ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

Return to Sport Tests: Do they reduce risk of re-rupture after Anterior Cruciate Ligament Reconstruction?

David Figueroa Poblete[a], Waldo Gonzalez Duque[a], Daniela Landea Caroca[b], Camila Tapia Castillo[b], Daniela Erskine Ventura[b]

Faculty of Medicine, Clinica Alemana Santiago - Universidad del Desarrollo, Santiago de Chile

Service of Physical Medicine and Rehabilitation, Clinica Alemana Santiago, Santiago de Chile

Faculty Disclosure Information

- Nothing to disclosure.
- All the authors contributed to the design, analyses and reporting for this manuscript. Both authors read and approved the final submitted manuscript.
- No funding was required for this study.

INTRODUCTION

- In the United States, the annual incidence of anterior cruciate ligament reconstruction (ACLR) surgery ranging from 60,000 to 175,000.
- The incidence of re-rupture increases over time after surgery: 3%, 6%, 9% at follow-ups of 2, 5, 8 years, respectively.
- The timelines for return to sport (RTS) after an ACLR are variable and depend not only on time but on multiple factors.
- Among the risk factors for a second ACL injury, early RTS has been identified, especially in young patients.

INTRODUCTION

- RTS tests are tools designed to assess the functional capacity of the athlete, measuring both strength and movement control in dynamic situations.

- Despite the implementation of these tests in many rehabilitation programs, there is no consensus on their effectiveness in predicting whether passing them decreases the risk of re-rupture.

- **The objective of this study is to determine if passing the RTS tests significantly reduces the re-rupture rate in patients undergoing ACLR.**

METHODS

- Retrospective cohort study, which included patients who underwent ACLR surgery between June 2018 and May 2023.

- Excluded from the study were those with neurovascular injuries, tibial plateau fractures, multiligament reconstructions, or procedures combined with osteotomy or extra-articular tenodesis.

- After completing the rehabilitation protocol, patients underwent a magnetic resonance image to assess graft ligamentization and performed RTS tests. Those who failed the tests were advised to continue rehabilitation or attend RTS sessions.

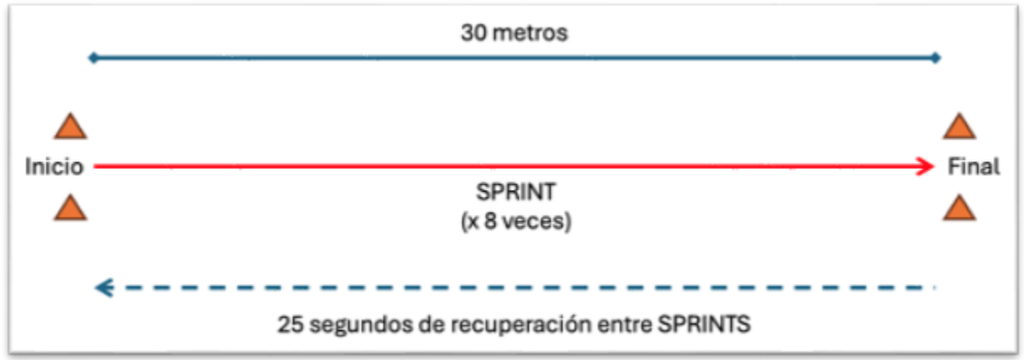
- Due to the lack of a standardized RTS battery in the literature, the test battery was designed collaboratively by the knee team's orthopedic surgeons and physiotherapists based on current evidence.

METHODS

Return to Sport Tests:

1. Repeat Sprint Ability (RSA)
2. Dynamic Valgus
3. Proagility Test
4. Unipodal Counter Movement Jump (CMJ)
5. Isokinetic
6. Triple Hop Test
7. Functional Movement Screen (FMS)

The Proagility test measures changes in direction over a ten-meter course, with the time being recorded

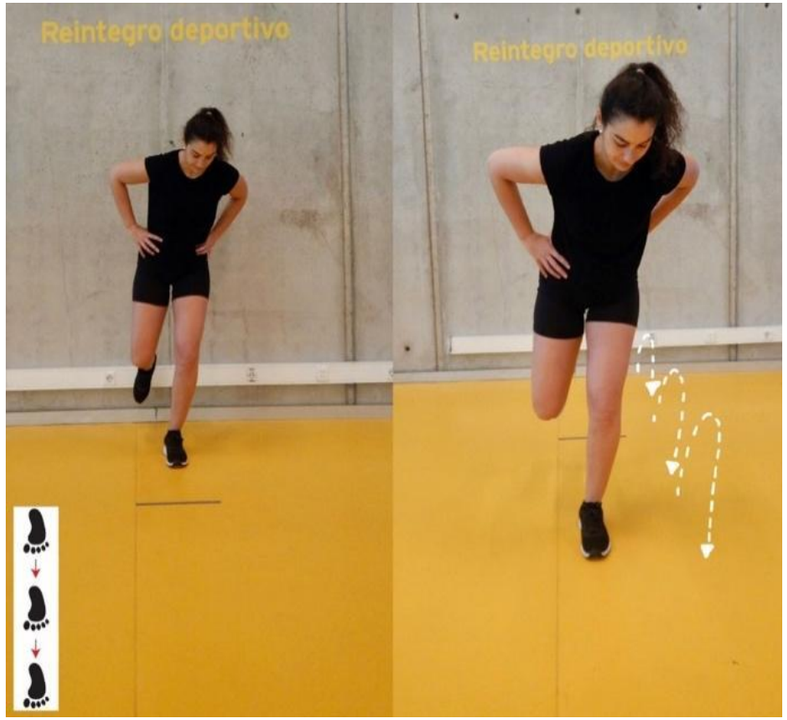


RSA: This test evaluates athletes' resistance to fatigue during high-intensity sports involving short sprints.

METHODS

Evaluation of the degrees of dynamic valgus, from dropping off a 30 cm high box followed by a maximum vertical jump.

Measurement of quadriceps and hamstring muscle strength using the HUMAC NORM isokinetic dynamometer (Computer Sports Medicine Inc., 101 Tosca Drive, Stoughton, MA, USA).



Initial and final position after performing three consecutives jumps during the Triple Hop Test. The best result obtained is recorded.

RESULTS

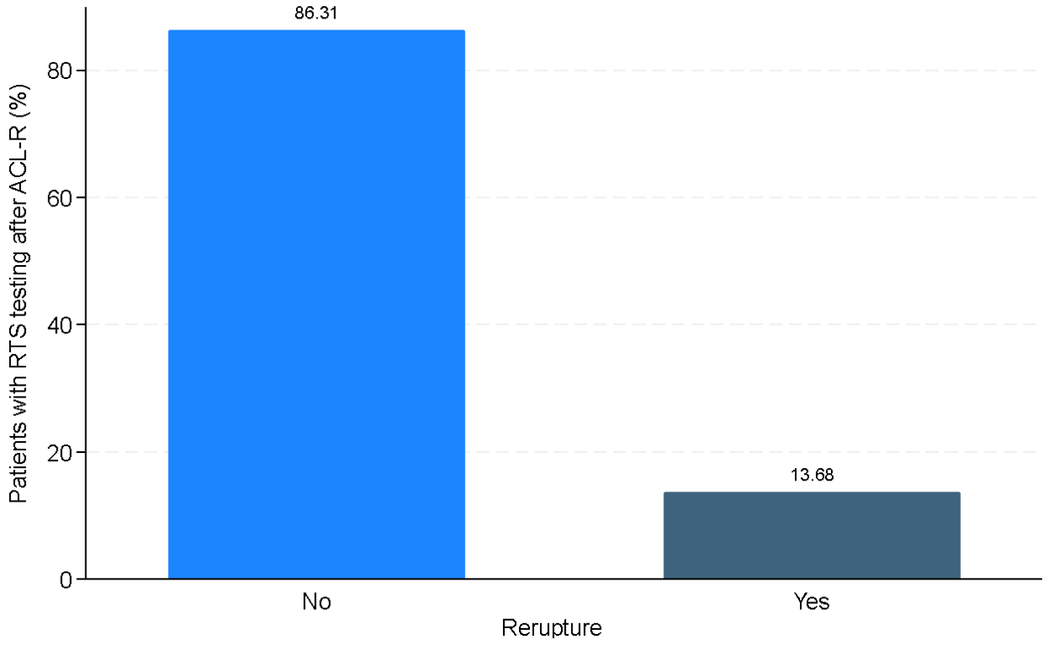
- A total of 109 patients underwent ACLR and RTS testing.
- All patients were contacted between July and September 2024 for a review.
- At follow-up, 95 patients were available, giving a follow-up rate of 87% at a mean follow-up time of 24 months.

	Re-rupture (n=13; 13.7%)	Without Re-rupture (n=82; 86.3%)	P-value
Demographic and anthropometric characteristics			
Women	4 (30.8)	23 (28.1)	0,84
Median age (IQR)	21 (21-25)	23.5 (19-32)	0,69
Median BMI (IQR)	25.4 (24.1)	24.1 (22.3-26.4)	0,27
Surgical and rehabilitation characteristics			
Type Allograft			0,94
- Allograft	1 (7.7)	8 (9.8)	
- PT	3 (23.1)	21 (25.6)	
- STG	9 (69.2)	53 (64.6)	
Days Surgery-RTS Test			0,10
- Median days (IQR)	342 (269-419)	297 (256-317)	
RTS test			0.03*
Pass	0 (0)	21 (25.6)	
Fail	13 (100)	61 (74.4)	

Baseline characteristics of patients with ACLR according to the presence of re-rupture. Legend: (*) denotes statistical significance ($p<0.05$). Abbreviations: BMI: body mass index; IQR: interquartile range; PT: patellar tendon; STG: semitendinosus and gracilis. RTS: return-to-sport.

RESULTS

- **Although the magnitude of the association was not significant, in the post hoc analysis the statistical power was found to be 0.70.**



The chart of patients represents the group that did not have re-ruptures (86.31%) versus the group that did have re-ruptures (13.68%).

DISCUSSION

- This study evaluates ACLR outcomes and re-ruptures following rehabilitation and RTS tests, aiming to determine if these tests help prevent second ACL injuries in the medium term.

- **The first finding was that no re-ruptures were reported up to the follow-up point in patients who passed the RTS tests.**

- Second ACL injury occurred in the group of patients who failed these tests. Therefore, the results suggest that passing the RTS tests after an ACLR is associated with a lower rate of re-ruptures in the medium term.

- However, the **statistical power of this study was 70%**, which limits the generalization of the results. A larger sample size and longer follow-up would be needed to confirm these findings.

DISCUSSION

- The second finding of our study was that, in patients who suffered re-ruptures, the average number of days after surgery until the RTS tests was performed was 357 days.
- **Second ACL injuries typically occur within the first 6 months to 2 years after returning to sport.**
- The time between surgery and return to sport (RTS) appears to be a critical factor in reducing the risk of reinjury. However, there is no consensus on the optimal timing for RTS.
- **The third finding of our study was that 18.18% (10 of 55 patients) of patients aged 25 years or younger suffered a re-rupture.**

CONCLUSION

- **Patients with re-ruptures were more likely to be from the group that failed the RTS tests (Pass: 0% vs. Fail: 18,1%; p= 0.03), with a statistical power of 0.70.**

- Passing the RTS tests appears to be a protective factor against re-ruptures, according to the results obtained in this study. These tests allow for an objective assessment of the patient's functional capacity before returning to competition, reducing the risk of new injuries.

- However, more research is needed to confirm these findings and optimize rehabilitation protocols.

REFERENCES

1. Lyman S, Koulouvaris P, Sherman S, Do H, Mandl LA, Marx RG. Epidemiology of anterior cruciate ligament reconstruction: trends, readmissions, and subsequent knee surgery. J Bone Joint Surg Am. 2009 Oct;91(10):2321-8. doi: 10.2106/JBJS.H.00539. PMID: 19797565.

2. Spindler KP, Wright RW. Clinical practice. Anterior cruciate ligament tear. N Engl J Med. 2008 Nov 13;359(20):2135-42. doi: 10.1056/NEJMcp0804745. PMID: 19005197; PMCID: PMC3782299.

3. Wright RW, Dunn WR, Amendola A, Andrish JT, Bergfeld J, Kaeding CC, Marx RG, McCarty EC, Parker RD, Wolcott M, Wolf BR, Spindler KP. Risk of tearing the intact anterior cruciate ligament in the contralateral knee and rupturing the anterior cruciate ligament graft during the first 2 years after anterior cruciate ligament reconstruction: a prospective MOON cohort study. Am J Sports Med. 2007 Jul;35(7):1131-4. doi: 10.1177/0363546507301318. Epub 2007 Apr 23. PMID: 17452511.

4. Salmon L, Russell V, Musgrove T, Pinczewski L, Refshauge K. Incidence and risk factors for graft rupture and contralateral rupture after anterior cruciate ligament reconstruction. Arthroscopy. 2005 Aug;21(8):948-57. doi: 10.1016/j.arthro.2005.04.110. PMID: 16084292.

5. Webster KE, Hewett TE. What is the Evidence for and Validity of Return-to-Sport Testing after Anterior Cruciate Ligament Reconstruction Surgery? A Systematic Review and Meta-Analysis. Sports Med. 2019 Jun;49(6):917-929. doi: 10.1007/s40279-019-01093-x. PMID: 30905035.

6. Lai CCH, Ardern CL, Feller JA, Webster KE. Eighty-three per cent of elite athletes return to preinjury sport after anterior cruciate ligament reconstruction: a systematic review with meta-analysis of return to sport rates, graft rupture rates and performance outcomes. Br J Sports Med. 2018 Jan;52(2):128-138. doi: 10.1136/bjsports-2016-096836. Epub 2017 Feb 21. PMID: 28223305.

7. Kaeding CC, Pedroza AD, Reinke EK, Huston LJ; MOON Consortium; Spindler KP. Risk Factors and Predictors of Subsequent ACL Injury in Either Knee After ACL Reconstruction: Prospective Analysis of 2488 Primary ACL Reconstructions From the MOON Cohort. Am J Sports Med. 2015 Jul;43(7):1583-90. doi: 10.1177/0363546515578836. Epub 2015 Apr 21. PMID: 25899429; PMCID: PMC4601557.

8. Burgi CR, Peters S, Ardern CL, Magill JR, Gomez CD, Sylvain J, Reiman MP. Which criteria are used to clear patients to return to sport after primary ACL reconstruction? A scoping review. Br J Sports Med. 2019 Sep;53(18):1154-1161. doi: 10.1136/bjsports-2018-099982. Epub 2019 Feb 2. PMID: 30712009.

9. van Melick N, van Cingel RE, Brooijmans F, Neeter C, van Tienen T, Hullegie W, Nijhuis-van der Sanden MW. Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. Br J Sports Med. 2016 Dec;50(24):1506-1515. doi: 10.1136/bjsports-2015-095898. Epub 2016 Aug 18. PMID: 27539507.

10. Nelson C, Rajan L, Day J, Hinton R, Bodendorfer BM. Postoperative Rehabilitation of Anterior Cruciate Ligament Reconstruction: A Systematic Review. Sports Med Arthrosc Rev. 2021 Jun 1;29(2):63-80. doi: 10.1097/JSA.0000000000000314. PMID: 33972483.

11. Andrade R, Pereira R, van Cingel R, Staal JB, Espregueira-Mendes J. How should clinicians rehabilitate patients after ACL reconstruction? A systematic review of clinical practice guidelines (CPGs) with a focus on quality appraisal (AGREE II). Br J Sports Med. 2020 May;54(9):512-519. doi: 10.1136/bjsports-2018-100310. Epub 2019 Jun 7. PMID: 31175108.

12. Perriman A, Leahy E, Semciw AI. The Effect of Open- Versus Closed-Kinetic-Chain Exercises on Anterior Tibial Laxity, Strength, and Function Following Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis. J Orthop Sports Phys Ther. 2018 Jul;48(7):552-566. doi: 10.2519/jospt.2018.7656. Epub 2018 Apr 23. PMID: 29685058..