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# High prevalence of abnormal lower limb biomechanics at 8-12 months after ACLR in adolescent patients

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# Faculty Disclosure Information

Nothing to disclose



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# Introduction

## Return-to-Sport (RTS) after ACL injury in young patients

RTS = important process to objectively measure knee function

High number of re-injuries after ACLR in young adults (1 in 4 patients)<sup>1</sup>

Strength measurements and jumping tests are gold standard<sup>2</sup>

- Limb symmetry index for jumps
- Isokinetic strength

No standardized tests assessing lower limb biomechanics to better understand knee functional deficits

# Objectives

- Assess lower limb biomechanics during running and jumping tests, as part of the RTS process after ACLR
- Identify deficits in knee function and compensatory motion strategies in young patients



Hypothesis: Despite nearing the end of rehabilitation, patients would still exhibit altered lower limb biomechanics affecting the RTS decision



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# Protocol

## Patients

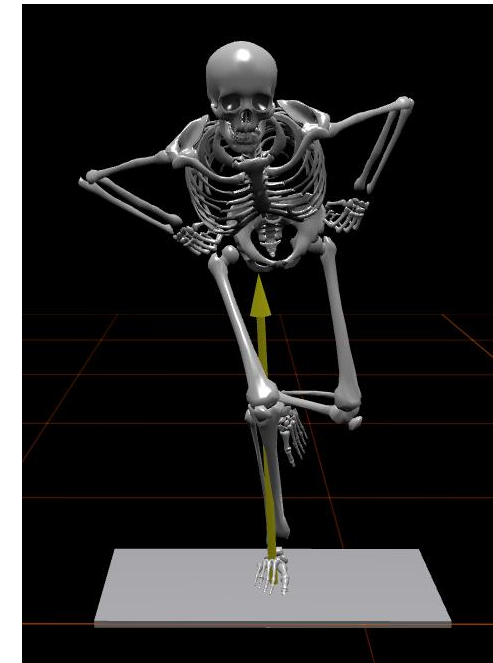
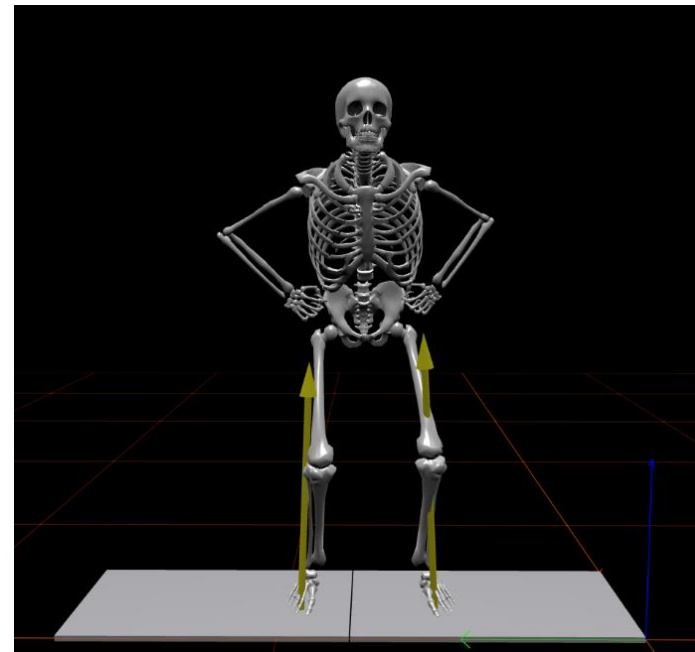
### Inclusion Criteria

- Patients under 25 years of age
- Primary ACLR surgery (with or without associated injuries)
- 8-12 months after surgery
- Inter-limb isokinetic knee strength >60%

# Protocol

## Methods

- Running Analysis at a comfortable speed
- Bilateral Counter Movement Jump (CMJ)
- Unilateral CMJ





# Protocol

## Data collection



**HUMAN MOTION LAB**  
LABORATOIRE D'ANALYSE DU MOUVEMENT



Powered by **Randré loch**

with the support of



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Motion data collected from:

16 markerless cameras

2 force plates



Allowing for the  
measurement of the lower  
limb:

- Joint Angles
- Joint Moments
- Joint Powers
- Ground Reaction Forces



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# Protocol

## Data analysis

Between limb differences calculated

- At mid-stance for running
- During the propulsion and landing phases of the jump

## Statistical Analysis

- Shapiro-Wilk for normal distribution
- Paired T-tests or Mann Whitney-U test



# Results

## Patients

N	26
Age	17.2 (1.5)
Sex	16 M, 10 F
Height	1.74 (0.1)
Weight	72 (10.5)
BMI	23.8 (3.1)
Time since surgery	9.4 (1.5)
Graft	18 QT, 8 ST/G
Isolated ACL injury	4
Meniscal Repair	22



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# Results

## Running between limb differences

Metric	Difference Operated/Contralateral	P-value
Knee Power (W/Kg)	↙ -20%	0.02
Ankle dorsiflexion angle°	↙ -3°	0.02
Knee extension moment landing (Nm/Kg)	↙ -11%	<0.01
Knee Flexion Excursion°	↙ -2.5°	<0.01

## Bilateral CMJ between limb differences

Metric	Difference Operated/Contralateral	P-value
Knee extension moment landing (Nm/Kg)	↙ -13%	<0.01
Ankle dorsiflexion angle°	↙ -3°	0.02



# Results

## Unilateral CMJ between limb differences

Metric	Difference Operated/Contralateral	P-value
Knee flexion angles°	↙ -4.5°	<0.01
Knee Extension moment landing (Nm/Kg)	↙ -9%	<0.01
Knee power generation (W/Kg)	↙ -14%	<0.01
Knee power absorption (W/Kg)	↙ -14%	0.01
Ankle Power propulsion (W/Kg)	↙ -11%	<0.01
Ankle Plantarflexion Moment propulsion (Nm/Kg)	↙ -6%	0.02



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# Conclusions

- Patients at RTS still exhibit knee biomechanical deficits 9 months after ACL reconstruction
  - Characterized by a stiffer operated knee
- Despite achieving rehabilitation milestones, biomechanical asymmetries are still present
- Greatest biomechanical asymmetries seen in the unilateral CMJ
- Motion compensations seen at the level of the ankle during bilateral and unilateral jumps



# References

- 1- Wiggins AJ et al. Risk of Secondary Injury in Younger Athletes After Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis. Am J Sports Med. 2016 Jul;44(7):1861-76
- 2- Gokeler A et al. Rehabilitation and Return to Sport Testing After Anterior Cruciate Ligament Reconstruction: Where Are We in 2022? Arthrosc Sports Med Rehabil. 2022 Jan 28;4(1):e77-e82.

