

NACHBEHANDLUNG NACH OPERATIVER THERAPIE  
VON KNIEVERLETZUNGEN



ALLI GOKELER, PHD



---

---

---

---

---

---

---

---

Finished files are the result of years of scientific study combined with the experience of many years.



---

---

---

---

---

---

---

---



---

---

---

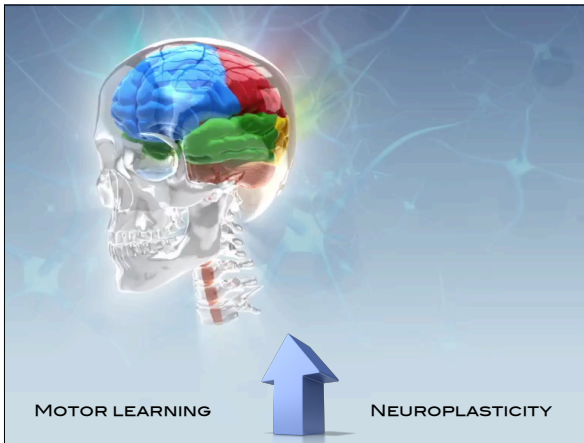
---

---

---

---

---



---

---

---

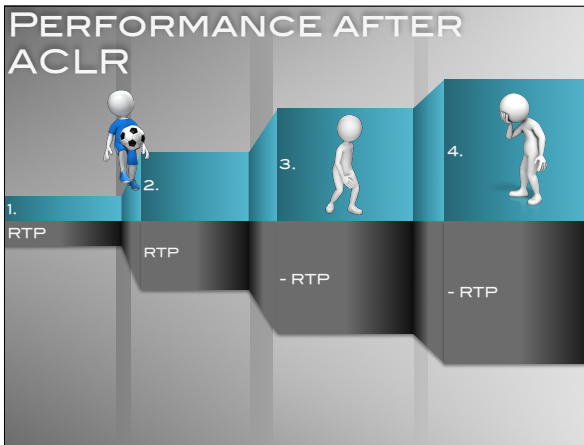
---

---

---

---

---



---

---

---

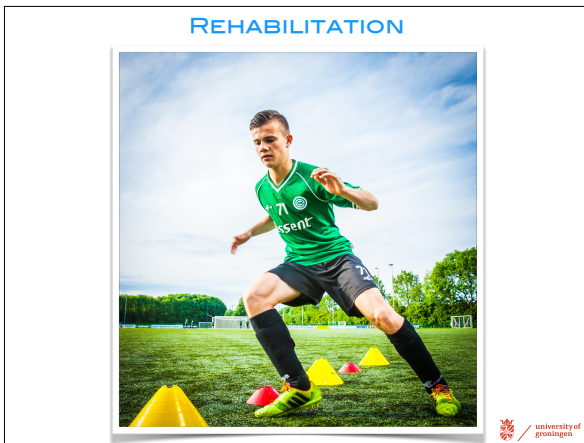
---

---

---

---

---



---

---

---

---

---

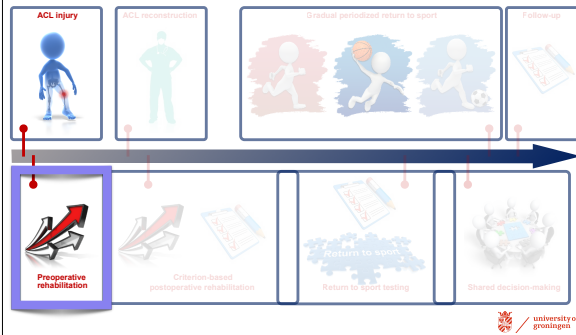
---

---

---

## Optimization of the Return-to-Sport Paradigm After Anterior Cruciate Ligament Reconstruction: A Critical Step Back to Move Forward

Bart Dingenen<sup>1,2</sup> · Alii Gokeler<sup>3</sup>



### Knee

#### EFORT open reviews

Clinical course and recommendations for patients after anterior cruciate ligament injury and subsequent reconstruction: a narrative review

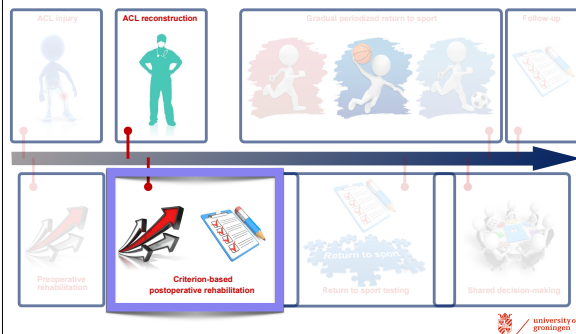
Alii Gokeler<sup>1</sup>  
Bart Dingenen<sup>2</sup>  
Caroline Mouton<sup>3</sup>  
Herman Sif



1. EDUCATION AND MENTAL PREPARATION
2. ACHIEVE FULL KNEE EXTENSION
3. PRE-OP STRENGTH DEFICIT QUAD < 20%
4. NORMAL GAIT PATTERN
5. NO-MINIMAL SWELLING

## Optimization of the Return-to-Sport Paradigm After Anterior Cruciate Ligament Reconstruction: A Critical Step Back to Move Forward

Bart Dingenen<sup>1,2</sup> · Alii Gokeler<sup>3</sup>



Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus  
Trey van den Broek, MSc, Robert van der Wal, MSc, Frank Riphagen, MSc, Corine Heesterbeek, MSc, Ferry van den Broek, MSc, Rudy de Luca, MSc, Wouter van den Broek, MSc

**KEY OPEN POINTS**  
Clinical course and recommendations for patients after anterior cruciate ligament injury and subsequent reconstruction: a narrative review  
van den Broek, Riphagen, Heesterbeek, de Luca, van den Broek, van der Wal, van den Broek

## PHASE 1 EARLY POST-OPERATIVE

### GOALS

1. MINIMAL EFFUSION
2. ACHIEVE FULL KNEE EXTENSION
3. QUADRICEPS CONTROL
4. "NORMAL" GAIT PATTERN

© 2017 American Physical Therapy Association. All rights reserved. This document is copyrighted by the American Physical Therapy Association. Any reproduction of this document without the permission of the American Physical Therapy Association is prohibited. For more information, visit [www.apta.org](http://www.apta.org).

### Knee Stability and Movement Coordination Impairments: Knee Ligament Sprain Revision 2017

*Clinical Practice Guidelines Linked to the  
International Classification of Functioning,  
Disability and Health from the Orthopaedic Section  
of the American Physical Therapy Association*  
© 2017 American Physical Therapy Association

#### 2017 RECOMMENDATION

**B**  
CLINICIANS SHOULD USE CRYOTHERAPY IMMEDIATELY  
AFTER ACL RECONSTRUCTION TO  
REDUCE POSTOPERATIVE KNEE PAIN.

© 2017 American Physical Therapy Association. All rights reserved. This document is copyrighted by the American Physical Therapy Association. Any reproduction of this document without the permission of the American Physical Therapy Association is prohibited. For more information, visit [www.apta.org](http://www.apta.org).

### Knee Stability and Movement Coordination Impairments: Knee Ligament Sprain Revision 2017

*Clinical Practice Guidelines Linked to the  
International Classification of Functioning,  
Disability and Health from the Orthopaedic Section  
of the American Physical Therapy Association*  
© 2017 American Physical Therapy Association

#### 2017 RECOMMENDATION

**A**  
NEUROMUSCULAR ELECTRICAL STIMULATION  
SHOULD BE USED FOR 6 TO 8 WEEKS

**Knee Stability and Movement  
Coordination Impairments:  
Knee Ligament Sprain  
Revision 2017**

*Clinical Practice Guidelines Linked to the  
International Classification of Functioning,  
Disability and Health From the Orthopaedic Section  
of the American Physical Therapy Association*

© 2017 American Physical Therapy Association

**Component 3: Determination of Irritability Stage**

Diagnosis of tissue irritability is important for guiding the clinical decisions regarding treatment frequency, intensity, duration, and type, with the goal of matching the optimal dosage of treatment to the status of the tissue being treated. There are cases where the alignment of irritability and the duration of symptoms does not match, requiring clinicians to make judgments when applying time-based research results on a patient-by-patient basis.



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

Help us make "Knee" even bigger! "Open Access", "Quality Matters",  
Only on "Knee" Also available "Knee W. 2" (Publication der Länders)

**Knee**

**EFFORT OPEN PROXIMALIS**

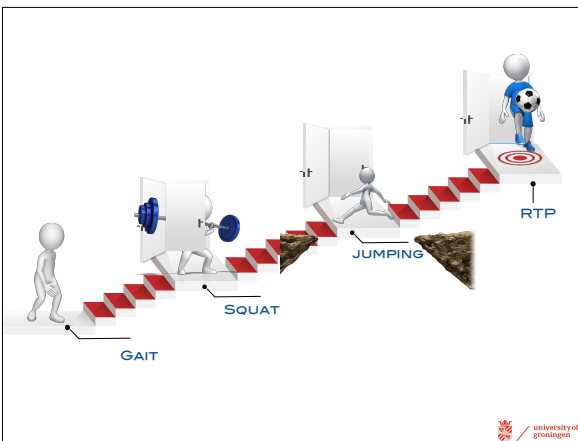
Clinical course and recommendations for patients  
after anterior cruciate ligament injury and  
subsequent reconstruction: a narrative review

© 2017  
All rights reserved  
This article is intended  
for personal use only  
Reproduction is  
prohibited

**PHASE 2 EARLY POST-OPERATIVE**

**CRITERIA**

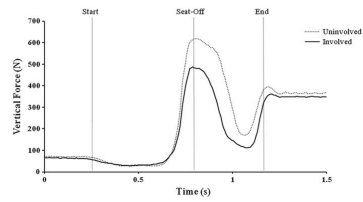
1. CLOSED WOUND BY WEEK 1
2. NO PAIN WITH PHASE 1 EXERCISES
3. MINIMAL SWELLING
4. NORMAL MOBILITY PFJ
5. FULL PASSIVE KNEE EXTENSION
6. 120-130 KNEE FLEXION
7. VOLUNTARY CONTROL OF THE QUADRICEPS;
8. ACTIVE DYNAMIC GAIT PATTERN WITHOUT CRUTCHES;
9. SATISFACTORY QUALITATIVE PERFORMANCE OF PHASE 1 EXERCISES.





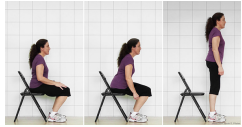
**Asymmetrical Lower Extremity Loading Early After Anterior Cruciate Ligament Reconstruction Is a Significant Predictor of Asymmetrical Loading at the Time of Return to Sport**

Luciana Iabonna, MSc  
Luca Landeni, PhD  
Federica Minetti, PhD  
Jacopo Rocchi, MSc  
Prof. Paolo Nattari, MD  
Arrigo Cocchiari, MD  
Fabio Pignati, MD  
Andrea Macaluso, MD, PhD



**Asymmetrical Lower Extremity Loading Early After Anterior Cruciate Ligament Reconstruction Is a Significant Predictor of Asymmetrical Loading at the Time of Return to Sport**

Luciana Iabonna, MSc  
Luca Landeni, PhD  
Federica Minetti, PhD  
Jacopo Rocchi, MSc  
Prof. Paolo Nattari, MD  
Arrigo Cocchiari, MD  
Fabio Pignati, MD  
Andrea Macaluso, MD, PhD



ASYMMETRY 1 MONTH



6 MONTHS

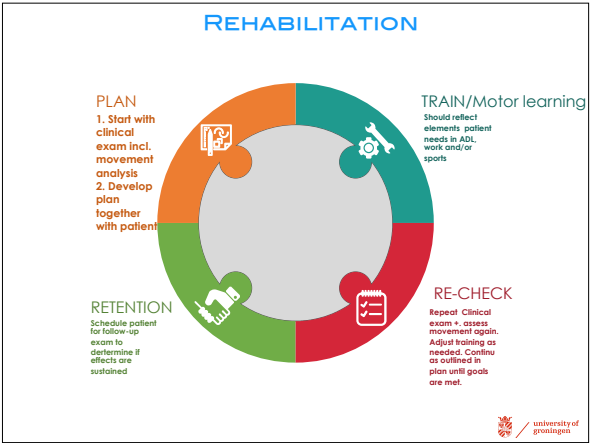
**Knee Stability and Movement Coordination Impairments: Knee Ligament Sprain**  
Revision 2017

*Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association*

EVIDENCE UPDATE

II SYSTEMATIC REVIEW BY GOKELER ET AL<sup>27</sup>

**THE EVIDENCE FROM THIS REVIEW INDICATES THAT NEUROMUSCULAR TRAINING INCORPORATING MOTOR LEARNING PRINCIPLES SHOULD BE ADDED TO STRENGTH TRAINING TO OPTIMIZE PATIENT OUTCOMES.**




---

---

---

---

---

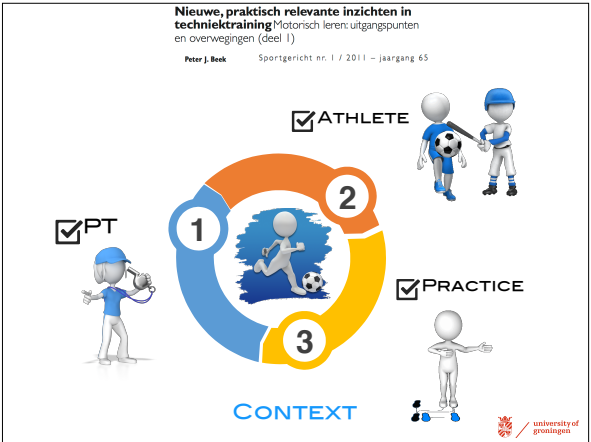
---

---

---

---

---




---

---

---

---

---

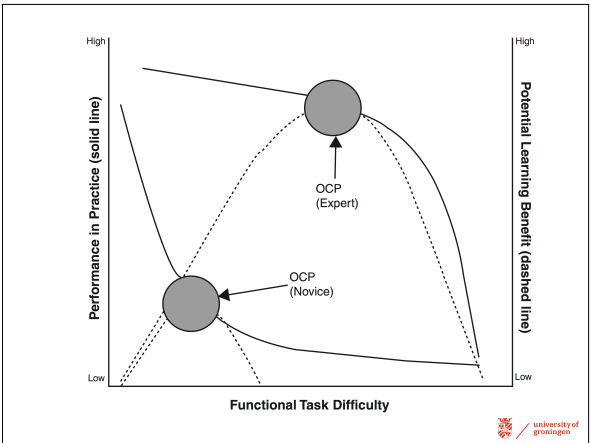
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---





Physical Therapy in Sport  
Novel methods of instruction in ACL injury prevention programs: a systematic review  
Anne Benjaminse<sup>1,2,3</sup>, Wouter Meiring<sup>1</sup>, Ben Oliver<sup>1</sup>, All Galster<sup>4</sup>

university of groningen

---

---

---

---

---

---

---

---

---

---

---

---

Optimization of the Anterior Cruciate Ligament Injury Prevention Paradigm: Novel Feedback Techniques to Enhance Motor Learning and Reduce Injury Risk

university of groningen

---

---

---

---

---

---

---

---

---

---

---

---

**Feedback Techniques to Target Functional Deficits Following Anterior Cruciate Ligament Reconstruction: Implications for Motor Control and Reduction of Second Injury Risk**  
All Galster<sup>1</sup>, Anne Benjaminse<sup>1</sup>, Timothy E. Hewett<sup>2</sup>, Mark V. Paterno<sup>3</sup>, Kevin R. Ford<sup>4</sup>, Robert Oliver<sup>5</sup>, Gregory D. Myer<sup>6</sup>

university of groningen

---

---

---

---

---

---

---

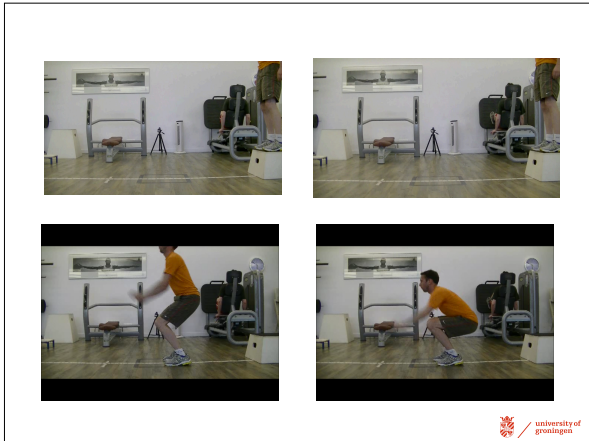
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

Contents lists available at ScienceDirect  
**Physical Therapy in Sport**  
 journal homepage: [www.elsevier.com/locate/ptsp](http://www.elsevier.com/locate/ptsp)

Original research  
**The effects of attentional focus on jump performance and knee joint kinematics in patients after ACL reconstruction**

Alli Gokerler <sup>a,\*</sup>, Anne Benjaminse <sup>a,b</sup>, Wouter Welling <sup>c</sup>, Malou Allread <sup>d</sup>, Peter Eppinger <sup>e,f</sup>, Bert Otiari <sup>g</sup>

**EXTERNAL FOCUS**                      **INTERNAL FOCUS**

University of Groningen logo

---

---

---

---

---

---

---

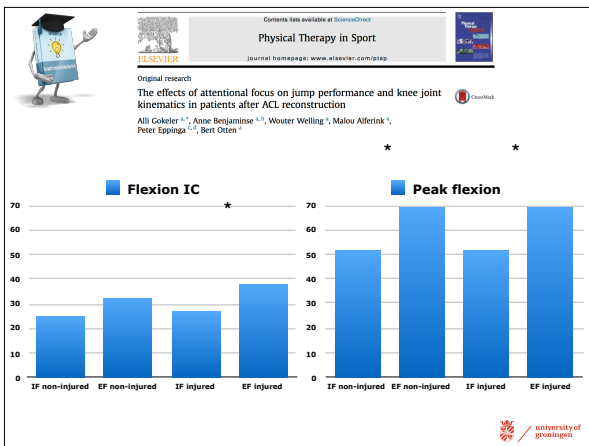
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

---

---

Knee Surg Sports Traumatol Arthrosc  
DOI 10.1007/s00167-013-2577-x

KNEE

**Quadriceps function following ACL reconstruction  
and rehabilitation: implications for optimisation  
of current practices**

Alli Gokeler · Marsha Bisschop · Anne Benjaminse ·  
Greg D. Myer · Peter Eppinga · Egbert Otten

---

---

---

---

---

---

---

---

---

---



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

July 2016; 13(7): 1-11

Open Access

KEY POINT OPEN ACCESS

Clinical course and recommendations for patients after anterior cruciate ligament injury and subsequent reconstruction: a narrative review

2016

2016

2016

## PHASE 3 RETURN TO SPORTS

### CRITERIA

1. SATISFACTORY QUALITATIVE PERFORMANCE OF PHASE 2 EXERCISES
2. NO FEELING OF GIVING WAY IN PREVIOUS PHASES OR A NEGATIVE PIVOT-SHIFT
3. LSI > 80% FOR QUADRICEPS AND HAMSTRING STRENGTH
4. LSI > 80% FOR A HOP TEST BATTERY
5. IKDC SUBJECTIVE KNEE FORM > 70



2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

Clara Arnesen,<sup>1,2</sup> Philip Grimmer,<sup>3,4</sup> Anthony Schwiderski,<sup>5</sup> Erik Mithrasen,<sup>1,2</sup> Benjamin Clasen,<sup>6,7</sup> Amy Cook,<sup>8</sup> Boris Gjajicovic,<sup>9,10</sup> Stefan Graftl,<sup>11</sup> Kristin M. Olson,<sup>12</sup> Robert Mithrasen,<sup>13</sup> Stephen A. Nuss,<sup>14</sup> Agneta Pridgen,<sup>15</sup> Gustaf Reurink,<sup>16</sup> Robert Luder,<sup>17</sup> Karin Sjöman Skerfvinger,<sup>18</sup> Kristian Thorborg,<sup>19,20</sup> Arntaug Wangenmen,<sup>21</sup> Koen I. Wilk,<sup>22</sup> Agneta Rizzoli<sup>23</sup>

RT ACTIVITY      RT SPORTS      RT PERFORMANCE



Knee Surg Sports Traumatol Arthrosc  
DOI 10.1007/s00137-016-0900-y

KNEE

### Athletic performance and career longevity following anterior cruciate ligament reconstruction in the National Basketball Association

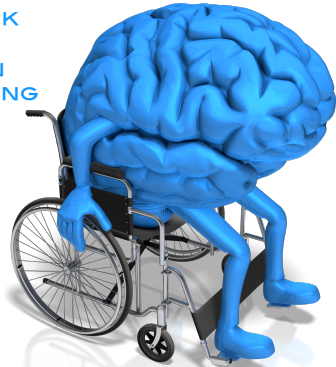
Benjamin S. Kester<sup>1,2</sup> · Omar A. Beheery<sup>1</sup> · Shohbit V. Minhas<sup>1,2</sup> · Wellington K. Hu<sup>2</sup>



- LEISTUNG
- SPIELEINSATZ
- KARRIERE 2 J. KÜRZER

# SENSOMOTORIK

## ÄNDERUNGEN NACH VERLETZUNG



---

---

---

---

---

---

---

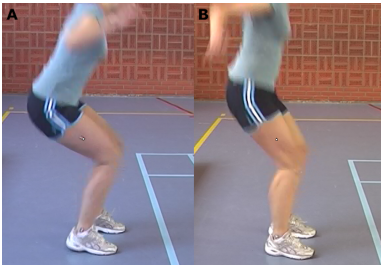
---

---

---

### Effect of Fatigue on the Landing Error Scoring System (LESS) in Patients after ACL reconstruction

Gokeler A.,<sup>1</sup> Eppinga P.,<sup>2</sup> Dijkstra P.U.,<sup>3</sup> Welling W.,<sup>1</sup> Padua D.A.,<sup>4</sup> Otten E.,<sup>1</sup> Benjaminse A.,<sup>1,5</sup>



---

---

---

---

---

---

---

---

---

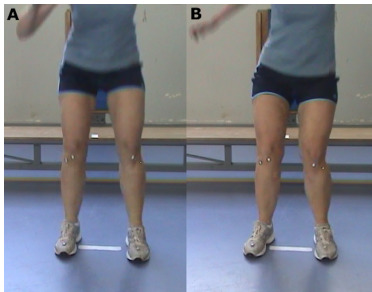
---

### Effect of Fatigue on the Landing Error Scoring System (LESS) in Patients after ACL reconstruction

Gokeler A.,<sup>1</sup> Eppinga P.,<sup>2</sup> Dijkstra P.U.,<sup>3</sup> Welling W.,<sup>1</sup> Padua D.A.,<sup>4</sup> Otten E.,<sup>1</sup> Benjaminse A.,<sup>1,5</sup>



### ACLR?



---

---

---

---

---

---

---

---

---

---

## Development of a test battery to enhance safe return to sports after anterior cruciate ligament reconstruction

Alii Gokeler<sup>1</sup> · Wouter Welling<sup>1,2</sup> · Stefano Zaffagnini<sup>3</sup> · Romain Seil<sup>4</sup> · Darin Padua<sup>5</sup>



---

---

---

---

---

---

---

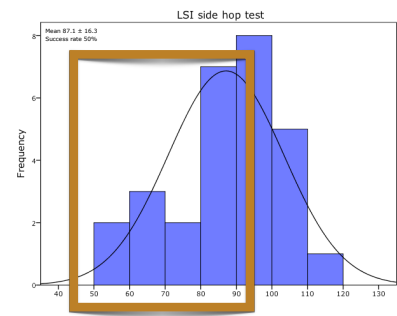
---

---

---

## Development of a test battery to enhance safe return to sports after anterior cruciate ligament reconstruction

Alii Gokeler<sup>1</sup> · Wouter Welling<sup>1,2</sup> · Stefano Zaffagnini<sup>3</sup> · Romain Seil<sup>4</sup> · Darin Padua<sup>5</sup>



NUR 13 PATIENTEN: LSI > 90% ALLE 3 HOP TESTS !!

---

---

---

---

---

---

---

---

---

---

## BILATERALE DEFIZITE VKB

URBACH 2000, HIEMSTRA 2007, KONISHI 2001, NEGAHBAN 2014, DINGENEN 2016



FALSCH + HOHE  
LIMB SYMMETRY INDEX (LSI)

---

---

---

---

---

---

---

---

---

---



A critical analysis of limb symmetry indices of hop tests in athletes after anterior cruciate ligament reconstruction: A case control study

A. Gokeler<sup>a,b</sup>, W. Welling<sup>a,b</sup>, A. Benjamins<sup>a,c</sup>, K. Lemmink<sup>a</sup>, R. Seil<sup>d</sup>, S. Zaffagnini<sup>e</sup>

<sup>a</sup> Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands  
<sup>b</sup> Medisch Centrum Zuid, Groningen, The Netherlands  
<sup>c</sup> Hanzel University Applied Science, School of Sport Studies, Groningen, The Netherlands  
<sup>d</sup> Département de l'Appareil Locomoteur, Centre Hospitalier de Luxembourg, Luxembourg, Luxembourg  
<sup>e</sup> Rizzoli Orthopaedic Institute, University of Bologna, Bologna, Italy

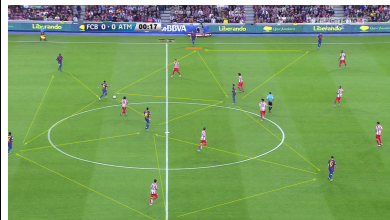


A critical analysis of limb symmetry indices of hop tests in athletes after anterior cruciate ligament reconstruction: A case control study

A. Gokeler<sup>a,b</sup>, W. Welling<sup>a,b</sup>, A. Benjamins<sup>a,c</sup>, K. Lemmink<sup>a</sup>, R. Seil<sup>d</sup>, S. Zaffagnini<sup>e</sup>

<sup>a</sup> Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands  
<sup>b</sup> Medisch Centrum Zuid, Groningen, The Netherlands  
<sup>c</sup> Hanzel University Applied Science, School of Sport Studies, Groningen, The Netherlands  
<sup>d</sup> Département de l'Appareil Locomoteur, Centre Hospitalier de Luxembourg, Luxembourg, Luxembourg  
<sup>e</sup> Rizzoli Orthopaedic Institute, University of Bologna, Bologna, Italy

	Male	Female
<b>TRIPLE LEG HOP DISTANCE (CM)</b>		
DIFFERENCE INVOLVED LIMB COMPARED TO NORMATIVE DATA	125.7 ± 71.4	43.5 ± 49.2
P VALUE	<0.001*	<0.001*
DIFFERENCE UNINVOLVED LIMB COMPARED TO NORMATIVE DATA	104.1 ± 65.6	30.8 ± 49.8





What do we need to do?

What to know?



---

---

---

---

---

---

---

---



### ON FIELD REHABILITATION



---

---

---




---

---

---

---

---



---

---

---

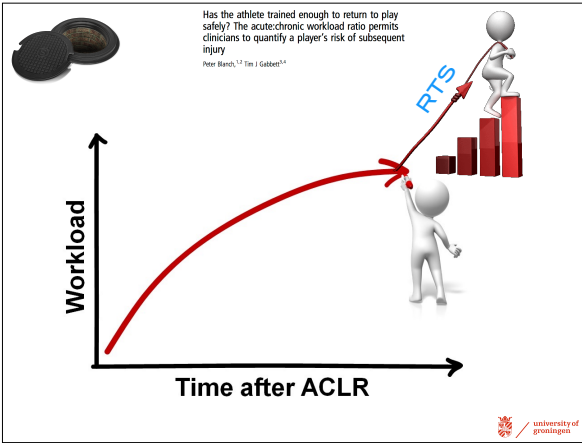
---

---

---

---

---



Gradual periodized return to sport

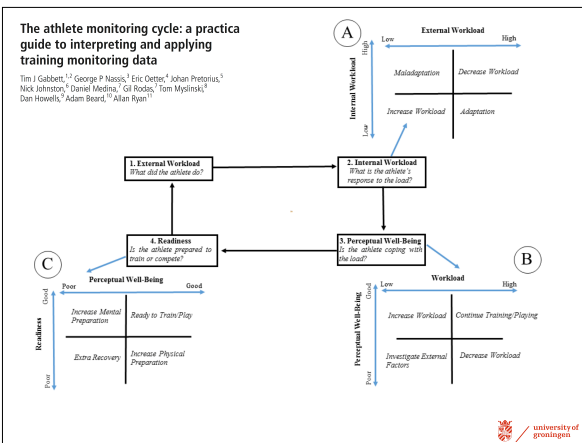
### WORK LOAD

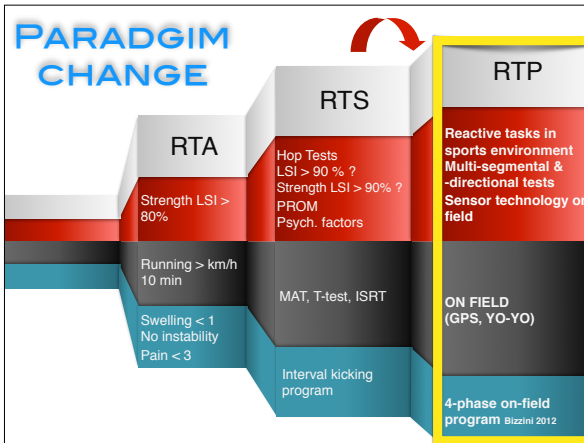
Has the athlete trained enough to return to play safely? The acute:chronic workload ratio permits clinicians to quantify a player's risk of subsequent injury

Peter Blanch,<sup>1,2</sup> Tim J Gabbett<sup>1,4</sup>

Chronic workload (% of normal average)	110	4.7	4.1	3.6	3.4	3.2	3.3	3.5
100	4.3	3.7	3.4	3.3	3.3	3.6	4.2	4.9
90	3.9	3.5	3.3	3.3	3.6	4.2	4.9	
80	3.5	3.3	3.3	3.7	4.3	5.3	6.6	
70	3.3	3.3	3.7	4.6	5.8	7.5	9.5	
60	3.3	3.8	4.9	6.6	8.8	11.6	14.9	
50	4.0	5.5	7.9	11.0	14.9	19.6	25.1	
40	6.6	10.1	14.9	20.9	28.2	36.7	46.5	
30	14.9	23.2	33.7	46.5	61.4	78.6	98.0	
	60	70	80	90	100	110	120	
	Acute workload (% of normal average)							

university of groningen






---

---

---

---

---

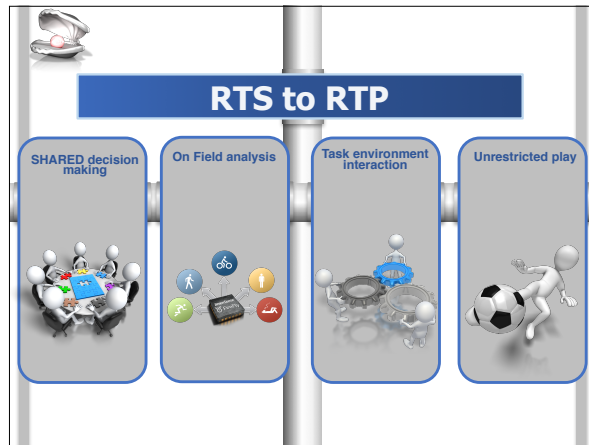
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

---

---



## Return-to-Play in Sport: A Decision-based Model

David W. Creighton, MS,\* Jan Strier, MD, PhD,† Rebecca Shultz, PhD,\*  
Willem H. Meuwisse, MD, PhD,‡ and Gordon O. Matheson, MD, PhD\*



Shared decision making



university of  
 groningen

---

---

---

---

---

---

---

---



[www.acrehabilitation.com](http://www.acrehabilitation.com)



Alli gokeler



@AlliGokeler



university of  
 groningen

---

---

---

---

---

---

---

---