

Return to Sport Tests' Prognostic Value after Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta Analysis

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Corresponding author:

Xuefeng Wang

825318550@qq.com

Author Affiliation:

Shanghai University of Sport.

Wang, XF¹, Yuan, P², Yu, SQ³; Xu, LL⁴, Yang, L⁵.**ADMINISTRATIVE INFORMATION****Support** - Shanghai Sports Science and Technology Project (22J05).**Review Stage at time of this submission** - Preliminary searches.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202360096**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 June 2023 and was last updated on 30 June 2023.**INTRODUCTION**

Review question / Objective What return-to-sport(RTS) tests have been used to clear athletes to return to sport after primary ACL reconstruction? Do these tests have prognostic value to identify reinjury risk and readiness for RTS? P (Population) : patients who want to return to sport with anterior cruciate ligament reconstruction. I (Intervention) : Return to sport tests were used to assess the status of ACL for patients. C (Comparison) : RTS tests passed group or RTS tests failed group. O (Outcome) : return to sport or not/ACL reinjury or not. S (Study Design) : observational studies (including cohort and case-control studies).

Rationale To improve the success rate of RTS (return to sport) and reduce the risk of ACL (anterior cruciate ligament) re-injury, the academic consensus is that the RTS test should

be used in the decision-making process of RTS to reflect the recovery of ACL. However, the application of RTS testing is not uniform because its prognostic value is still controversial. Our study differentiated patients who passed and failed the RTS tests and compared the rate of RTS and reinjury between the two groups. In this way, it can be seen whether the current test has value and is worthy of widespread application.

Condition being studied Anterior cruciate ligament (ACL) injury is the most common injury of the knee joint. For athletes trying to return to competitive sports, anterior cruciate ligament reconstruction (ACLR) is the best treatment for ACL injuries. However, studies have reported that less than two-thirds of patients can return to preinjury sports, and the reported re-injury rate is as high as 37.5%. In order to improve the success rate of RTS and reduce the risk of ACL re-injury, the academic consensus is that RTS test should be used in the decision-making process of RTS to reflect the recovery of ACL.

METHODS

Search strategy The English databases included EBSCO (CINAHL, MEDLINE, SPORTDiscus), Web of Science and PubMed, and the Chinese databases included CNKI and Wanfang database. The search date was limited from January 1, 2000 to November 11, 2022. The keywords of "anterior cruciate ligament", "reconstruction surgery", "return to sport" and "test" were searched, and Boolean logic operation was used to limit the search scope.

(1) English search strategy: #1 "ACL" or "anterior cruciate ligament" #2 "ACLR" or "reconstruct*" or "rehabilitat*" or "repair" or "operati*" or "surgery" or "surgical" #3 "RTS" or "return-to-sport" or "return to sport*" or "return to play" or "return to athletic" or "return to activity" or "return to competi*" or "return to training" or "return to previous" or "return to pre-injury" or "return to function" or "return to participat*" or "return to performance" #4 "criterion" or "criteria" or "guideline*" or "test*" or "measure*" or "standard*" or "assess*" or "batter*" or "evaluat*" or "examin*" or "predict*" or "time" or "scor*" or "index" or "rating" or "scale" or "survey" or "system" #1 and #2 and #3 and #4

(2) Chinese search strategy: #1 "前交叉韧带" or "ACL" or "ACLR" or "前十字韧带" #2 "重返赛场" or "重返比赛" or "重返体育" or "重返运动" or "重返活动" or "回归运动" or "恢复运动" or "重返运动" or "重返竞赛" #3 "撕裂" or "手术" or "康复" or "重建" or "修复" or "损伤" #1 and #2 and #3.

Participant or population Patients with primary anterior cruciate ligament reconstruction; athletes of any age or competition level.

Intervention The Return-to-Sport Tests are applicable to athletes who have undergone anterior cruciate ligament (ACL) reconstruction and are seeking to return to sports. Its objective is to identify patients at risk of re-injury and restrict their return to sports activities. However, patients who passed the RTS test were able to safely return to their preinjury levels of sports. The return-to-sport tests include strength tests, hop tests, patient-reported outcome measures, clinical examinations, and performance-based tests. Only athletes who successfully pass each individual test are considered as the "Test Passed" group, indicating their readiness to return to sports.

Comparator RTS test passed group and RTS failed group.

Study designs to be included We will include observational studies (including cohort and case-control studies) to assess prognostic value of return-to-sport tests.

Eligibility criteria Inclusion criteria: (1) patients with primary anterior cruciate ligament reconstruction; (2) athletes of any level, those with Tegner \geq 5 or regular exercise habit, and (3) the level and number of return-to-sport or the number of re-injury cases clearly stated in the outcomes; (4) report the RTS test protocol. Exclusion criteria: (1) reviews, reviews, books, consensus, comments, letters, scientific and technological achievements, appendices, guidelines, statements, etc. (2) Non-Chinese and English literature, literature whose results could not be obtained, literature whose full text could not be obtained, literature which was repeatedly published or withdrawn; (3) no description of return to sport or reinjury, or no return to pre-injury sport or level; (4) conservative treatment, non-ACLR or ACL revision; (4) Non-athletes, those with tegner < 5 and irregular exercise; (5) RTS test was not specified.

Information sources The English databases included EBSCO (CINAHL, MEDLINE, SPORTDiscus), Web of Science and PubMed, and the Chinese databases included CNKI and Wanfang database.

Main outcome(s) Patients' rates of anterior cruciate ligament and return-to-sport were recorded from the available last follow-up. Return to sport: A successful return to pre-injury activity level or return to pre-injury activities was defined as the return to sport; re-injury: re-injury was defined as any ACL injury on either side that occurred after ACLR.

Additional outcome(s) None.

Data management Two authors extracted data from each included article separately, and any disagreement needed to be reviewed by a third author. The final assessment result was decided by the three authors with consultation. The number of people who passed and failed the RTS test, the number of people who returned to sport in both groups, and the number of future ACL injury were recorded. The reported application of RTS test, the degree of exercise participation and the level of return to exercise were also collected.

Quality assessment / Risk of bias analysis The Methodological Index for Non-Randomized Studies (MINORS) was used to evaluate the quality of the included studies. The MINORS scale is

applicable to observational studies, such as case-control, cohort studies and case series. According to MINORS, 8 articles were scored for literature without control group, 12 articles were scored for literature with control group, and 2 points were scored for report and qualified, 1 point was scored for report but not qualified, and 0 point was scored for no report.

Strategy of data synthesis Review Manager.5.3 was used to analyze the risk ratio (RR) of return to sport and the number of re-injury in the passed group and the failed group. This meta-analysis compared the rate of ACL reinjury and return to sport in the passed group and failed group. If the patient passes the RTS criteria, an RR value of less than 1 indicates a reduced risk of re-injury. I^2 was used to determine the degree of variation in the results of the included studies. The larger I^2 , the more heterogeneous the study population. Random effects models were used to control for the inherent heterogeneity of the study population. A P value of less than 0.05 was considered statistically significant.

Subgroup analysis None.

Sensitivity analysis Review Manager 5.4 software was used for sensitivity analysis. One-by-one elimination method was chosen to reflect the sensitivity of the articles by the change in effect size after deleting one of the articles.

Language restriction Language limits won't be imposed on the search.

Country(ies) involved China (Shanghai University of Sport).

Other relevant information None.

Keywords anterior cruciate ligament reconstruction; return to sport; reinjury.

Contributions of each author

Author 1 - Xuefeng Wang - Author 1 : drafted the manuscript; Data extraction and analysis; Risk of bias assessment.

Email: 825318550@qq.com

Author 2 - Peng Yuan - Author 2 : Data extraction and analysis; Risk of bias assessment.

Author 3 - Shiqi Yu - Author3: Data extraction and analysis; screening of search results against eligibility criteria.

Author 4 - Yilin Xu - Author4: Risk of bias assessment; screening of search results against eligibility criteria.

Author 5 - Lei Yang - Author 5: Risk of bias assessment; screening of search results against eligibility criteria.