



# 8th Advanced Course on Knee Surgery

January 23rd to 27th - 2022



## ACL Re-injury: How do we prevent it ?

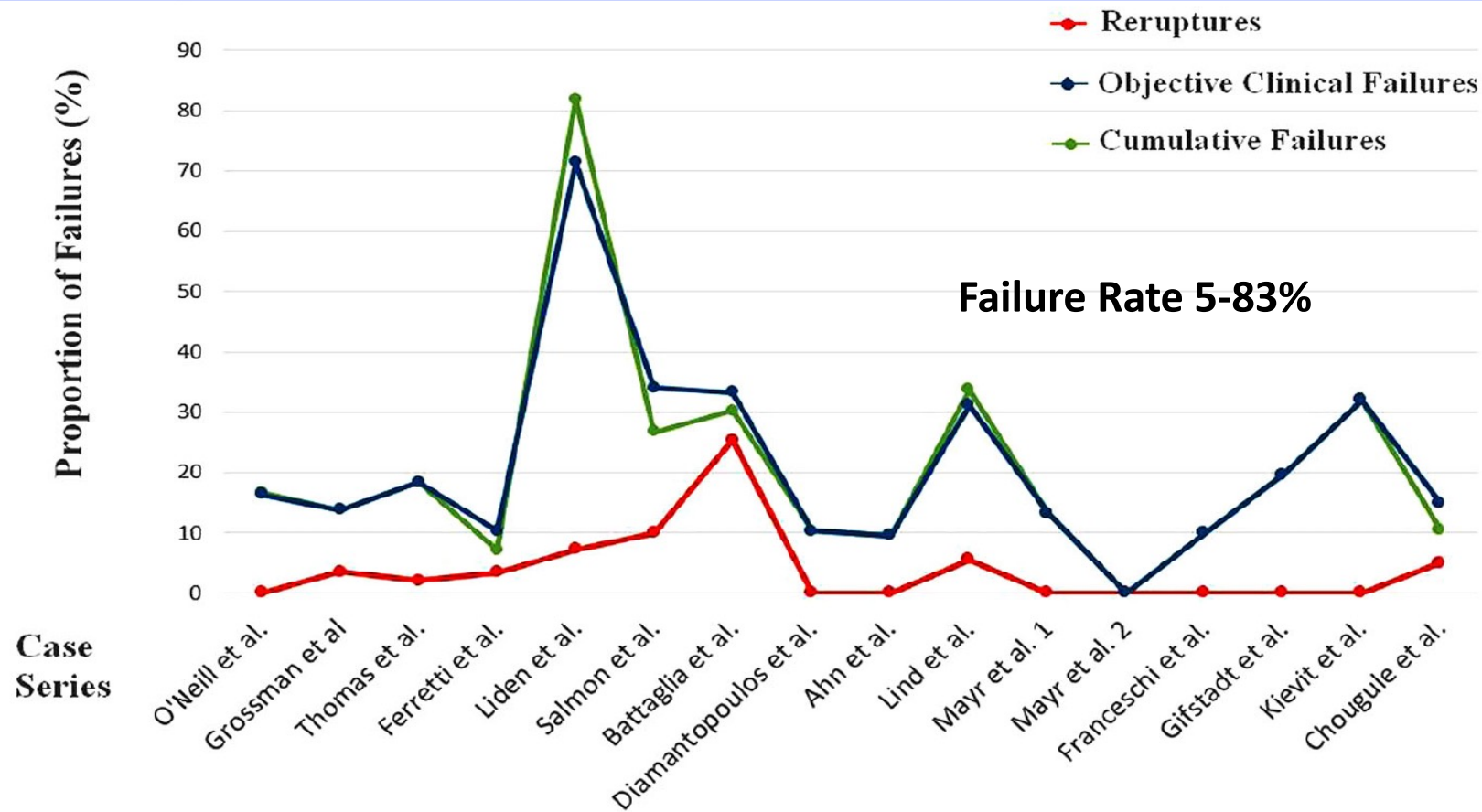
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# What Is the Mid-term Failure Rate of Revision ACL Reconstruction? A Systematic Review

CORR 2017

Alberto Grassi MD, Christopher Kim MD, Giulio Maria Marcheggiani Muccioli MD, Stefano Zaffagnini MD, Annunziato Amendola MD





## ACLR : Reasons for failure

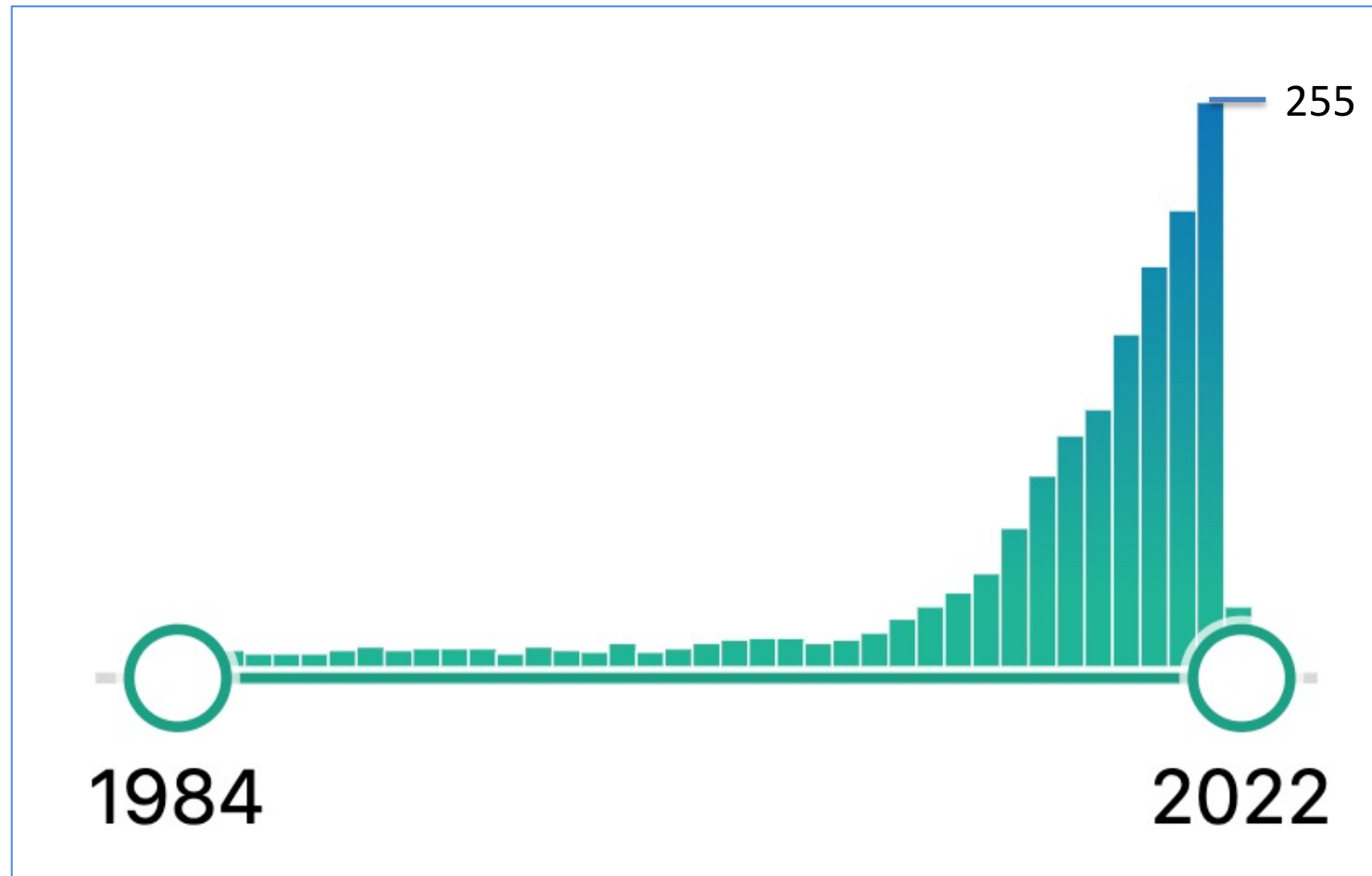
1. Technical : poor tunnel placement
2. Meniscal deficiency
3. Graft choice
4. Malalignment : Coronal / Sagittal
5. Associated laxity : MCL/PLC
6. *Early Return to Sport*

21 YO M  
ACLR age 13





# Explosion of literature on ACL RTP



Source - Pubmed

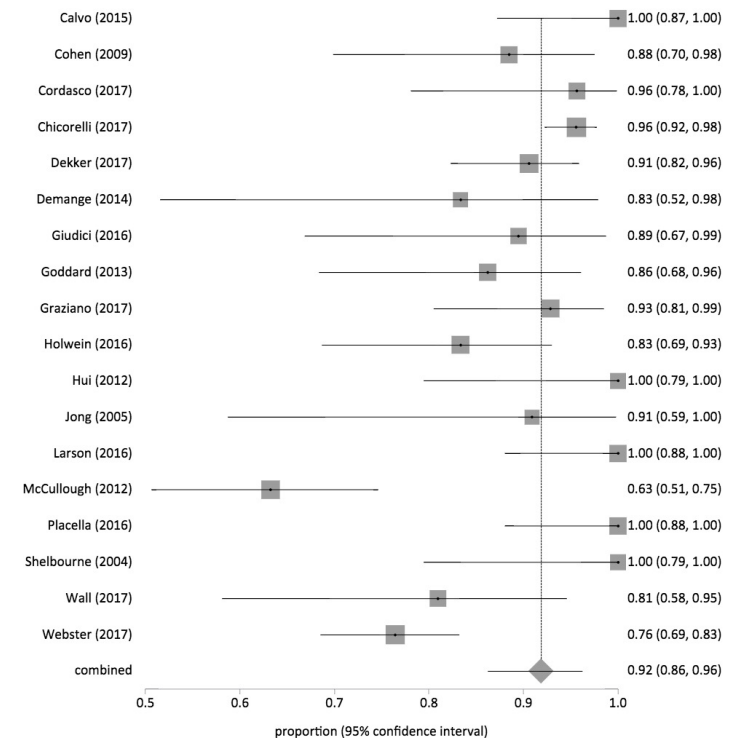


# 92% of children return to sport

**Over 90 % of children and adolescents return to sport after anterior cruciate ligament reconstruction: a systematic review and meta-analysis**

Jeffrey Kay<sup>1</sup> · Muzammil Memon<sup>1</sup> · Robert G. Marx<sup>2</sup> · Devin Peterson<sup>1</sup> · Nicole Simunovic<sup>3</sup> · Olufemi R. Ayeni<sup>1,4</sup>

- Systematic review of 18 studies
- 1156 ACL reconstructions included
- 92% return to sport
- 81% return to competitive sport
- 79% return to same level of sport
- 13% graft rupture, 14% contralateral ACL tear





# ACL re-injury is a major issue

## **Risk of Secondary Injury in Younger Athletes After Anterior Cruciate Ligament Reconstruction**

A Systematic Review and Meta-analysis

[Amelia J. Wiggins, DO,\\*](#) [Ravi K. Grandhi, MBA,†‡](#) [Daniel K. Schneider,‡§](#) [Denver Stanfield, MD,||](#) [Kate E. Webster, PhD,¶](#) and [Gregory D. Myer, PhD§#\\*\\*](#)

- Meta-analysis of 14 studies
- 7% graft rupture, 8% contra-lateral rupture in overall population
- Combined 2<sup>nd</sup> injury rate 23% if < 25 and returning to sports
  - This is 40x higher than matched controls without prior ACL injury



# Early return to sport carries significant risk

Simple decision rules can reduce reinjury risk by 84% after ACL reconstruction: the Delaware-Oslo ACL cohort study

Hege Grindem,<sup>1</sup> Lynn Snyder-Mackler,<sup>2</sup> Håvard Moksnes,<sup>3</sup> Lars Engebretsen,<sup>3,4</sup>  
May Arna Risberg<sup>1,4</sup>

- Prospective 2 year cohort of 106 patients
- Re-injury rate reduced by **51%** for each month RTP was delayed up to **9 months**
- Re-injury was **5.6%** for those that passed a RTP test, **38.2%** for those that failed
- Return to level I sports carries a **4 fold higher risk of re-injury**



# Early return to sport carries significant risk in the pediatric athlete

## Return to Sport After Pediatric Anterior Cruciate Ligament Reconstruction and Its Effect on Subsequent Anterior Cruciate Ligament Injury

Travis J. Dekker, MD, Jonathan A. Godin, MD, MBA, Kevin M. Dale, MD, William E. Garrett, MD, PhD,  
Dean C. Taylor, MD, and Jonathan C. Riboh, MD

*Investigation performed at the Department of Orthopaedic Surgery, Duke University Medical Center, Durham, North Carolina*

- Retrospective cohort of 85 patients
- **19% graft rupture**
- **13% contra-lateral ACL rupture**
- **13% decrease in risk of 2<sup>nd</sup> ACL tear for each month RTP was delayed**

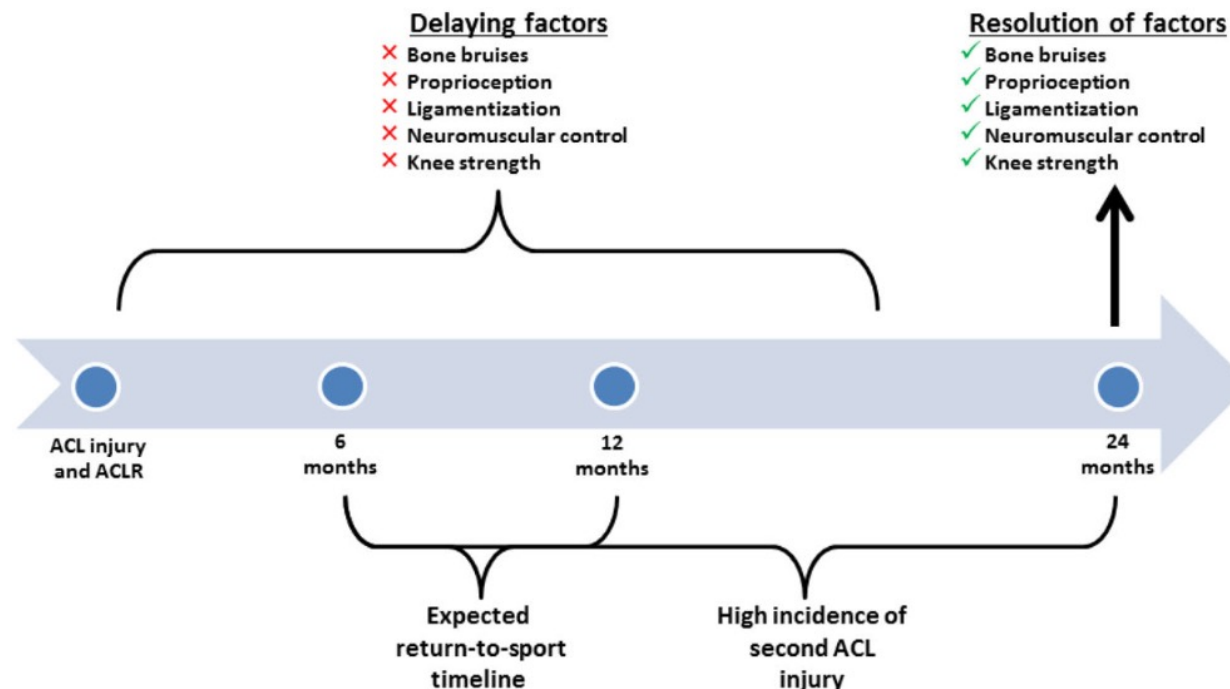




# Biologic and neuromuscular normalization may take 2 years after ACLR

**Should return to sport be delayed until two years after anterior cruciate ligament reconstruction? Biological and functional considerations**

Christopher V. Nagelli<sup>1,2,4,5</sup> and Timothy E. Hewett<sup>1,2,3,4,5</sup>





# What's best practice then?

## **ACL Return to Sport Guidelines and Criteria**

[George J. Davies](#),<sup>1,2,3</sup> [Eric McCarty](#),<sup>4</sup> [Matthew Provencher](#),<sup>5</sup> and [Robert C. Manske](#)<sup>6</sup>

1. Testing psychometric readiness
2. Testing impairment, strength and power
3. Quantitative and qualitative assessment of motion and function
4. Simulation of real-sports activities
5. Fatigue testing in final phases
6. Assessment of kinesophobia
7. Patient-reported outcomes



# Kinesophobia predicts re-injury and poor function

## Self-Reported Fear Predicts Functional Performance and Second ACL Injury After ACL Reconstruction and Return to Sport: A Pilot Study

Mark V. Paterno, PT, PhD, MBA, SCS,\*† Kaitlyn Flynn, DPT, SCS,‡ Staci Thomas, MS,§  
and Laura C. Schmitt, PT, PhD||

- Prospective cohort of 40 patients
- High TSK-11 scores correlate with
  - Lower levels of activity
  - Poor performance on functional tests
  - Higher risk of second ACL injury



# Limb symmetry Indexes Aren't Enough

[J Orthop Sports Phys Ther.](#) 2017 May;47(5):334-338. doi: 10.2519/jospt.2017.7285. Epub 2017 Mar 29. [Paperpile](#)

## **Limb Symmetry Indexes Can Overestimate Knee Function After Anterior Cruciate Ligament Injury.**

[Wellsandt E](#), [Failla MJ](#), [Snyder-Mackler L](#).

- Prospective cohort of 70 athletes
- At 6 months, only 28% meet expected pre-injury capacity (EPIC)
- Even of those who had > 90% LSI on all tests, only 60% met EPIC for all tests



# Testing at 6 months may be predictive of function even 1-2 years out

[Am J Sports Med.](#) 2017 Apr;45(5):1037-1048. doi: 10.1177/0363546516680619. Epub 2016 Dec 21. [Paperpile](#)

## **Do Patients Failing Return-to-Activity Criteria at 6 Months After Anterior Cruciate Ligament Reconstruction Continue Demonstrating Deficits at 2 Years?**

[Nawasreh Z](#)<sup>1,2</sup>, [Logerstedt D](#)<sup>3,4</sup>, [Cummer K](#)<sup>1,5</sup>, [Axe MJ](#)<sup>2,5,6</sup>, [Risberg MA](#)<sup>7,8</sup>, [Snyder-Mackler L](#)<sup>1,4,5</sup>.

- Prospective cohort of patients tested at 6, 12, and 24 months after ACLR
- Patients who passed at 6 months had:
  - Higher RTP rates at 12 and 24 months
  - Higher performance on hop tests at 12 and 24 months
  - Less movement asymmetry
- Begs the question → how do we get more people to be in the “pass” group by 6 months?



# Indeed, functional deficits persist over time

## **No Association of Time From Surgery With Functional Deficits in Athletes After Anterior Cruciate Ligament Reconstruction**

Evidence for Objective Return-to-Sport Criteria

[Gregory D. Myer](#), PhD, FACSM, CSCS\*D,<sup>†‡\$||\*</sup> [Larry Martin, Jr.](#), PhD,<sup>†||#\*\*</sup> [Kevin R. Ford](#), PhD,<sup>†‡†‡\$\$</sup> [Mark V. Paterno](#), PT, PhD, SCS, ATC,<sup>\$\$|||</sup> [Laura C. Schmitt](#), PT, MPT, PhD,<sup>†‡†||</sup> [Robert S. Heidt, Jr.](#), MD, FACS,<sup>†</sup> [Angelo Colosimo](#), MD,<sup>\*\*</sup> [Timothy E. Hewett](#), PhD,<sup>†‡\$##</sup> and Investigation performed at Cincinnati Children's Hospital Medical Center

- Retrospective review of 33 athletes at different time points after ACLR
- Vertical jump height and vertical ground reactive forces were independent of time from surgery



# Putting it all together...

Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus

Nicky van Melick,<sup>1,2</sup> Robert E H van Cingel,<sup>3,4</sup> Frans Brooijmans,<sup>5</sup> Camille Neeter,<sup>6</sup> Tony van Tienen,<sup>7</sup> Wim Hullegie,<sup>8</sup> Maria W G Nijhuis-van der Sanden<sup>1</sup>

- There is **little to no literature showing strong predictive value of any single RTP test for re-injury**
- Consensus is that a battery of tests should be used
- Limb symmetry should be 90-100%
- Strength, function (hop test), motion quality and psychosocial assessments should be performed.
- Better prospective studies are needed!



# Putting it all together – We should focus on **modifiable** risk factors

## Non-modifiable risk factors



## Modifiable risk factors







# Multidimensional testing is necessary

## Psychological Readiness:

Tampa Kinesophobia Scale (TSK-11)  
ACL Return to Sport after Injury (ACL-RSI)

## Patient Reported Outcomes:

KOOS  
IKDC  
Lysholm

## Psychological Readiness:

Tampa Kinesophobia Scale (TSK-11)  
ACL Return to Sport after Injury (ACL-RSI)

## Functional Testing:

Single Leg Hop Tests  
Double Leg Hop Tests  
Jump Tests  
Landing Tests

## Strength Testing:

Closed Chain Strength  
Open Chain Strength (Isotonic/Isokinetic)

## Motion Quality:

Landing Error Scoring System (LESS)  
Movement Performance Assessment (Powers)



# Research Questions Moving Forward

1. When is the optimal time to RTP?
2. Measuring Psychosocial factors?
3. Need more definitive decision-making tools ....**more research**