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A Pair-Matched Comparison of Return to Pivoting Sports at 1 Year in Anterior Cruciate Ligament–Injured Patients After a Nonoperative Versus an Operative Treatment Course

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Background: Patients usually return to pivoting sports between 6 months and 1 year after anterior cruciate ligament (ACL) reconstruction, but no matched study has so far examined 1-year return to sport rates in nonoperatively and operatively treated ACL-injured patients.

Hypothesis: Anterior cruciate ligament-injured patients following a nonoperative treatment course, including recommendation of activity modification, will have lower return to pivoting sport rates than operatively treated patients 1 year after baseline testing/surgery, when matched by preinjury sports activity, age, and sex.

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

Methods: Sixty-nine nonoperatively treated ACL-injured patients were pair-matched with 69 operatively treated patients (n = 138), based on specific preinjury sport, age, and sex. Nonoperatively treated patients were recommended not to return to level I sports. Patients were defined as nonoperatively or operatively treated according to their status at follow-up. The baseline and follow-up testing included registration of sports participation, KT-1000 arthrometer measurements, 4 hop tests, and patient-reported outcome measures. McNemars test and paired *t* tests or Wilcoxon test were used to compare outcomes of nonoperatively and operatively treated patients.

Results: No significant baseline differences were found. At 12.9 ± 1.2 months (mean ± standard deviation) after baseline testing (nonoperative) and 12.7 ± 1.2 months after surgery (operative), there was no significant difference in overall return to sport rates (nonoperative: 68.1%, operative: 68.1%, $P = 1.00$), or in return to level I sport rates (nonoperative: 54.8%, operative: 61.9%, $P = .66$). Nonoperatively treated patients who participated in level I sports before injury had a significantly lower return to sport rate (54.8%) than nonoperatively treated patients who participated in level II sports (88.9%, $P = .003$). The nonoperatively treated patients had significantly higher knee joint laxity, but significantly better hop test limb symmetry indexes, Knee Outcome Survey Activities of Daily Living scores, and International Knee Documentation Committee Subjective Knee Form 2000 scores. None of the functional differences was larger than the smallest detectable difference.

Conclusion: Anterior cruciate ligament-injured patients following a nonoperative treatment course, including recommendations of activity modifications, and operatively treated patients did not have significantly different rates of returning to pivoting sports after 1 year in this pair-matched cohort study. Clinicians should be aware of a potentially high level of noncompliance to recommendations of activity modifications. Although these results show that it is possible for nonoperatively treated patients to return to sport after rehabilitation, future follow-ups are needed to examine whether these patients maintain sports participation over time, and what long-term consequences they may suffer regarding subsequent injuries and knee osteoarthritis.

Keywords: anterior cruciate ligament; nonoperative treatment; anterior criucate ligament reconstruction; return to sport; knee function

Injuries to the anterior cruciate ligament (ACL) are common in pivoting sports such as soccer, team handball, basketball, alpine skiing, and tennis.[8] After an ACL injury, patients have shown increased knee joint laxity,[12] altered

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TABLE 1
Sports Activity Classification[21] Modified to European Sport Activities[16,30]

Level	Sports Activity	Examples of Sports
I	Jumping, cutting, pivoting	Soccer, team handball, basketball, floorball
II	Lateral movements, less pivoting than level I	Racket sports, alpine skiing, snowboarding, gymnastics, aerobics
III	Straight-ahead activities, no jumping or pivoting	Running, cross-country skiing, weightlifting
IV	Sedentary	

neuromuscular strategies,[36,39] proprioceptive deficits,[6,10] and loss of muscle strength.[14,43] For a substantial number of patients, the injury and resulting loss of dynamic knee stability lead to a lower activity level.[3,31] Additionally, psychological and social factors may also influence whether a patient returns to sport after injury.[13,38]

The main treatment options after an ACL injury are nonoperative and operative management. These 2 courses of treatment differ not only with regard to the surgical intervention, but also the content and length of rehabilitation, and recommendations for future sports activity. It is frequently advocated that patients who aim at returning to pivoting sports should undergo operative management with ACL reconstruction.[9,25,26,28] The rationale behind this treatment algorithm is that an ACL reconstruction will improve passive knee stability and limit the risk of subsequent injuries, in particular meniscus and cartilage injuries, in patients who subject their knees to high loads.[7,37] On the other hand, patients who are willing to modify their activity level may not need the additional passive knee stability provided by an ACL reconstruction and can therefore be considered candidates for nonoperative treatment. Because the patient's motivation for resuming pivoting sports is a major indication for surgery, it should be expected that existing cohort studies reveal a lower return to sport rate in nonoperatively treated patients. Furthermore, nonoperatively treated patients are recommended not to return to high-demand pivoting sports.[18,20,27,41] Still, several studies do not show a difference in return to sport rates between nonoperatively and operatively treated patients.[18,29,42] This result may in part be explained by a difference in preinjury activity level, as nonoperatively treated patients have been shown to participate in less demanding sports activities than operatively treated patients.[11,15,18] Thus, it is possible that even if the return to sport rates are comparable, the nonoperatively treated patients return to less challenging sports activities.

In a recent meta-analysis, Ardern et al[3] found that the mean time between ACL-reconstruction and resumption of sport is 7.3 months. However, the timing of return to sport varies between institutions and individual patients. Both nonoperatively and operatively treated patients are expected to have finished rehabilitation and attempted to return to sports activities within 1 year.[1,5,8,20,35,45] To our knowledge, no previous study has reported 1-year return to sport rates for nonoperatively and operatively treated patients with identical preinjury activity levels.

Therefore, the purpose of this study was to compare the 1-year return to sport rates in patients following a nonoperative treatment course, including recommendations of activity modifications, and individually matched operatively treated patients, who all participated in pivoting sports prior to injury. We hypothesized that nonoperatively treated patients would have lower return to pivoting sport rates than operatively treated patients when matched by specific preinjury sport, sex, and age.

MATERIAL AND METHODS

Subjects

This study is based on data from a prospective cohort study on ACL-injured subjects. Patients were consecutively included from the Musculoskeletal and Sport Medicine Clinic NIMI in Oslo, Norway. To be included in the study, patients had to have sustained a unilateral ACL-rupture within the past 6 months (confirmed by magnetic resonance imaging [MRI] and $\geq$3 mm side-to-side difference with a KT-1000 arthrometer),[12] be from 13 to 60 years of age, and participate in pivoting sports (Table 1) at least twice a week before injury. Pivoting sports was defined as level I or level II sports according to the activity level classification by Hefti et al,[21] modified to European sport activities.[16,30] Sports with frequent pivoting (eg, soccer, team handball, floorball, basketball) are classified as level I sports. Level II sports are pivoting sports with less frequent pivoting than level I sports (eg, racket sports, alpine skiing, snowboarding, gymnastics, and aerobics). Patients who participated in level III sports (eg, running, cross-country skiing, and weightlifting) were not included in this study. The exclusion criteria were bilateral injuries, previous knee injuries, or symptomatic concomitant injuries. Of a total of 233 patients, 210 (90.1%) attended the follow-up 1 year after baseline testing (nonoperatively treated patients) or surgery (operatively treated patients; Figure 1). Nonoperatively treated patients

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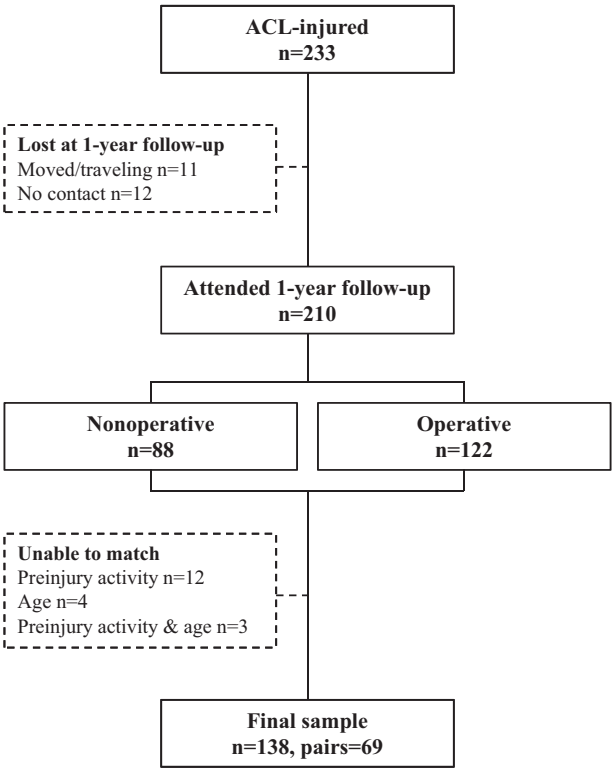

Figure 1. Flowchart of patient participation.

with available 1-year follow-up data (n = 88) were eligible for pair matching with operatively treated patients (n = 122), based on specific preinjury sport, sex, and age (±3 y). The study was carried out in accordance with the Declaration of Helsinki. All subjects signed a written consent form before inclusion, and the study was approved by the Regional Ethical Committee for Eastern Norway.

Treatment Algorithm

At our institution (NIMI), all subjects undergo active rehabilitation before the decision of nonoperative or operative treatment is made. After resolving initial impairments, the rehabilitation program consists of heavy resistance strength training, neuromuscular training, and plyometric exercises.[16] During this time, the patients are informed about both nonoperative and operative treatments. The decision of nonoperative or operative treatment is made by the responsible orthopaedic surgeon, in close communication with the patient and treating physical therapist. A wish to return to level I sports (Table 1), dynamic instability, young age (but skeletally mature), and a patient's preference for surgery are factors that positively influence a surgical decision. Following a nonoperative treatment course, patients undergo continued active rehabilitation as needed. Nonoperatively treated patients at our institution typically undergo 3 to 4 months of rehabilitation after initial impairments have been resolved. Patients are discharged from rehabilitation when they meet specific criteria for quadriceps and hamstring strength (limb symmetry index [LSI] >90%) and 4 single-legged hop tests (LSI >90% for all 4 hop tests).

Reconstructive surgery is performed with either a hamstring tendon or a bone-patellar tendon-bone (BPTB) autograft. In the early postoperative phase (0-6 wk), the aim of rehabilitation is to eliminate effusion, regain full range of motion, and minimize muscular atrophy. From 2 to 6 months postoperatively, the aim of rehabilitation is to regain adequate muscle strength and dynamic knee stability. The rehabilitation aims from 6 to 12 months postoperatively are to normalize muscle strength and dynamic knee stability and to prepare the patient for return to sport with sport-specific training. Rehabilitation protocols are adjusted individually by the responsible physical therapist.

The return to sport criteria at our institution are at least 90% hamstring and quadriceps strength, and limb symmetry indexes of at least 90% on 4 hop tests.[33] Operatively treated patients are recommended not to return to level II sports earlier than 6 months postoperatively, and to level I sports no earlier than 9 months postoperatively. Nonoperatively treated patients may return to level II or lower sports as soon as the return to sports criteria are fulfilled; however, they are recommended to refrain from returning to level I sports without reconstructive surgery.

Data Collection

All patients went through baseline functional testing after inclusion. The same tests were then performed 1 year after baseline testing (nonoperatively treated patients) or 1 year after surgery (operatively treated patients). The initial KT-1000 arthrometer measurements were included in the baseline data. Before testing, all patients performed a 10-minute standardized warm-up on a stationary bicycle. Thereafter, 4 hop tests (the single hop for distance, the crossover hop for distance, the triple hop for distance, and the 6-meter timed hop)[33] were performed. These hop tests have previously been shown to be reliable and valid for the ACL-injured population and have a reported minimal detectable difference of 7-13 LSI.[34] For the first 3 hop tests, the hop distance in centimeters was measured with a standard tape measure. For the 6-meter timed hop test, a stopwatch was used to record the time to the nearest 100th of a second. All patients performed 1 practice trial followed by 2 recorded test trials on each leg, and the uninvolved leg was always tested first. After the hop tests, the patients completed the Knee Outcome Survey Activities of Daily Living (KOS-ADLS)[24] and the International Knee Documentation Committee Subjective Knee Form (IKDC 2000).[22,23] Both questionnaires are scored from 0 (worst) to 100 (best), and have established reliability, validity, and responsiveness in patients with knee injuries.[22-24] The KOS-ADLS has a reported standard error of measurement of 3.2,[24] which corresponds to a minimal detectable difference of 8.9.[44] The minimal detectable difference of the IKDC 2000 has been estimated at 12.8.[22,23] The patients also completed a self-reported numeric global rating scale (GRS) of knee function from 0 (cannot do daily activities) to 100 (preinjury knee function) and reported

what specific types of sports activity they participated in before injury and present.

Data Management and Statistical Analysis

Single-legged hop test limb symmetry indexes (LSI) were calculated as the longest distance hopped on the involved leg divided by the longest distance hopped on the uninvolved leg × 100. For the 6-meter timed hop test, the LSI was calculated as the fastest time hopped on the uninvolved leg divided by the fastest time hopped on the involved leg × 100.

Preinjury sports activity was defined as the patient's self-reported main sports activity before injury. The patient was registered as having returned to sport if his or her sports activity at follow-up matched the preinjury main sports activity. Patients who returned to sports other than their preinjury main sports activity were thus classified as not having returned to sport.

Comparisons of return to sport rates between nonoperatively treated patients and operatively treated patients were conducted using the Mantel-Haenszel estimate of the risk ratio, which takes pairing into account. The analyses were also stratified by preinjury activity level, defined by the preinjury main sport activity of the patient. *P* values for comparisons of all other nominal variables were obtained using the McNemar chi-square test. For continuous variables, differences between nonoperatively treated patients and operatively treated patients were analyzed using paired *t* tests for normally distributed variables and Wilcoxon signed rank test for variables that were not normally distributed. The level of significance was set to .05 for all analyses. All analyses were conducted using SPSS (version 17.0 for Windows, SPSS Inc, Chicago, Illinois).

RESULTS

From the 88 available patients following a nonoperative treatment course, including recommendations of activity modifications, 69 pairs were formed. In total, 138 patients were thus included in the final analyses. The reasons for not being able to match nonoperatively treated patients were no operatively treated patients participating in the same preinjury sport (n = 12; 57.1%), not matching age (n = 4; 19.0%), and a combination of these 2 factors (n = 3; 14.3%). Of the 69 operatively treated patients, 53 (76.8%) had undergone reconstructive surgery with a hamstring tendon autograft, and 16 (23.2%) with a bone-patellar tendon-bone autograft. The mean time from injury to surgery was 5.5 ± 2.3 (SD) months.

In both the nonoperatively and operatively treated groups, 42 patients (60.9%) participated in level I sports and 27 patients (39.1%) in level II sports before injury. The most frequent preinjury main sports were soccer (20 pairs, 29%), alpine skiing/snowboarding (17 pairs, 24.6%), and team handball (12 pairs, 17.4%). There were no significant differences in descriptive variables, concomitant injuries, or any functional outcomes at baseline (Table 2).

Nonoperatively treated patients returned for follow-up testing 12.9 ± 1.2 months (mean ± SD) after baseline testing, and the operatively treated patients were tested 12.7 ± 1.2 months after surgery ($P = .48$). At the follow-up, 47 of 69 nonoperatively treated patients had returned to sport (68.1%). The return to sport rate of the operatively treated patients was also 68.1% ($RR_{MH} = 1.00$ [0.61-1.63], $P = 1.00$). There were no significant differences between nonoperatively and operatively treated patients in return to level I or level II sports (Table 3). Of the 42 patients in each group who participated in level I sports before injury, 23 (54.8%) of the nonoperatively treated patients returned to sport, whereas 26 (61.9%) of the operatively treated patients returned to sport ($P = .66$). Of the 27 patients in each group who participated in level II sports before injury, the nonoperative return to sport rate was 88.9%, compared with an operative return to sport rate of 77.8% ($P = .51$).

Within nonoperatively treated patients only, patients who participated in level I sports had significantly lower return to sport rates (54.8%) than patients who participated in level II sports (88.9 %, $P = .003$). There was no significant difference in return to sport between operatively treated level I and level II athletes (return to level I sports: 61.9%, return to level II sports: 77.8%, $P = .20$).

The KT-1000 arthrometer measurements revealed that nonoperatively treated patients had significantly higher knee joint laxity (Table 3). The nonoperatively treated patients had significantly higher limb symmetry indexes for all 4 hop tests, KOS-ADLS scores, and IKDC 2000 scores (all $P < .05$). There was no significant difference between nonoperatively treated patients and operatively treated patients for the GRS for knee function.

At the time of reconstruction, injuries to the medial meniscus were recorded in 20 of the operatively treated patients (29.0%). Eleven (55%) of these injuries were treated with partial resection, 7 (35%) were sutured, and 2 (10%) were left untreated. Fourteen (20.3%) of the operatively treated patients had a lateral meniscus injury; 10 (71.4%) were treated with partial resection, 1 was sutured (7.1%), and 3 (21.4%) were left untreated. No surgical procedures were performed at any point during this study in the nonoperatively treated group.

Based on the medical records, there was no significant difference between nonoperatively and operatively treated patients in the number of complications, new injuries, or exacerbated concomitant injuries at follow-up (nonoperative: 9, operative: 10, $P = .71$). Nor was there any significant difference in the number of patients who incurred complications, new injuries, or exacerbated concomitant injuries between the 2 groups (nonoperative: 6, operative: 10, $P = .33$). In the nonoperatively treated patients, 3 (4.3%) symptomatic medial meniscus injuries, 4 (5.8%) symptomatic lateral meniscus injuries, 1 (1.4%) lateral cartilage injury, and 1 (1.4%) contralateral ACL rupture were recorded at follow-up. In the operatively treated patients, 1 (1.4%) symptomatic medial meniscus injury, 4 (5.8%) symptomatic lateral meniscus injuries, 2 (2.9%) symptomatic medial cartilage injuries, 1 (1.4%) rerupture of the ACL, 1 (1.4 %) patellar subluxation, and 1 (1.4%) surgically treated cyclops lesion were recorded.

TABLE 2
Baseline Characteristics of Study Participants[a]

	Nonoperative (n = 69)	Operative (n = 69)	*P*
Sex, M/F (% F)	37/32 (46.4%)	37/32 (46.4%)	1.00
Age, y	27.9 (7.3)	27.3 (6.9)	.15
Preinjury sport, n (%)			
Level I sports	42 (60.9%)	42 (60.9%)	1.00
Soccer	20 (29.0%)	20 (29.0%)	1.00
Team handball	12 (17.4%)	12 (17.4%)	1.00
Floorball	6 (8.7%)	6 (8.7%)	1.00
Basketball	4 (5.8%)	4 (5.8%)	1.00
Level II sports	27 (39.1%)	27 (39.1%)	1.00
Alpine skiing/snowboarding	17 (24.6%)	17 (24.6%)	1.00
Aerobics	3 (4.3%)	3 (4.3%)	1.00
Squash	2 (2.9%)	2 (2.9%)	1.00
Tae kwon do	2 (2.9%)	2 (2.9%)	1.00
Ballet	1 (1.4%)	1 (1.4%)	1.00
Ice hockey	1 (1.4%)	1 (1.4%)	1.00
Track and field	1 (1.4%)	1 (1.4%)	1.00
Preinjury sports frequency, times per week	3.8 (1.8)	4.2 (1.8)	.21
Days from injury to baseline testing	75.2 (33.0)	72.5 (34.2)	.66
Medial meniscus injury, n (%)[b]	9 (13.0%)	13 (18.8%)	.45
Lateral meniscus injury, n (%)[b]	5 (7.2%)	6 (8.7%)	.77
Medial cartilage injury, n (%)[b]	1 (1.4%)	0 (0%)	—
Lateral cartilage injury, n (%)[b]	5 (7.2%)	2 (2.9%)	.45
KT-1000 side-to-side difference, mm	6.1 (3.0)	4.8 (2.4)	.12
Single hop for distance, LSI	89.0 (10.6)	86.7 (14.1)	.22
Crossover hop, LSI	90.3 (10.2)	88.4 (12.1)	.33
Triple hop for distance, LSI	89.9 (10.7)	88.7 (8.6)	.45
6-m timed hop, LSI	92.9 (9.2)	90.9 (9.8)	.20
KOS-ADLS	84.0 (10.8)	81.8 (12.4)	.22
GRS for knee function	71.0 (17.5)	65.6 (22.3)	.14
IKDC 2000	69.8 (8.1)	67.3 (12.8)	.24

[a]Values are expressed as mean (standard deviation) unless otherwise indicated. GRS, global rating scale; IKDC, International Knee Documentation Committee Subjective Knee Form; KOS-ADLS, Knee Outcome Survey Activities of Daily Living; LSI, limb symmetry index.
[b]Diagnosed with magnetic resonance imaging.

TABLE 3
Outcomes at 1-Year Follow-up[a]

	Nonoperative (n = 69)	Operative (n = 69)	*P*
Overall return to sport[b]	47/69 (68.1%)	47/69 (68.1%)	1.00
Return to level I sport[b]	23/42 (54.8%)	26/42 (61.9%)	.66
Return to level II sport[b]	24/27 (88.9%)	21/27 (77.8%)	.51
Sports frequency, times per week	3.3 (1.6)	3.3 (1.8)	.83
KT-1000 side-to-side difference, mm	5.6 (2.8)	2.7 (1.8)	<.001
Single hop for distance, LSI	96.3 (6.4)	90.5 (14.0)	.009
Crossover hop, LSI	95.9 (6.2)	91.3 (11.2)	.02
Triple hop for distance, LSI	97.1 (5.5)	92.6 (11.4)	.01
6-m timed hop, LSI	97.7 (5.5)	93.5 (9.8)	.005
KOS-ADLS	95.4 (4.9)	91.0 (7.7)	<.001
GRS for knee function	88.8 (12.0)	88.7 (10.7)	.95
IKDC 2000	88.5 (9.2)	85.0 (11.6)	.05

[a]Values are presented as mean (standard deviation) unless otherwise inidicated. GRS, global rating scale; IKDC, International Knee Documentation Committee Subjective Knee Form; KOS-ADLS, Knee Outcome Survey Activities of Daily Living; LSI, limb symmetry index.
[b]Patients returned / patients who participated in the respective level of sport preinjury (%)

DISCUSSION

The main finding of this study was that patients following a nonoperative treatment course, including recommendations of activity modifications, and operatively treated patients—matched by specific preinjury sport, sex, and age—did not have significantly different return to pivoting sport rates after 1 year. Our hypothesis was therefore not supported.

To our knowledge, this is the first matched study to compare return to pivoting sport rates for nonoperatively and operatively treated ACL-injured patients at a time when most patients are expected to have returned to sport (1 year). Furthermore, it is so far the largest matched study in this field and the only study to match patients by their specific preinjury sport. A difference in preinjury sports would likely represent a major confounding factor in cohort studies that compare return to sport rates. As operatively treated patients have been shown to participate in sports that may entail a higher degree of knee loading,[11,15,18] returning to sport would also pose higher demands on dynamic knee stability for this group. By matching the patients by their specific preinjury sport, each pair of patients in this study thus had to achieve the same level of dynamic knee stability to return to sport. Patients who followed a nonoperative treatment course, including recommendations of activity modifications, had a return to sport rate of 68%, which suggests that the majority of nonoperatively treated patients were able to return to pivoting sports. The return to sport rate in this study is comparable with our research group's previously published 1-year results from a prospective cohort,[29] yet higher than in several other previous studies.[2,4,40] Both nonoperatively and operatively treated patients in the current study underwent active rehabilitation, with emphasis on heavy resistance strength training, neuromuscular training, and plyometrics.[16] Furthermore, patients were not discharged from rehabilitation until they met specific functional criteria. This must be taken into consideration when comparing our results to other cohorts.

At follow-up, nonoperatively treated patients had significantly higher anterior knee laxity as measured with the KT-1000 arthrometer, but also significantly higher scores on all 4 hop tests, the KOS-ADLS, and the IKDC 2000. However, none of the differences in functional outcomes was larger than the previously reported minimal detectable difference of these tests.[22-24,34] These small differences, although statistically significant, are thus probably of no clinical relevance. In line with our results, 2 other matched studies did not find significant differences in functional outcomes or activity level between nonoperatively and operatively treated patients.[27,41] However, these studies had a follow-up of 10 and 15 years. Moreover, the only published randomized controlled trial on rehabilitation plus early ACL reconstruction versus rehabilitation plus optional delayed ACL reconstruction showed no significant differences in self-reported outcome measures or activity level after 2 years.[19]

Anterior cruciate ligament-injured patients treated at our institution are recommended not to participate in level I sports without reconstructive surgery. In spite of this policy, our results surprisingly showed that 55% of the nonoperatively treated level I athletes returned to sport (Table 3). These results indicate a high level of noncompliance to the activity modifications recommended to reduce the risk of giving-way episodes. Institutions and clinicians that recommend activity modifications in combination with nonoperative treatment should therefore be cautious of the risk that patients might not follow their recommendations. Although these results show that it is possible for nonoperatively treated patients to return to sport after rehabilitation, future follow-ups are needed to examine whether these patients maintain sports participation over time, and what long-term consequences they may suffer regarding subsequent injuries and knee osteoarthritis.

The low rate of subsequent injuries and exacerbated concomitant injuries observed in this study can likely be attributed to patients having returned to sport only months before the follow-up. Furthermore, only symptomatic injuries were recorded. Although both nonoperatively and operatively treated patients underwent MRI before inclusion, there was no systematic follow-up MRI in this study. Future studies are therefore needed to examine a possible difference in the incidence of further injury to the knee (in particular meniscus injuries, cartilage injuries, reruptures, and give-way episodes resulting in late reconstructive surgery) between nonoperatively and operatively treated patients. Although the prevalence of meniscectomy in high-level athletes 10 years after an ACL injury has been reported to be as high as 80% and 68% for nonoperatively and operatively treated patients, respectively,[27] it is crucial that future studies also record the athletic exposure of the patients. Previous reports on subsequent meniscus/cartilage injuries in ACL-injured patients describe that activity modifications were recommended to the nonoperatively treated patients.[18,27,41] However, noncompliance with these recommendations places the nonoperatively treated patients at considerably higher risk of further knee injury than suggested by the treatment guidelines. The results from this study clearly highlight the importance of recording athletic exposure in studies on subsequent injuries, as the frequency of injuries depends on the proportion returning to sport and the duration of sports participation.[32]

Nonoperatively treated patients who participated in level I sports before injury had a significantly lower return to sports rate (55%) than patients who participated in level II sports prior to injury (89%). There was no significant difference in return to sport rates between operatively treated patients with different preinjury activity levels. As the nonoperatively treated patients in this study were advised not to return to level I sports, this finding was expected. So far, few studies have reported separate return to sport rates for different types of sports. At 6-year follow-up, Fink et al[17] reported that nonoperatively and operatively treated patients had slightly more comparable sports participation in low-risk sports than in high-risk sports. However, neither the aforementioned study nor our study was statistically powered to address this issue. Future studies are therefore needed to establish whether there is a significant interaction between preinjury sports type and return to sport in nonoperatively and operatively treated patients, even within patients that participate in pivoting sports prior to injury.

A disadvantage of any nonrandomized study on nonoperative and operative treatment is the inability to control for the factors that led to surgery. In this patient population, factors that were given weight in the surgical decision making included a wish to return to level I sports, dynamic instability, age, and the preferred treatment of the patient.

The 2 groups were not significantly different in terms of age, additional injuries, or any baseline functional outcome measure. However, we recorded neither the patients' intention to return to level I sports nor which treatment they preferred. It is not unlikely that the nonoperatively and operatively treated patients differed in terms of these 2 factors, and both the presence of self-selection and a potential difference in the motivation for returning to sport may have introduced a confounding bias that could not be eliminated by the matching process. As ACL injuries typically occur in an athletically active population,[8] return to sports participation after ACL injury is an important measure. In this study, the patients were classified as having returned to sport if they reported participation in their preinjury main sport at the 1-year follow-up. Still, it is unknown whether the patients had returned to their previous level of play or level of performance. This definition also excludes patients who chose to quit their preinjury main sport but were active in other sports. Finally, we did not register the reasons why patients had not returned to sport. A systematic review recently reported fear of reinjury to be a more dominant reason for not returning to sport after ACL reconstruction than problems with the reconstructed knee.[3] A more detailed registration of athletic participation might therefore be needed to disclose other differences between nonoperatively and operatively treated patients.

CONCLUSION

There was no significant difference in return to pivoting sport rates between ACL-injured patients following a nonoperative treatment course, including recommendations of activity modifications, and operatively treated patients in this pair-matched cohort study. Although nonoperatively treated patients were recommended not to return to level I sports, 55% of these patients returned to sport. Clinicians should therefore be aware of a potentially high level of noncompliance to recommendations of activity modifications.

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