of steps per day in which the accelerometer was worn).

Statistical Analysis

The primary dependent variable of interest was the mean time (min/d) spent in MVPA. Previous research was used to power this study using the International Physical Activity Questionnaire (IPAQ) data.²⁷ The analysis demonstrated that 14 participants per group were needed to achieve 80% power ($\alpha = .05$) to detect a 20% difference between groups. Group means and SDs for all patient-reported and physical activity outcomes were calculated. Objective measures of physical activity, time (min/d) spent in MVPA as well as daily step count, were compared between groups using 1-way analyses of variance after controlling for the total wear time (minutes) over the course of the 7-day wear period. It is important to control for the total wear time, as it would be expected that a participant who averaged 14 hours of wear time per day would potentially accrue more steps and a longer duration of MVPA based on the amount of measurement time when compared with a participant who averaged the minimum criteria of 10 hours of wear time. Because MVPA and step count are highly correlated, the P values of analyses of variance were adjusted (Bonferroni) to account for multiple comparisons at $P < .025$.

Between-group comparisons of age, body mass index, and IKDC score were conducted using independent-samples t tests. The magnitude of between-group differences was also assessed using Cohen d effect sizes and associated 95% CIs. Effect sizes were classified as weak ($d = 0.2$), small ($d = 0.2\text{--}0.5$), moderate ($d = 0.5\text{--}0.8$), or large ($d = 0.8$).²¹ Nonparametric Mann-Whitney U tests were used to examine differences in Marx and Tegner scores between groups, which are reported as median values and interquartile ranges (IQRs). Pearson product-moment correlation coefficients and Spearman rank tests were used to determine the relationship between MVPA, step count, Tegner score, Marx score, and IKDC score between both groups. In addition, Pearson product-moment correlation coefficients were used to estimate the relationship between MVPA, step count, and time since surgery in the ACLR group. Finally, descriptive statistics were used to determine what percentage of participants in each group met the recommendations for MVPA or step count. All analyses were performed in SPSS statistical software (version 22).

RESULTS

No significant differences were observed for height ($t = 0.45$, $P = .64$), weight ($t = 0.73$, $P = .93$), body mass index ($t = 0.46$, $P = .64$), or age ($t = 1.00$, $P = .32$) between the groups (Table 1). The ACLR group had a lower IKDC score compared with the control group ($t = 5.63$, $P < .001$). After controlling for the amount of accelerometer wear time (mean, 5512 minutes), patients with a history of ACLR spent significantly less time in MVPA (unadjusted values: ACLR: 78.34 ± 26.62 min/d; control: 94.16 ± 22.09 min/d) (adjusted values: ACLR: 79.37 ± 23.95 min/d; control: 93.12 ± 23.94 min/d; $P = .02$; $d = -0.72$; 95% CI for effect size, -1.21 to -0.22) and had a significantly lower step count (unadjusted values: ACLR: 7982 ± 3020 steps/d; control: 9945 ± 2885 steps/d) (adjusted values: ACLR: 8158 ± 2780 steps/d; control: 9769 ± 2785 steps/d; $P = .02$, $d = -0.68$; 95% CI for effect size, -1.18 to -0.18) when compared with healthy control participants. The magnitude of the effect for ACLR was considered to be moderate and significant for both MVPA ($d = -0.72$) and step count ($d = -0.68$), as the associated 95% CI did not cross zero in both cases. There were no between-

group differences for patient-reported physical activity level as measured by the Marx score (ACLR median, 11.0 [IQR, 7.0]; control median, 12.0 [IQR, 5.0]; $P = .85$) or Tegner score (ACLR median, 6.0 [IQR, 3.0]; control median, 7.0 [IQR, 2.0]; $P = .12$). When considering step recommendations, only 42% (14/33) of control participants met the guideline of 10,000 steps per day, while only 24% (8/33) of patients who underwent ACLR met the guideline of 10,000 steps per day. For physical activity guidelines, almost all of our participants met MVPA recommendations (ACLR: 32/33 [97%]; control: 33/33 [100%]).

MVPA and step count were significantly, positively, and strongly correlated in the ACLR group ($r = 0.91$, $P < .001$) and control group ($r = 0.88$, $P < .001$) (Figure 1). MVPA was not significantly correlated with the Marx score (ACLR: $r = 0.05$, $P = .79$; control: $r = 0.11$, $P = .55$), Tegner score (ACLR: $r = 0.25$, $P = .16$; control: $r = -0.07$, $P = .69$), or IKDC score (ACLR: $r = -0.02$, $P = .89$; control: $r = 0.33$, $P = .06$) in either group. Step count was significantly correlated with the Tegner score in the ACLR group ($r = 0.36$, $P = .04$) but not in the control group ($r = -0.23$, $P = .21$). Step count was not significantly correlated with the Marx score (ACLR: $r = 0.16$, $P = .37$; control: $r = -0.03$, $P = .89$) or IKDC score (ACLR: $r = -0.01$, $P = .97$; control: $r = 0.20$, $P = .27$) in either group (Table 2). Finally, time since surgery was not significantly related to MVPA ($r = -0.14$, $P = .44$) or step count ($r = -0.15$, $P = .42$).

DISCUSSION

To the best of our knowledge, this is the first study to objectively measure physical activity in patients after ACLR. The most important finding of this study is that patients who underwent ACLR participated in about 15 less minutes per day of MVPA and took 1611 fewer steps per day as compared with highly matched controls. These data are in direct conflict with traditional self-reported assessments of physical activity levels. We observed no group differences in the Tegner and Marx scores; however, we did observe a moderate relationship between the Tegner score and step count in the ACLR group. These findings highlight the importance of the objective monitoring of physical activity levels after returning to activity because of the potential risk associated with chronic physical inactivity and the limitations in common patient-reported approaches to assessments.

Current aerobic physical activity recommendations are based on minutes per week of MVPA.²⁶ The guidelines for the population utilized in this study (adults aged 18–65 years) state that this group should be participating in a minimum of 150 minutes per week of MVPA. The participants in the current study were mostly college students who were very active and lived in an urban environment in which walking is required. On average, our population was meeting the physical activity recommendations for their age group; however, the results of this study support the notion that physical activity seems to be affected after ACLR. Additionally, the findings of this study are even more concerning, given the long-term implications of an altered physical activity profile in these patients. For example, a difference in 15 minutes per day of MVPA would result in approximately 5500 fewer minutes of MVPA over the course of a year. Although the mean differences between groups in MVPA may seem relatively small, they could have long-lasting health implications over the course of a lifetime. The MVPA values observed in the current study are higher

compared with a broad range of college students⁶ but similar to other studies focusing on patients with musculoskeletal injuries.^{8,27} For example, Hubbard-Turner and Turner²⁷ observed that patients with chronic ankle instability participated in approximately 24 less minutes per day of MVPA than healthy controls. The elevated MVPA values in the current study are not surprising, considering that college students are generally active and patients with a history of ACLR are active and enjoy sport and activity.²⁷

In the current study, patients who underwent ACLR took about 2000 fewer steps per day compared with healthy controls. The average adult takes between 4000 and 18,000 steps per day, and normative data suggest that 10,000 steps per day is a reasonable goal for a healthy adult population.⁵² Only 42% (14/33) of control participants met the guideline of 10,000 steps per day, while only 24% (8/33) of patients who underwent ACLR met the guideline of 10,000 steps per day. This was an interesting finding because we theorized that most of our population would achieve the recommendation of 10,000 steps per day, given their younger age and practice of walking to class, among others. While a difference of 1611 steps per day may seem small, this could result in approximately 600,000 fewer steps over the course of the year. The step counts observed in the current study are in agreement with those of other studies in college students.^{30,38,52}

The majority of the literature regarding ACLR is focused on successful outcomes from surgery including return to play and return-to-play decision making.^{4,29,46} However, current evidence demonstrates that up to 35% of patients will not return to their preinjury sport level and that only about half of patients will return to competitive sports.⁵ Returning to demanding sports may not be the most important goal from an overall health perspective. However, sport participation is positive because physical activity in young adulthood is associated with physical activity as an adult.^{40,48} Participation in activity that will help patients to maintain a physically active lifestyle is critical, even if that includes activities short of sport participation.

The second major finding of this study was the lack of significant associations between objective measures of physical activity and the Marx and Tegner activity scales. The only significant relationship observed between all of these variables was between the daily step count and the Tegner score in the ACLR group. The correlation coefficient was moderate ($r = 0.36$), which means that only approximately 11% of the variance in the step count is explained by the Tegner score. One possible explanation is that the Tegner score describes the highest level of activity of a participant, so in theory, he or she could play high-level soccer and then have relatively low levels of activity at other times. Because both these measurements are attempting to assess somewhat similar constructs (ie, physical activity), a greater level of agreement would be ideal and leads us to question the clinical significance of this correlation. No significant relationships were observed between the Marx and Tegner scores and MVPA as assessed by the physical activity monitors. The Marx and Tegner activity scales have been reported to be valid and reliable assessments of physical activity levels. However, overreporting of physical activity is a common issue in other instruments that are associated with self-reporting, including the IPAQ. The Tegner and Marx activity scales may also be prone to overreporting the activity level. However, more research is needed to verify this theory, given the limited data available in this area. We did observe a

positive correlation between the daily step count and time (min/d) spent in MVPA. Therefore, it is possible that the daily step count may serve as a clinician-friendly surrogate for participation in MVPA. This is particularly attractive, given the wide availability of commercially available pedometers or fitness trackers on the market. Clinicians could use this information to set thresholds for their patients and to monitor physical activity as a postoperative metric.

Another interesting finding was the lack of significant relationships between the physical activity metrics (MVPA and step count) investigated in this study and the time from surgery and subjective knee function. The participants enrolled in this study were, on average, 27.8 months from surgery (range, 6–67 months). It is not clear when physical activity levels return to normal, if at all, after surgery. Future research is needed to track the natural progression of physical activity after knee surgery. Additionally, self-reported function was not significantly associated with either MVPA or step count. This is an interesting finding in that postoperative subjective knee function is often related to important components of rehabilitation such as quadriceps strength and torque demands during functional tasks such as squatting.^{9,33} In our sample, the mean IKDC score was similar to previously reported values, and a majority ($n = 22$) of our patients had self-reported knee function >85 , which is considered a successful surgical outcome.⁹ This may indicate that while participants generally report being capable of high-level function with limited symptoms after ACLR, they have opted not to participate in as much MVPA as their healthy counterparts. Unfortunately, because of the cross-sectional nature of this study, it is unclear if this was the case before the injury or if this behavior is a result of ACLR. More research is needed to investigate the variables that are associated with knee surgery and also affect participation in physical activity.

We acknowledge that this study has limitations. Because of the cross-sectional nature of our study design, it is possible that our patients who underwent ACLR were less physically active before their injury; however, we attempted to address this issue by ensuring that patients met a minimal physical activity level (± 1 Tegner score). There are other factors that influence participation in physical activity that we were unable to account for, given our study design, such as motivation, self-efficacy, fear of reinjury, sex, socioeconomic status, race, and environmental factors. Future research should further investigate the interaction of these parameters with physical activity and injury history. Recent reports have described limitations in the ability of the ActiGraph wGT3X-BT to accurately assess the step count as compared with more traditional pedometers.⁴¹ In this study, the step count was strongly related to MVPA, which provides evidence that the monitor did successfully measure a greater step count in those with a greater time spent in MVPA. Finally, we are unable to identify the types of activity that differed between our groups.

CONCLUSION

Patients who underwent ACLR were less physically active compared with matched healthy controls but, on average, still achieved the recommended physical activity guidelines. Patients who underwent ACLR spent less time in MVPA and had a lower daily step count, despite reporting similar levels of physical activity on the Tegner and Marx activity scales.

These findings highlight the importance of the objective monitoring of physical activity levels after returning to activity because of the potential risk associated with chronic physical inactivity and the limitations in common patient-reported approaches to assessments.

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Figure 1.

A scatterplot depicting the relationship between moderate-to-vigorous physical activity (MVPA) and step count in the total sample as well as within the anterior cruciate ligament reconstruction (ACLR) and healthy matched control groups.

TABLE 1Participant Demographics^a

	ACLR Group (n = 33)	Control Group (n = 33)
Sex, male/female, n	11/22	11/22
Age, y	20.3 ± 1.8	20.8 ± 1.6
Height, cm	171.8 ± 10.5	172.9 ± 8.5
Weight, kg	69.9 ± 11.3	70.2 ± 13.5
Body mass index, kg/m ²	23.7 ± 3.2	23.3 ± 3.0
IKDC score (0–100)	86.8 ± 10.5 ^b	97.7 ± 3.9 ^b
Graft source, n	15 BPTB, 17 hamstring, 1 allograft	N/A
Time since surgery, mo	27.8 ± 17.5 (6–67)	N/A

^aValues presented as mean ± SD (range) unless otherwise indicated. ACLR, anterior cruciate ligament reconstruction; BPTB, bone–patellar tendon–bone; IKDC, International Knee Documentation Committee; N/A, not applicable.

^b*P* .05.

TABLE 2

Correlations Between Objective and Patient-Reported Physical Activity Characteristics and Knee-Related Function^a

	ACLR Group		Control Group	
	MVPA	Step Count	MVPA	Step Count
Step count (steps/d)	0.914 ^b	—	0.877 ^b	—
Marx score (0–16)	0.049	0.162	0.108	−0.026
Tegner score (0–10)	0.250	0.356 ^b	−0.072	−0.225
IKDC score (0–100)	−0.024	−0.008	0.327	0.197
Time since surgery (mo)	−0.142	−0.147	N/A	N/A

^aACLR, anterior cruciate ligament reconstruction; IKDC, International Knee Documentation Committee; MVPA, moderate-to-vigorous physical activity; N/A, not applicable.

^b*P* .05.