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RTS TESTING DEMONSTRATES MINIMAL PREDICTIVE VALUE OF LONG-TERM OUTCOMES FOLLOWING ACL RECONSTRUCTION

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DISCLOSURES

- I (or my co-authors) have nothing to disclose

BACKGROUND

- No consensus on how to best determine an athlete's readiness to return to sport after ACL reconstruction
 - Functional testing with limb-symmetry index (LSI) evaluation is commonly utilized
 - Biomechanical testing is becoming increasingly popular
- **Little is known about the clinical utility of functional tests and biomechanical assessment at the time of RTS following ACLR**



OBJECTIVE

Systematically review the relationship between functional testing at the time of return-to-sport following ACL reconstruction and long-term outcomes

Outcomes

- 1.) Second ACL tear
- 2.) Successful return to preinjury level of sport

MATERIALS AND METHODS

- Systematic literature search of MEDLINE, EMBASE, Scopus, and Web of Science following PRISMA guidelines
- Inclusion
 - Studies examining athletes who underwent functional RTS testing in the final stages of rehabilitation and were followed for at least 12 months following RTS
- Information extracted regarding
 - Study characteristics
 - ACLR information
 - Functional test results
 - Risk factors associated with retear or reduced RTS

RESULTS

- Study Characteristics

- 1,075 studies screened
 - 22 studies included
- 4,447 patients (36.9%) women
 - Average age → 22.9 years
 - Average time between ACLR and functional testing → 8.5 months

- Reinjury Rate

- Combined (ipsilateral or contralateral): 15%
- Ipsilateral Only: 9%

RESULTS

- **Functional Testing**

- Single leg, crossover, and 6-meter timed hop tests had no correlation with reinjury in any study

- **Quadriceps strength had conflicting results**

- Quad strength deficit associated with reinjury in two studies
- No relationship in four studies
- Greater quad strength associated with reinjury in three studies

- **Hamstring Strength**

- 6/8 studies found no association between hamstring strength and reinjury

Study	Sample Size (% Women)	Time Between ACLR and Assessment, mo	Follow-Up Length	Reinjury Rate	Ipsilateral Versus Contralateral	Quad Strength	HS Strength	SLD	THD	COH	Test Battery	LOE
Ithurburn et al., 2019 ³⁹	124 (75%)	8.2	1-y post-RTS	21%	Both	NSD	NSD	NSD	Greater involved limb THD			II
Kyritsis et al., 2016 ⁴⁵	158 (0%)	7.5	21-mo post-RTS	16.5%	Ipsilateral	Decreased HS to quad strength ratio		NSD	NSD	NSD		III
Van Melick et al., 2022 ³⁸	144 (31%)	11.8	2-y post-ACLR	7%	Both	NSD	NSD				Failing hop test only battery	II
Capin et al., 2017 ³⁴	14 (100%)	6.1	2-y post-ACLR	50%	Both	NSD	Reduced hamstring force					II
Faleide et al., 2021 ³⁵	103 (49%)	10.4	2-y post-ACLR	6.8%	Both						Failing combined hop and strength battery	II
Grindem et al., 2020 ³⁶	213 (43%)	6.0	2-y post-ACLR	10.8%	Both						Failing combined hop and strength battery	II
Grindem et al., 2016 ^{37*}	100 (54%)	6.0	2-y post-ACLR	10%	Both	Reduced quad strength		NSD	NSD	NSD	NSD	II
Kew et al., 2022 ⁴⁰	100 (60%)	6.7	4-y post-ACLR	28%	Both	Greater quad strength and symmetry	NSD	NSD	NSD	NSD		IV
King et al., 2021 ⁴¹	993 (0%)	9.2	2-y post-ACLR	3.8%	Ipsilateral	NSD	NSD	NSD				II
King et al., 2021 ⁴²	993 (0%)	9.2	2-y post-ACLR	6.7%	Contralateral	Reduced contralateral quad peak torque	NSD	NSD				II
Marigi et al., 2022 ⁴⁶	344 (45.6%)	6.0	6.4-y post-ACLR	17%	Both	Greater quad LSI	Greater hamstring LSI	NSD	NSD			III
Sousa et al., 2017 ⁵²	223 (58.7%)	6.0	4- post-ACLR	12.1%	Both						Passing combined hop and strength battery	III
Simonson (2023), ⁵⁴ OJSM	835 (46.0%)	10.2	2-y post-ACLR	8.3%	Both	Greater quad strength in injured leg	NSD					III

ACL, anterior cruciate ligament; COH, crossover hop for distance; HS, hamstring; LSI, limb symmetry index; LOE, Level of Evidence; NSD, no significant difference/relationship; RTS, return to sport; SLD, single leg hop for distance; THD, triple hop for distance.

RESULTS

	Number of Subjects Included	% Passed Battery	Specificity	Sensitivity	PPV	NPV
No reinjury*	400	24.75%	78.57%	25.29%	87.88%	14.62%
Return to preinjury level of sport	220	30.45%	77.32%	36.59%	67.16%	49.02%

ACL, anterior cruciate ligament; NPV, negative predictive value; PPV, positive predictive value; RTS, return to sport.

Combined Test Batteries

- Three studies considered a combined test battery of hop and strength tests
 - LSI cut-off value of at least 90%
- 99/400 (24.75%) patients passed the test battery
 - 12/99 (12.1%) that passed suffered reinjury
 - 44/301 (14.6%) of patients that did not pass battery suffered reinjury
 - NPV: 14.6%
- Similarly poor sensitivity in predicting return to pre-injury level of sport in two studies, encompassing 220 patients, that assessed RTS success

CONCLUSIONS

Can hop and strength tests predict return to sport and retear after ACLR in the first year after surgery?

NOT CONSISTENTLY

- Individual hop and strength tests show inconsistent associations with reinjury or RTS
- Combined hop and strength test batteries have a poor predictive value in RTS or retear rates
- 3D Motion Assessment
 - Understudied, but the *most promising*
 - Specific deficiencies may be associated with retear risk

Motion analysis may be the most promising approach in predicting RTP and Reinjury



THANK YOU