On-Field Tests for Patients After Anterior Cruciate Ligament Reconstruction

A Scoping Review

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Background: After anterior cruciate ligament reconstruction (ACLR), a patient's physical capacities, such as (repeated) sprint performance, agility performance, and intermittent endurance performance, are often reduced because of detraining effects. Monitoring the progression of these physical capacities is essential for specific training goals before patients return to complex team sports.

Purpose: To map the existing literature regarding on-field tests for (repeated) sprint performance, agility performance, and intermittent endurance performance in patients after ACLR.

Study Design: Scoping review; Level of evidence, 4.

Methods: A search was performed in 4 electronic databases, PubMed, Embase, CINAHL, and PsycInfo, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for scoping reviews.

Results: There were 11 studies that met the inclusion criteria and described a total of 14 on-field tests for patients after ACLR. Overall, 2 tests were described for sprint performance, 11 tests were related to agility performance, and 1 test was performed for intermittent endurance performance.

Conclusion: The results of this scoping review provide an overview of on-field tests to monitor sport-specific progression and to set performance-specific training goals for patients after ACLR before returning to complex team sports.

Keywords: scoping review; anterior cruciate ligament; return to sport; on-field rehabilitation; testing

The decision of whether and when a patient is ready to return to complex team sports after anterior cruciate ligament (ACL) reconstruction (ACLR) is multifactorial and therefore challenging. Current test batteries for patients after ACLR are mainly focused on muscle strength, hop tests, and psychological factors. These test batteries lack assessments and outcomes related to optimal performance for complex team sports. For example, it is uncertain if performance on a hop for distance test can be translated to a sport-specific situation in which a patient needs to react to opponents, teammates, and the ball. Additionally, the test batteries are often not administered in a sport-specific environment in which the patient has to perform during complex team sports. There is a need for more ecological, valid, sport-specific tests that better reflect the demands of complex team sports.

Complex team sports are characterized by intermittent bursts of high-intensity exercise and require the execution of complex sport-specific skills and cognitive tasks over a prolonged period of time (1-2 hours), with longer breaks at scheduled intervals (eg, half-time break) as well as unscheduled times (eg, injury or restarting play after scoring in soccer). In complex team sports, performance depends on physical capacities such as (repeated) sprint performance, agility performance, and intermittent endurance performance. Using soccer as an example, sprints tend to be relatively short and rely on the ability to

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accelerate quickly and change direction. During a 90-minute soccer game, players sprint 200 to 400 m. In addition to sprint performance, agility performance is important. Agility is defined as a rapid whole-body movement with a change in velocity or direction in response to a stimulus. During a soccer match, players change direction every 2 to 4 seconds, thus making 1200 to 1400 changes in direction, most of which are fast 180° turns. Also, complex team sports require sport-specific endurance to maintain performance during training or a match. For example, during a soccer match, players run about 10 km at an average intensity close to the anaerobic threshold.

For patients after ACLR, these physical capacities are often impaired because of detraining effects as a result of the injury and period after ACLR. It is important that patients after ACLR are exposed to the sport-specific demands of complex team sports during rehabilitation to be fully prepared for return to sports (RTS). These physical capacities should therefore be incorporated in ACLR rehabilitation. Thus, it is advised to include so-called on-field rehabilitation (OFR) for patients after ACLR as the bridge between gymnasium-based rehabilitation and the team sports environment. Monitoring the progression of these physical capacities, such as (repeated) sprint performance, agility performance, and intermittent endurance performance, is suggested to be essential for successful participation in complex team sports in patients after ACLR. By monitoring these physical capacities, performance-specific training goals can be set for both the patient and staff members.

Currently, little is known about on-field tests for physical capacities, including (repeated) sprint performance, agility performance, and intermittent endurance performance, which can help in guiding the final phase of ACLR rehabilitation before RTS. Therefore, the purpose of this scoping review was to map the existing literature regarding on-field tests for (repeated) sprint performance, agility performance, and intermittent endurance performance in patients after ACLR.

METHODS

This scoping review was performed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

Selection Criteria

Studies had to meet the following inclusion criteria: (1) tests for progression through ACLR rehabilitation or RTS; (2) patients after ACLR with a bone–patellar tendon–bone graft, hamstring tendon graft, quadriceps tendon graft, or allograft; (3) professional or competitive recreational level; (4) description of an on-field test; (5) available in full text; and (6) written in English. Studies were excluded if (1) there was no clear description of the tests, (2) tests were performed in a laboratory setting, (3) studies were focused on the prevention of ACL injuries instead of rehabilitation, and (4) studies were focused on other injuries than ACL injuries. A disagreement between the 2 authors regarding eligibility was followed by a discussion until a consensus was reached.

Search Strategy

A literature search was performed in 4 electronic databases: PubMed (between 1966 and February 2021), Embase (between 1947 and February 2021), CINAHL (between 1981 and February 2021), and PsycInfo (between 1989 and February 2021). The search terms per database can be found in Appendix Table A1. All published studies up to February 28, 2021 were considered eligible. The results of the searches were compiled. After that, duplicates were removed.

Study Selection

Potentially relevant studies were first screened by title and abstract by both authors independently. Furthermore, references in full-text articles were screened for additional relevant studies, and a “snowball” technique was adopted in which citations within studies were searched if they appeared relevant to the scoping review. Any disagreements between the authors were resolved by a discussion.

Data Collection

The authors extracted all relevant data independently. The following study characteristics were collected from the included studies: study design, participants, sport, and criteria and outcomes for on-field tests. The main outcome of interest in the current study was the use of an on-field test for patients after ACLR during rehabilitation. The secondary outcome was the description of a criterion for on-field tests. An additional search was performed regarding the reliability and validity of each on-field test.

RESULTS

Search Results

After removing duplicates and screening titles and abstracts, 232 studies were analyzed. Based on the inclusion and exclusion criteria, 11 studies were included in the current scoping review (Figure 1). Of the included studies, 7 had only male patients, and 4 studies had a combination of male and female patients. Soccer was identified as the predominant sport in the described on-field tests, followed by football, basketball, handball, volleyball, and lacrosse. All studies were published in the past 11 years, and 8 studies were published in the past 6 years.

On-Field Tests

Overall, 14 on-field tests were mentioned in the included studies.

(Repeted) Sprint Performance. A total of 2 tests related to sprint performance were described in 2 studies: the
sprint braking test\(^5\) and the peak speed test.\(^{36}\) The protocol for the sprint braking test is a maximal sprint of 30 m. In the peak speed test, patients need to sprint 12 times from 0 to 40 m as fast as possible.

**Agility Performance.** A total of 11 agility performance tests were described in 10 different studies (Table 1). The study of Bisciotti et al\(^{17}\) described 2 tests for agility performance: the Illinois agility test and the modified Illinois agility test with a ball for soccer players. Blakeney et al\(^8\) included the modified Illinois agility test. Additionally, the co-contraction test was described in 3 studies,\(^{26,28,32}\) and the run test with maximal speed and change-of-direction maneuvers was described by Królikowska et al.\(^{29}\) Kyritsis et al\(^{31}\) included the running T-test, and 2 studies included the modified agility T-test.\(^{18,39}\) In addition, the study of Nyland et al\(^{40}\) included the L-agility test and the 5-10-5 agility test. Lastly, Myer et al\(^{39}\) described the modified long shuttle test and the modified pro-shuttle test.

**Intermittent Endurance Performance.** Overall, 1 test for intermittent endurance performance was mentioned in 3 studies: the shuttle run test (Table 1).\(^{26,28,32}\)

**Criteria for On-Field Tests**

Criteria for on-field tests were mentioned for 5 tests (35.7\%), described in 3 studies (Table 1).\(^{5,8,31}\)

**Reliability and Validity of On-Field Tests**

The reliability and validity of each on-field test can be found in Table 1. Reliability and validity were not evaluated for the sprint braking test, the peak speed test, the modified pro-shuttle test, the modified long shuttle test, the L-agility test, or the 5-10-5 agility test.

**DISCUSSION**

This scoping review identified a total of 14 on-field tests for patients after ACLR. Only one-third of the on-field tests described a criterion for RTS after ACLR.

Detraining effects often reduce physical capacities such as (repeated) sprint performance, agility performance, and intermittent endurance performance as a result of an ACL injury, ACLR, and the rehabilitation period after ACLR.\(^{37,44}\) Therefore, it is advised to monitor these elements to set performance-specific training goals. Current clinical RTS test batteries are mainly focused on muscle strength, hop tests, and psychological factors.\(^{22,34,51,53,54}\) These clinical test batteries provide some information about the patient's physical capacity, but these tests alone may provide an incomplete evaluation of the patient because they lack performance-related elements.\(^{35}\) Thus, a paradigm shift may be necessary regarding more ecological, valid, sport-specific demanding tests, including performance-related outcomes.\(^{21,50}\)

(Repeated) Sprint Performance

The ability to sprint is a determinant of performance in complex team sports.\(^{47}\) Repeated sprint ability is especially important because short-duration sprints (<10 seconds), including recovery periods, are common in complex team sports.\(^8\) Only one of the included studies described a repeated sprint performance test for patients after ACLR. In detail, McGrath and colleagues\(^{36}\) described a test of 12 sprints for 40 m with maximal acceleration for measuring peak speed. The results of that study showed a strong correlation between peak speed and RTS rates, which indicates that repeated sprint performance is essential for RTS success in patients after ACLR. Unfortunately, the recovery period time between the 12 sprints was not described, and therefore, this study is not reproducible.\(^{36}\) Another test for measuring sprint performance in patients after ACLR is the sprint braking test.\(^5\) The purpose of the sprint braking test is to quantify the effectiveness of the contraction of the flexor muscles during the braking phase by dissipating kinetic energy during a 30-m sprint, as fast as possible, to zero.\(^5\) This is a relatively difficult method of testing sprint performance and might be more a method for assessing deceleration performance. The results of this scoping review show a lack of on-field tests for monitoring repeated sprint performance for patients after ACLR. In addition, this indicates that measuring repeated sprint performance is not part of the standard approach in rehabilitation after ACLR. The findings of the current scoping review imply that there might be a need for more simple tests to monitor sprint performance in patients after ACLR. For the final phase of rehabilitation after ACLR, it is suggested that repeated sprint ability is essential for optimal performance and RTS success.\(^{36}\) Therefore, it is advised that repeated sprint performance should be included in rehabilitation and tested over time so that progression can be monitored.
| Lead Author (Year) | Sex, Male/Female, n | Age, Mean ± SD, y | Sport | Tests | Criteria | Reliability | Validity | Main Outcomes |
|-------------------|-------------------|------------------|-------|-------|----------|-------------|----------|---------------|
| Bisciotti (2016) | 80/0              | 24.4 ± 6.1       | Soccer | Sprint braking test | NE | Excellent | Very large | No main outcomes for on-field tests |
|                   |                   |                  |       | Illinois agility test | NR |            |          |               |
|                   |                   |                  |       | Modified Illinois agility test (with ball) | 12.5 s (3 points), 12.5-13.5 s (2 points), and >13.5 s (1 point) | Excellent | Very large |               |
| Blakeney (2018)   | ACLR: 287/84      | ACLR: 28.0 ± 9.9 | NR    | Modified Illinois change-of-direction test | ≤12.5 s (3 points), 12.5-13.5 s (2 points), and >13.5 s (1 point) | Excellent | Very large | No main outcomes for on-field tests |
|                   | RTS: 25/8         | RTS: 22.9 ± 6.2  |       | Co-contraction test | — |            |          |               |
|                   | Control: 29/10     | Control: 6.5 ±   |       | Shuttle run test | — |            |          |               |
|                   |                   | 8.0              |       |                   |     |            |          |               |
| Dickerson (2020)  | 9/21              | 19.4 ± 4.2       | NR    | Modified agility T-test | — | Excellent | Very large | Agility in patients after ACLR improved in 3 mo after RTS |
|                   |                   |                  |       | Co-contraction test | — |            |          | Significant differences in co-contraction test between RTS and no RTS groups |
|                   |                   |                  |       | Shuttle run test | — |            |          | On-field tests are important indicators of knee function after ACLR |
| Jang (2014)       | RTS: 51/0         | RTS: 21.9 ± 4.0  | NR    | Co-contraction test | — |            |          |               |
|                   | No RTS: 16/0      | No RTS: 21.8 ±   |       | Shuttle run test | — |            |          |               |
|                   |                   | 3.5              |       |                   |     |            |          |               |
| Kong (2012)       | ACLR: 30/0        | ACLR: 23.4 ± 3.2 | NR    | Co-contraction test | — |            |          | On-field tests are important indicators of knee function after ACLR |
|                   | Control: 30/0      | Control: 24.7 ±  |       | Shuttle run test | — |            |          |               |
|                   |                   | 2.2              |       |                   |     |            |          |               |
| Krolikowska (2018)| Supervised PT and RTS (>6 mo): 15/0 | Supervised PT (>6 mo) and independent RTS (not supervised): 27.5 | NR | Run test with maximal speed and change-of-direction maneuvers | — | Excellent | Very large | Longer duration of rehabilitation improved speed and agility in patients at 8 mo after ACLR to level of healthy patients |
|                   | Supervised PT (<3 mo) and independent RTS (not supervised): | Supervised PT (<3 mo) and independent RTS (not supervised): |       |                   |     |            |          |               |
|                   | 15/0              | 24.6             |       |                   |     |            |          |               |
|                   | Control: 30/0      | Control: 25.3    |       |                   |     |            |          |               |
| Kyritsis (2016)   | No second ACL injury: 132/0 | No second ACL injury: 21 ± 4 | Soccer, handball | Sprint braking test | NE | Excellent | Large | Athletes not meeting criteria before RTS had 4 times greater risk of sustaining second ACL injury compared with those who achieved RTS after passing criteria |
|                   | Second ACL injury: 26/0 | Second ACL injury: 22 ± 5 |       | Sprint braking test | — |            |          |               |
|                   |                   |                  |       | Illinois agility test | — |            |          |               |
|                   |                   |                  |       | Modified Illinois agility test (with ball) | — |            |          |               |
| Lee (2018)        | 75/0              | 27.5 ± 9.2       | NR    | Co-contraction test | — |            |          | No further main outcomes for on-field tests |
|                   |                   |                  |       | Shuttle run test | — |            |          |               |
| McGrath (2017)    | ACLR: 44/20       | ACLR: 27.9       | NR    | Peak speed test | — |            |          | Ability to achieve peak speed during running at 24 wk after ACLR was strongly correlated with RTS outcomes at 12 and 24 mo |
|                   | Control: 16/16    | Control: 26.3    |       |                   |     |            |          |               |
Agility Performance

Agility is defined as a rapid whole-body movement with a change in velocity or direction in response to, for example, another patient’s movement, movement of the opponent, movement of play, or movement of the ball. Preplanned change-of-direction movements include those in which patients know what to do before a movement, such as specific instructions before a test. However, it is uncertain if preplanned movements should be defined as change-of-direction movements instead of agility movements because preplanned movements do not entail a reaction to a stimulus. Reactive agility, however, refers to an athlete reacting to an actual stimulus, such as verbal instructions (go "left" or go "right") or flashing lights. Reactive movements especially challenge biomechanics and increase knee loads more than preplanned movements do. Knee loads could be twice as high during reactive movements compared with preplanned movements, which makes reactive agility more comparable to movement behaviors in pivoting sports. Considering that complex team sports include these reactive agility movements, it is important to prepare our patients for these knee loads by including these movements in the final phase of ACLR rehabilitation. Furthermore, these agility movements should be tested and monitored over time for optimal performance when returning back to the field. We advise to develop training and testing from preplanned change-of-direction movements to reactive agility.

The current study identified a total of 11 agility tests, which all include preplanned movements. Furthermore, the criteria for “excellent performance” from the study of Bisciotti et al came from a database with reference values. These reference values might be useful when testing patients after ACLR. However, it is unknown how specific these reference values are for type of sport, sex, and/or age. Therefore, caution is warranted when using these reference values, and more research in this area is needed. Additionally, the study of Blakeney et al used a criterion of ≤12.5 seconds on the modified Illinois agility test as a maximal score, and Kyritsis and colleagues used <11 seconds on the running T-test as a criterion for passing the test. However, it is unknown how these criteria were established. Furthermore, no associations were found between performance on the running T-test and the risk of a second ACL injury. A clinical commentary on criteria-driven progression through the last phase of ACLR rehabilitation proposed a criterion of a performance score (time) within 10% of the uninjured leg. However, caution is warranted when using the uninjured leg as a reference value for the injured leg because this can mask bilateral deficits and can therefore overestimate performance. The use of preinjury data might be an alternative, but unfortunately, this is not available for most patients. In addition to only focusing on performance aspects during agility tests, the quality of a patient’s movement is suggested to be essential for the prevention of second ACL injuries. Previous research has also demonstrated between-limb differences in biomechanics during both preplanned change-of-direction and reactive agility movements at 9 months after ACLR in a laboratory setting. Recently, the Cutting Movement Assessment Score was developed as a qualitative screening tool for analyzing cutting movements. The Cutting Movement Assessment Score includes a 9-item scale in which trials are videotaped and scored afterwards, comparable with the Landing Error Scoring System for analyzing a vertical drop jump. This clinically friendly test might be a useful tool for analyzing movement quality in patients after ACLR during preplanned change-of-direction movements and reactive agility movements in the last phase of rehabilitation.

The identified agility tests in the current scoping review were all related to preplanned change-of-direction movements. Preplanned change-of-direction movements show 

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**Table 1 (continued)**

| Lead Author | Sex, Male/Female, n | Age, Mean ± SD, y | Sport | Tests | Criteria | Reliability<sup>a</sup> | Validity<sup>b</sup> | Main Outcomes |
|-------------|---------------------|-------------------|-------|-------|----------|--------------------------|-----------------|---------------|
| Myer<sup>c</sup> (2011) | ♂ | ACR (RTS) | ♂ | ACR (RTS) | Football, soccer, basketball, volleyball | Modified agility T-test, Modified pro-shuttle test, Modified long shuttle test | — | Modified agility T-test: excellent<sup>d</sup> | Modified agility T-test: very large<sup>d</sup> | No asymmetries between injured and uninjured legs were found in performance of on-field tests in patients after ACLR (RTS 1 y): 18/0 (20/0) football, 16.9 ± 2.1 (16.0 ± 1.1) control: 20.3 ± 7.2 (20.3 ± 7.2) volleyball 1.1 (1.1) | | |
| Nyland<sup>c</sup> (2020) | 83/67 | 20.3 ± 7.2 | Football, soccer, lacrosse | • L-agility test | — | NE | NE | No further main outcomes for on-field tests |

<sup>a</sup>ACL, anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction; NE, not evaluated; NR, not reported; PT, physical therapy; RTS, return to sports. Dashes indicate not described.

<sup>b</sup>Reliability was determined by calculating the intraclass correlation coefficient: <0.40 (poor), 0.40-0.70 (fair), 0.70-0.90 (good), and >0.90 (excellent).

<sup>c</sup>Validity was determined by calculating the Pearson product-moment correlation coefficient: 0.1-0.3 (small), 0.3-0.5 (moderate), 0.5-0.7 (large), and 0.7-0.9 (very large).

<sup>d</sup>Extracted from the ACLR group.
Interventions are needed to provide comprehensive rehabilitation protocols. The importance of reactive agility cannot be overstated in the context of ACLR. As mentioned, knee loads are twice as high during reactive movements compared with preplanned movements, which make reactive agility more comparable to movement behaviors in pivoting sports compared with preplanned change-of-direction movements. It is important to prepare patients for these knee loads before RTS, and therefore, there is a need for more reactive agility training and tests. Recently, Wilke and colleagues developed reactive agility tests using a sensor-based system with light-emitting diodes in which athletes need to respond to a stimulus. This is a first step toward more reactive agility tests, and future research should investigate the use of these sensor-based systems in patients after ACLR. Additionally, virtual reality simulation may provide a competitive environment in which reactive agility can be trained and measured for patients after ACLR. This might lead to more understanding of reactive agility performance in patients after ACLR before RTS.

Intermittent Endurance Performance

It is essential that patients have sufficient intermittent endurance performance to participate during training or a match. Because of detraining effects after an ACL injury and ACLR, intermittent endurance performance of patients is often reduced. In detail, a study by Almeida and colleagues found reduced endurance performance in professional soccer players after ACLR compared with a control group. This indicates that restoring endurance performance after ACLR needs more attention during rehabilitation. The study by Della Villa et al showed that the endurance capacity of patients after ACLR (measured via a treadmill run) can be optimized by following an OFR program. The results of the current scoping review showed that only 1 test was described for measuring intermittent endurance performance: a shuttle run test without a criterion for RTS. Alternatively, the interval shuttle run test and yo-yo intermittent recovery test are more specific tests for measuring intermittent endurance performance and, therefore, more valid for complex team sports compared with the shuttle run test. Specifically, the yo-yo intermittent recovery test is a valid measure of intermittent endurance performance for soccer players because during the test, both the aerobic and anaerobic energy systems approach maximal values. Currently, thresholds for different phases related to intermittent endurance performance are unknown. Therefore, creating norm values for different complex team sports (soccer, handball, or basketball) and different positions (eg, defenders, midfielders, or attackers) could be helpful for decision-making in the last phase of rehabilitation.

Practical Implications

Because recent research has emphasized the importance of sport-specific OFR for RTS in complex team sports after ACLR, we suggest monitoring (repeated) sprint performance, agility performance, and intermittent endurance performance over time to set performance-specific training goals. This information can be helpful in guiding the final phase of ACLR rehabilitation before RTS. Many studies have described clinical test batteries, including muscle strength, hop tests, and psychological factors, and, therefore, provide incomplete information about a patient’s physical capacity. However, these clinical test batteries are still important because research has shown that muscle strength imbalances are a good predictor of imbalances (stronger vs weaker leg) in the performance of agility tasks. Also, movement technique has been suggested to play a key role in the performance of agility movements. These findings emphasize that current clinical tests are important as minimal requirements for OFR but might not be sufficient enough as criteria for RTS. There is a need for a paradigm shift in RTS testing from prevention to performance, including more ecological, valid, sport-specific tests that better reflect the demands of complex team sports.

Not only clinicians but also all members of a multidisciplinary team (patient, medical staff, coaching staff) should participate in managing the balance among rehabilitation, training, and competitive sports within the RTS continuum for each athlete. This is called a shared decision-making process. To monitor rehabilitation progression, the multidisciplinary team should create an individual RTS profile based on repeated measurements assessing the strengths and weaknesses of the performance outcomes. With consistent monitoring of the rehabilitation progress, RTS becomes a dynamic process with an individual approach instead of a static moment in time. Importantly, nonclinicians such as the coaching staff should participate in the decision-making process.

The results of the current scoping review showed that there is a lack of on-field tests for measuring (repeated) sprint performance, agility performance, and intermittent endurance performance for patients after ACLR. It is important to mention that a lack of described tests does not indicate that these physical capacities are not integrated in rehabilitation for patients after ACLR. Future research is needed to understand which on-field criteria may be necessary for successful RTS after ACLR.

Limitations

This scoping review is the first study that is primarily focused on on-field tests and criteria for patients after ACLR. However, this study is not without limitations. The current study was focused on patients after ACLR only. Therefore, the results cannot be generalized to other sport injuries. Furthermore, more than half of the included studies consisted of only male patients, and therefore, the results cannot be generalized to female patients. This is of concern because female patients are at a higher risk of ACL injuries compared with male patients. Future research should focus on creating an on-field test battery, including tests for (repeated) sprint performance, agility performance, and intermittent endurance performance. Furthermore, future research should focus on longitudinal
prospective studies in which patients after ACLR are tested using an on-field test battery and followed over time.

CONCLUSION

The current scoping review showed that there are limited on-field tests and criteria for measuring (repeated) sprint performance, agility performance, and intermittent endurance performance for patients after ACLR. These findings suggest that testing and monitoring these physical capacities are not part of the standard approach in ACLR rehabilitation. Furthermore, current on-field tests do not appear to be in agreement with relevant demands for pivoting sports. Future research should be focused on bridging this gap by implementing more sport-specific tests before RTS.

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APPENDIX

| TABLE A1 | Search Terms by Database |
|----------|--------------------------|
| PubMed (between 1966 and February 2021) | (“Anterior cruciate ligament reconstruction” [Mesh] OR ACL reconstruction*[tiab] OR anterior cruciate ligament inju*[tiab] OR ACL rehabilitation*[tiab] OR ACL recovery*[tiab]) AND (return to sport*[Mesh] OR return to play*[tiab] OR return to performance*[tiab] OR return to competition*[tiab]) AND (on-field test*[tiab] OR performance outcome*[tiab] OR field test batter*[tiab] OR agility*[tiab] OR sprint*[tiab] OR endurance*[tiab] OR shuttle run test*[tiab] OR functional performance test*[ti] OR test batter*[tiab] OR decision-making*[tiab] OR crit*[tiab] OR return to sport crit*[tiab] OR return to play crit*[tiab]) |
| Embase (between 1947 and February 2021) | (‘Anterior cruciate ligament reconstruction’: ab, ti OR ‘ACL reconstruction’: ab, ti OR ‘anterior cruciate ligament inju’: ab, ti OR ‘ACL rehabilitation’: ab, ti OR ‘ACL recovery’: ab, ti) AND (‘return to sport’: ab, ti OR ‘return to play’: ab, ti OR ‘return to performance’: ab, ti OR ‘return to competition’: ab, ti) AND (‘on-field test’: ab, ti OR ‘performance outcome’: ab, ti OR ‘field test batter’: ab, ti OR ‘agility’: ab OR ‘sprint’: ab OR ‘endurance’: ab OR ‘shuttle run test’: ab OR ‘functional performance test’: ti OR ‘test’: ti OR ‘measur’: ti OR ‘test batter’: ab, ti OR ‘decision-making’: ab, ti OR ‘crit’: ab, ti OR ‘return to sport crit’: ab, ti OR ‘return to play crit’: ab, ti) |
| CINAHL (between 1981 and February 2021) | (Anterior cruciate ligament reconstruction OR TI ACL reconstruction* OR AB ACL reconstruction* OR TI anterior cruciate ligament inju* OR AB anterior cruciate ligament inju* OR TI ACL rehabilitation OR AB ACL rehabilitation OR TI ACL recovery) AND (return to sport* OR TI return to play OR AB return to performance OR AB return to performance OR TI return to competition OR AB return to competition) AND (TI on-field test* OR AB on-field test* OR TI performance outcome* OR AB performance outcome* OR AB field test batter* OR AB agility OR AB sprint OR AB endurance OR AB shuttle run test OR TI functional performance test* OR AB functional performance test* OR TI test* OR TI measur* OR TI test batter* OR AB test batter* OR TI decision-making OR AB decision-making OR TI crit* OR AB crit* OR TI return to sport crit* OR AB return to sport crit* OR TI return to play crit* OR AB return to play crit*) |
| PsychInfo (between 1989 and February 2021) | (Anterior cruciate ligament reconstruction OR TI ACL reconstruction* OR AB ACL reconstruction* OR TI anterior cruciate ligament inju* OR AB anterior cruciate ligament inju* OR TI ACL rehabilitation OR AB ACL rehabilitation OR TI ACL recovery) AND (return to sport* OR TI return to play OR AB return to performance OR AB return to performance OR TI return to competition OR AB return to competition) AND (TI on-field test* OR AB on-field test* OR TI performance outcome* OR AB performance outcome* OR AB field test batter* OR AB agility OR AB sprint OR AB endurance OR AB shuttle run test OR TI functional performance test* OR AB functional performance test* OR TI test* OR TI measur* OR TI test batter* OR AB test batter* OR TI decision-making OR AB decision-making OR TI crit* OR AB crit* OR TI return to sport crit* OR AB return to sport crit* OR TI return to play crit* OR AB return to play crit*) |