

Die Rehabilitation der vorderen Kreuzbandruptur

**University Hospital Brandenburg,
Centre of Orthopedics and Traumatology**

Dr. Robert Prill



Chair of ESSKA Rehabilitation Committee

Associate Editor KSSTA

JBI Convenor: Evidence Based Practice @MHB

Consultant OPED GmbH

CEO P3 Zeuthen

IAOM Faculty

Conflicts of Interest

Projekt:

Advancements in Back to Sports Decision making after Anterior Cruciate Ligament Reconstruction

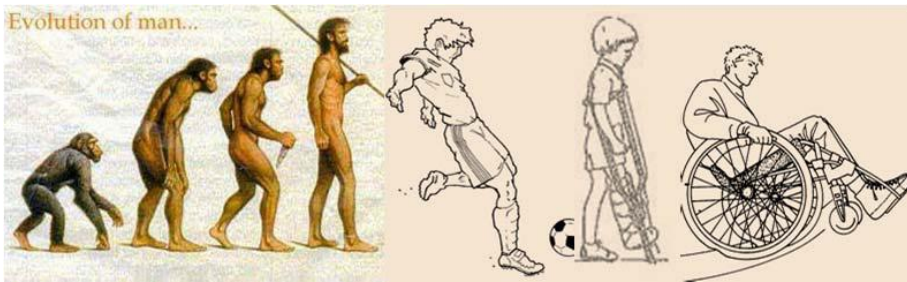
Robert Prill, Aleksandra Królikowska

The project is co-financed by the Bundesministerium für Bildung und Forschung (BMBF) and the Polish National Agency for Academic Exchange



Das vordere Kreuzband ist der häufigste Grund für „Ex-Athleten“

1970 Kennedy



acl rupture – life changing event

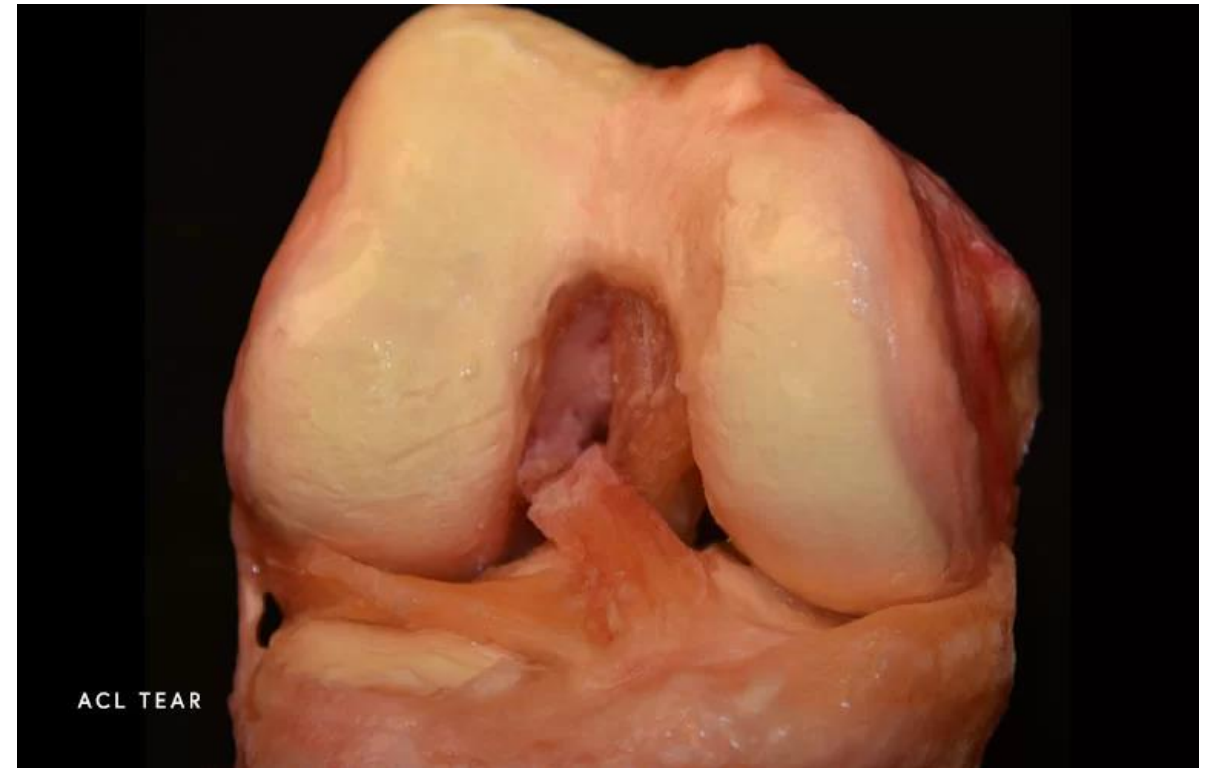
2010 Patt

let's try to avoid that

Wie verletzt man sich den?

<https://youtube.com/shorts/13P0eOQJyYg?si=BqP18S59gLSkaSc0>

https://youtube.com/shorts/I3tvCbgndA4?si=OqZCK2RGqYdo6_0q



@jose3030

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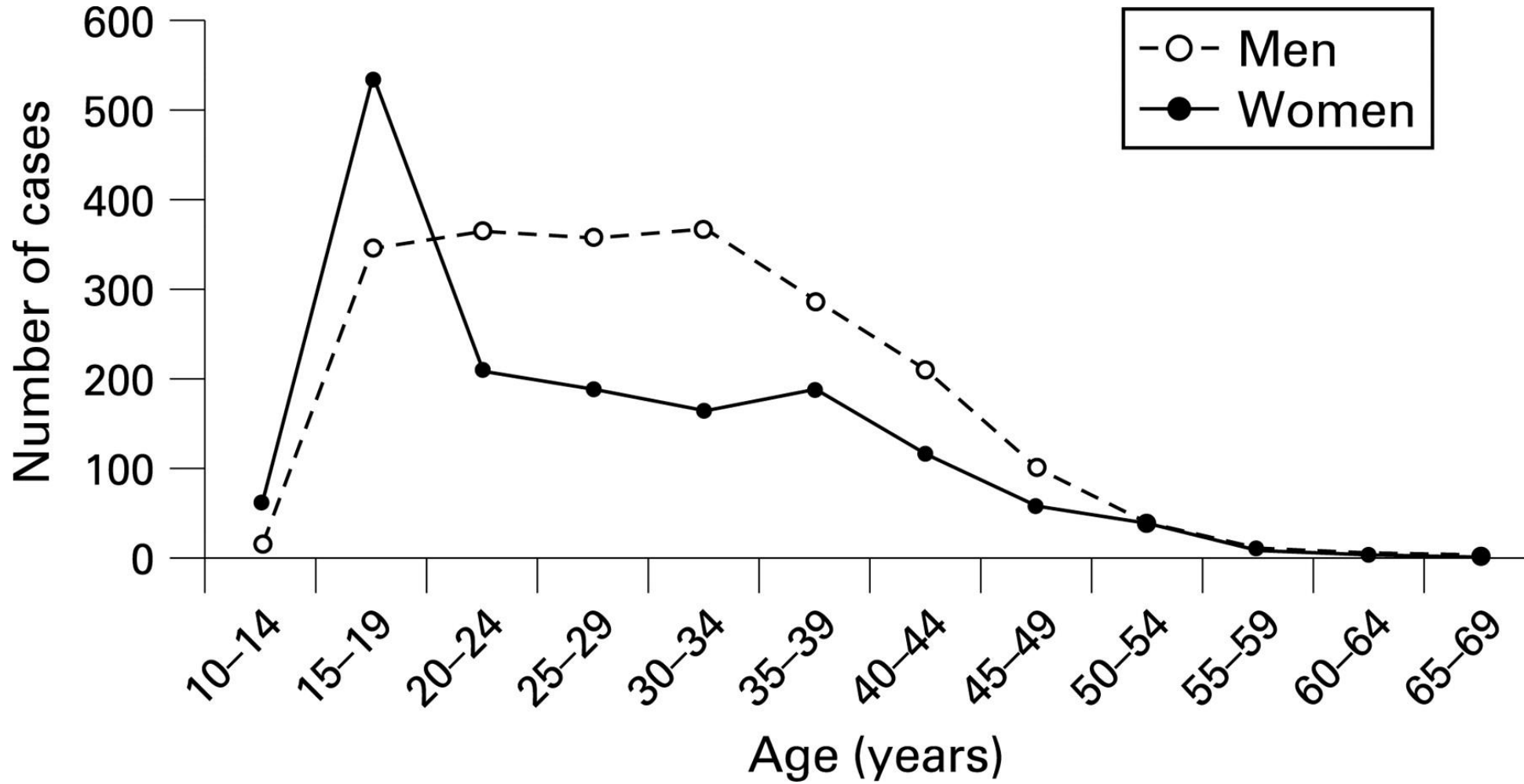
@jose3030

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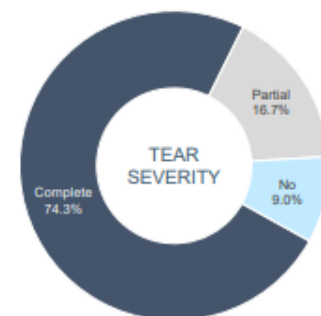
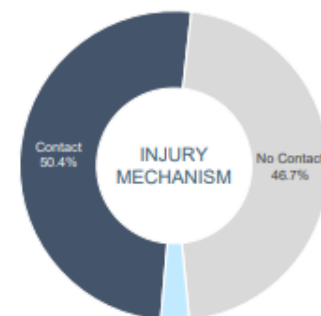
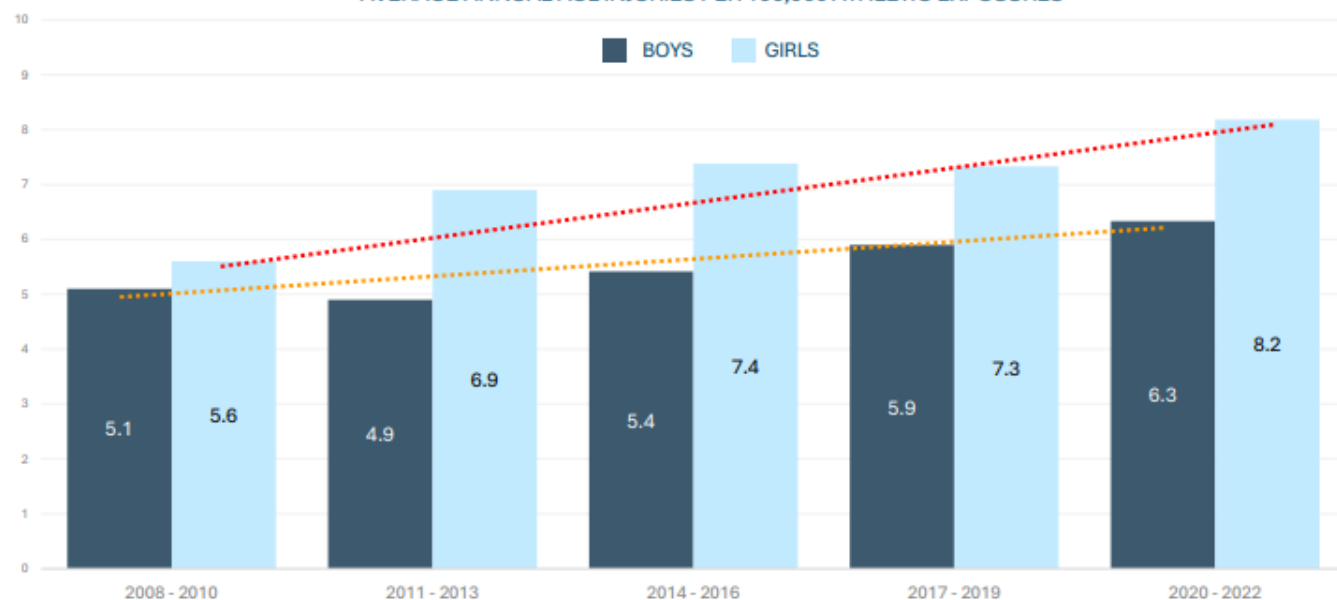
ABC Revenge All New - Wednesday 10/9c

Alter und Geschlecht

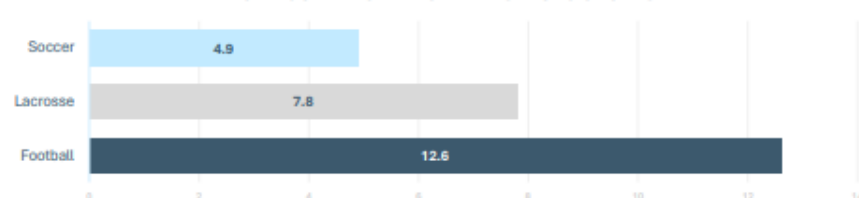


A 15-Year Epidemiologic Analysis of Anterior Cruciate Ligament Injuries Among U.S. High School Sports Participants

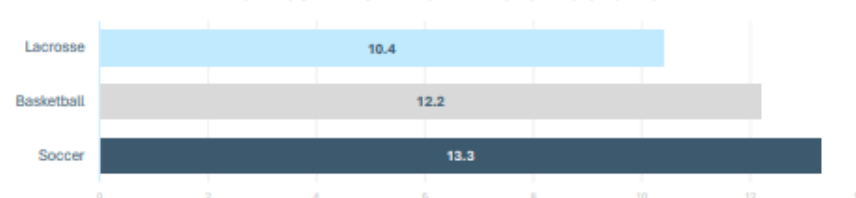
AVERAGE ANNUAL ACL INJURIES PER 100,000 ATHLETIC EXPOSURES



ACL INJURY INCIDENCE RATES: BOYS SPORTS



ACL INJURY INCIDENCE RATES: GIRLS SPORTS



PRIMARY INVESTIGATOR

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Vincent Minjares, PhD
Andrew Pearte, MD

BACKGROUND

High rates of sports-related ACL injuries have prompted calls for implementation of preventive interventions over the past two decades. Little evidence has been produced recently, however, to quantify ACL injury incidence rates among high school sports participants.

METHODS

This study is a secondary analysis of ACL injury data from 12 sports included in the Datalys Center's National High School Sports-Related Injury Surveillance Study from 2007-08 to 2021-22.

Incidence of Anterior Cruciate Ligament Tears and Reconstruction

A 21-Year Population-Based Study

Thomas L. Sanders,^{*†} MD, Hilal Maradit Kremers,^{†‡} MD, MSc, Andrew J. Bryan,[†] MD, Dirk R. Larson,[‡] MS, Diane L. Dahm,[†] MD, Bruce A. Levy,[†] MD, Michael J. Stuart,[†] MD, and Aaron J. Krych,[†] MD
Investigation performed at Mayo Clinic, Rochester, Minnesota, USA



AJSM Vol. 44, No. 6; 2016

Die alters- und geschlechtsbereinigte jährliche Inzidenz von Kreuzbandrissen betrug 68,6 pro 100.000 Personenjahre.

Die Spitze der Inzidenz bei den Männern war 241.0 between 19 and 25 years

Spitzenwert der Inzidenz bei Frauen war 227.6 between 14 and 18 years

Die Rate der VKB-Rekonstruktionen stieg im Laufe der Zeit in allen Altersgruppen deutlich an (P \ .001).

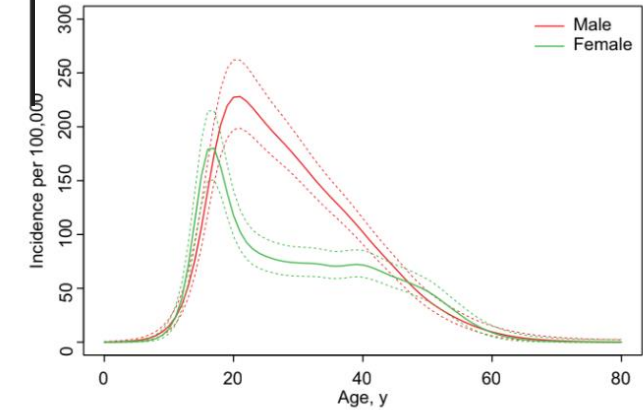


Figure 1. Age-specific incidence of anterior cruciate ligament (ACL) injury in males and females.

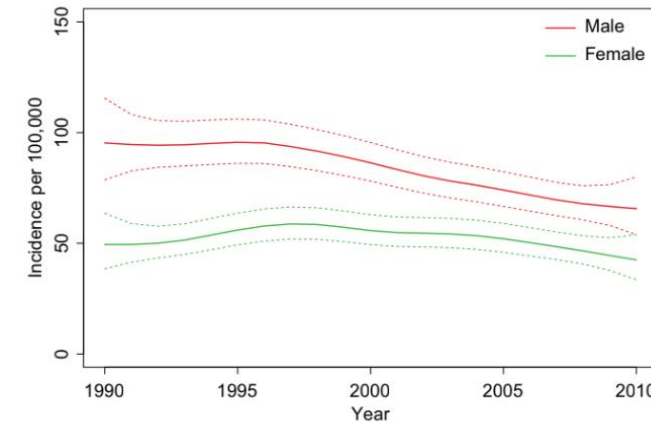


Figure 2. Trends in age-adjusted incidence of anterior cruciate ligament (ACL) tears in males and females.



ABC NEWS

Explosion of women's ACL injuries in Australian sport is just the 'tip of the iceberg' fear medical experts

By [Chloe Hart](#)

Posted Sat 4 Nov 2023 at 9:11pm, updated Sat 18 Nov 2023 at 8:46pm



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Non-contact Anterior Cruciate Ligament Injury Epidemiology in Team-Ball Sports: A Systematic Review with Meta-analysis by Sex, Age, Sport, Participation Level, and Exposure Type

Lionel Chia^{1,2}  · Danilo De Oliveira Silva³ · Matthew Whalan^{4,5} · Marnee J. McKay¹ · Justin Sullivan¹ · Colin W. Fuller⁶ · Evangelos Pappas^{1,7}

Key Points

- The overall proportion of non-contact to total ACL injuries in team ball-sports was 55%.
- Injury incidence of non-contact ACL injuries in team ball-sports was higher in female athletes than in male athletes.
- Injury incidence of non-contact ACL injuries in team ball-sports during competition was higher than during training.

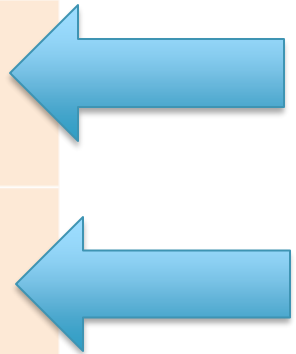
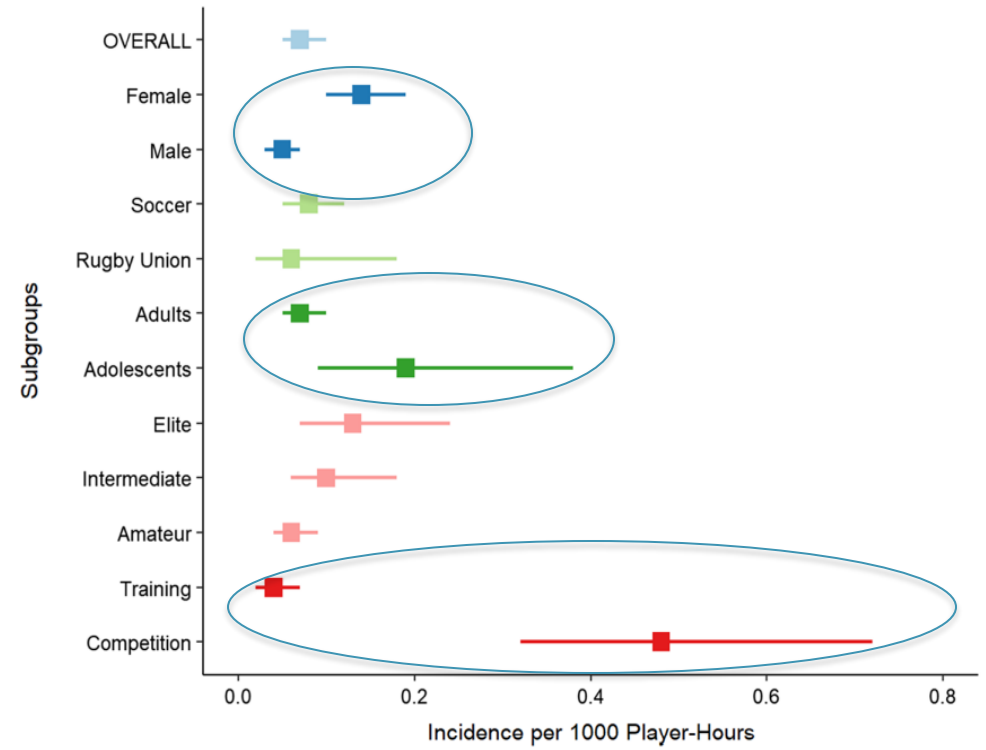


Fig. 5 Summary of selected injury incidence meta-analyses by player-hours. Squares, summary measure; accompanying horizontal line, 95% CI



Was vergessen wir gerne?: Arthrose nach VKB-R

The Effect of Anterior Cruciate Ligament Reconstruction on the Progression of Osteoarthritis

Rory Norris¹, Pete Thompson¹ and Alan Getgood^{*2}

¹University Hospitals Coventry and Warwickshire, UK

²Fowler Kennedy Sport Medicine Clinic, 3M Centre, University of Western Ontario, London, Ontario, N6A 3K7, Canada

Abstract: Anterior cruciate ligament rupture (ACL) is a common injury, particularly among young sporting adults. Early onset osteoarthritis (OA) can be a devastating and difficult to manage consequence of such an injury. The techniques for reconstructing the ACL are advancing all the time, but the effect that this has on the progression of OA is less well

30 Jahre alter Hobbysportler

Alter	Event
30	VKB-R
40	beginnende Arthrose
50	progressive Arthrose
Leben	Event
30	Familie/Karriere startet
40	eingermaßen fest im Sattel
50	Pferde im trockenen

14 Jahre alte Highschool Athletin

Age	Event
14	VKB-R
24	beginnende OA
34	progressive Arthrose
Leben	Event
14	High School
24	College/Universtity
34	Familie/Karriere ???



THE ANTERIOR CRUCIATE LIGAMENT STUDY GROUP
Dedicated to the Understanding, Teaching & Research of the Knee



prevention@acl.app

chair ESMA/ESSKA
co-chair guardians of the ACL
founder join(t)forces
prevention committee GOTS



MEDIZINISCHE
HOCHSCHULE
BRANDENBURG

Risikofaktoren bei Frauen

nicht veränderbar

- hormonell
- Anatomische Differenzen

beeinflussbar

- Unausgewogenheit der Q/H Stärke
- Zeit und Aktivierungsmuster von Q/H
- Rekrutierungsmuster verschiedener Muskeln der unteren Extremität (und des Rumpfes)

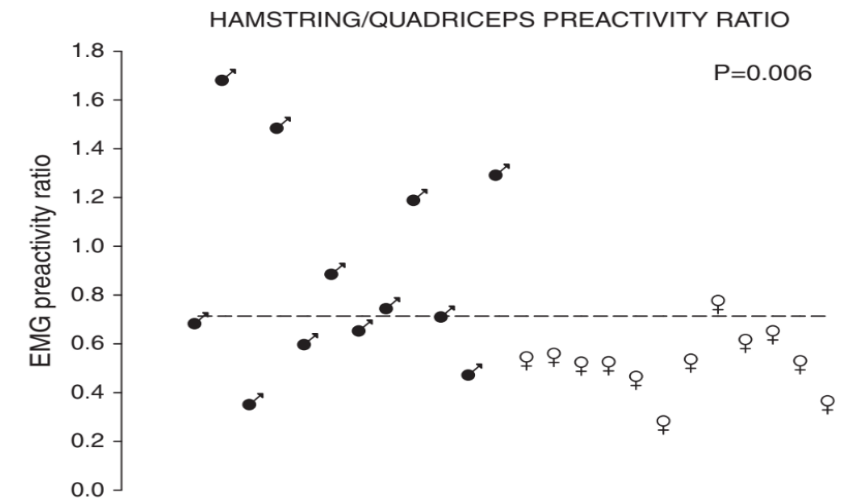
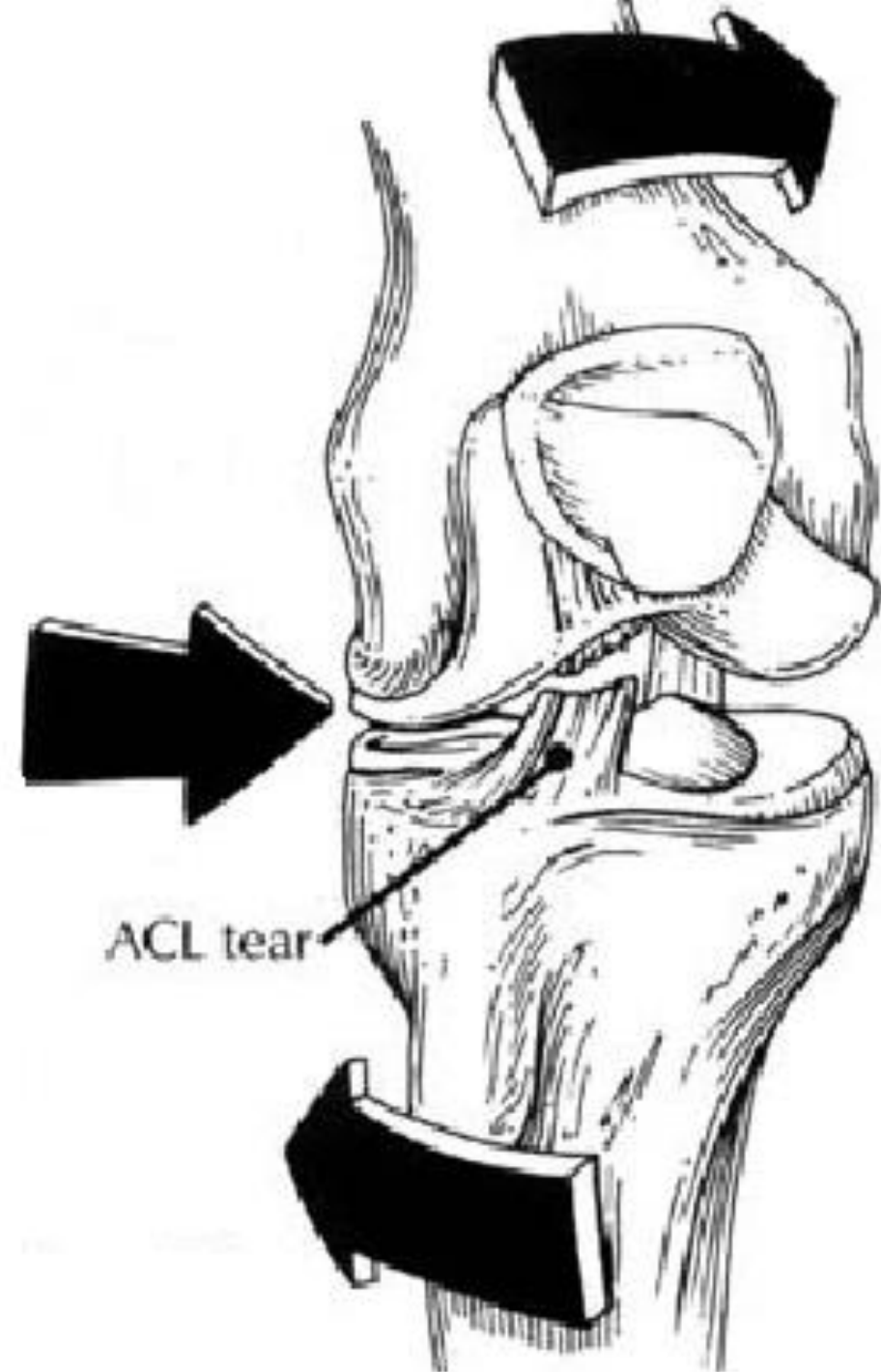
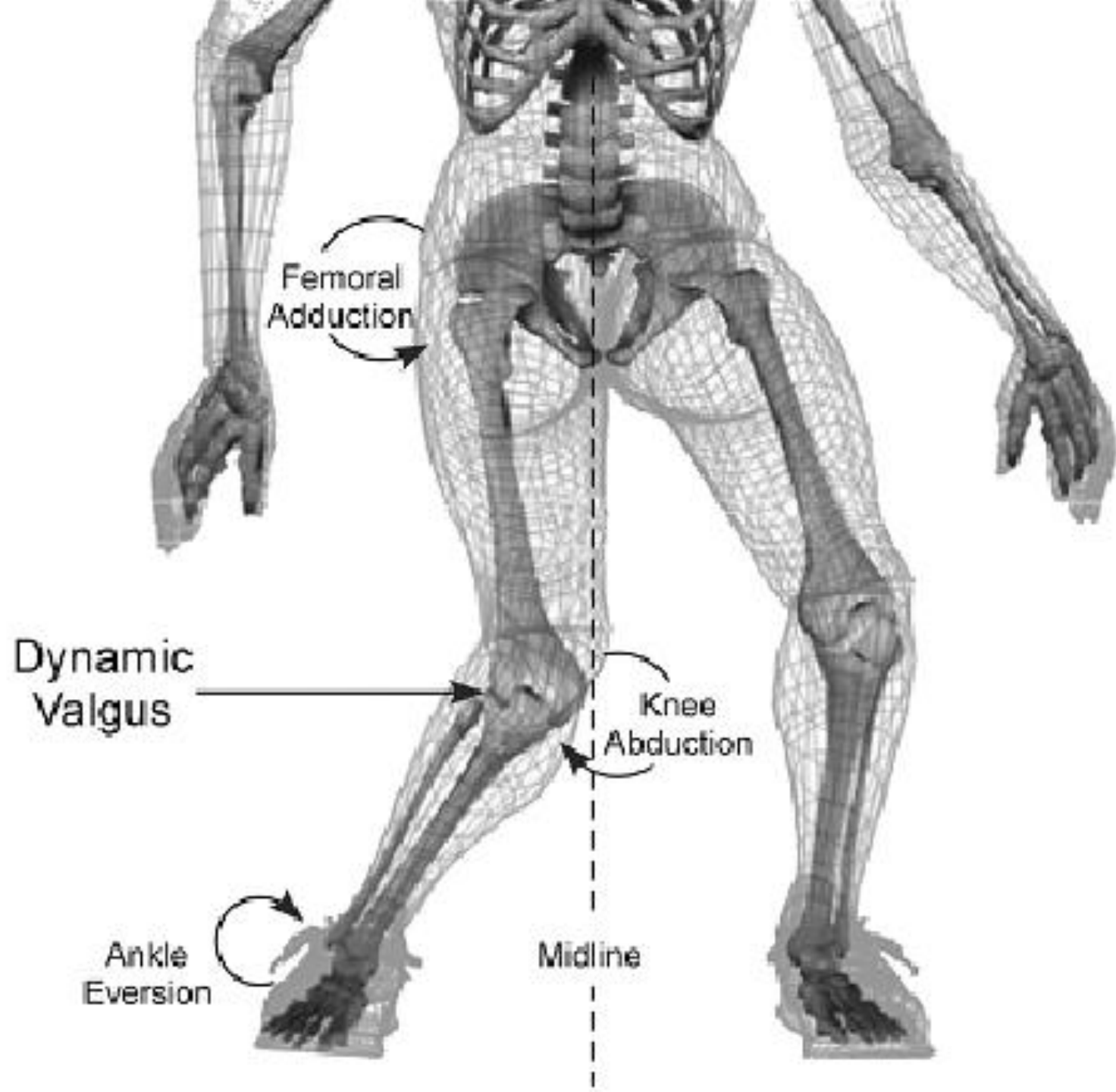


Fig. 3. Electromyography (EMG) hamstring-to-quadriceps pre-activity ratio during side-cutting. ♂: Male players. ♀: Female players. Dashed line indicates overall mean. The *P* value shows the significant difference level between the 2 groups.



Prävention is besser als Rekonstruktion!

The PEP Program: Prevent injury and Enhance Performance

warm-up, stretching, strengthening, plyometrics, and sport specific agilities

FIFA 11+

Knar Control

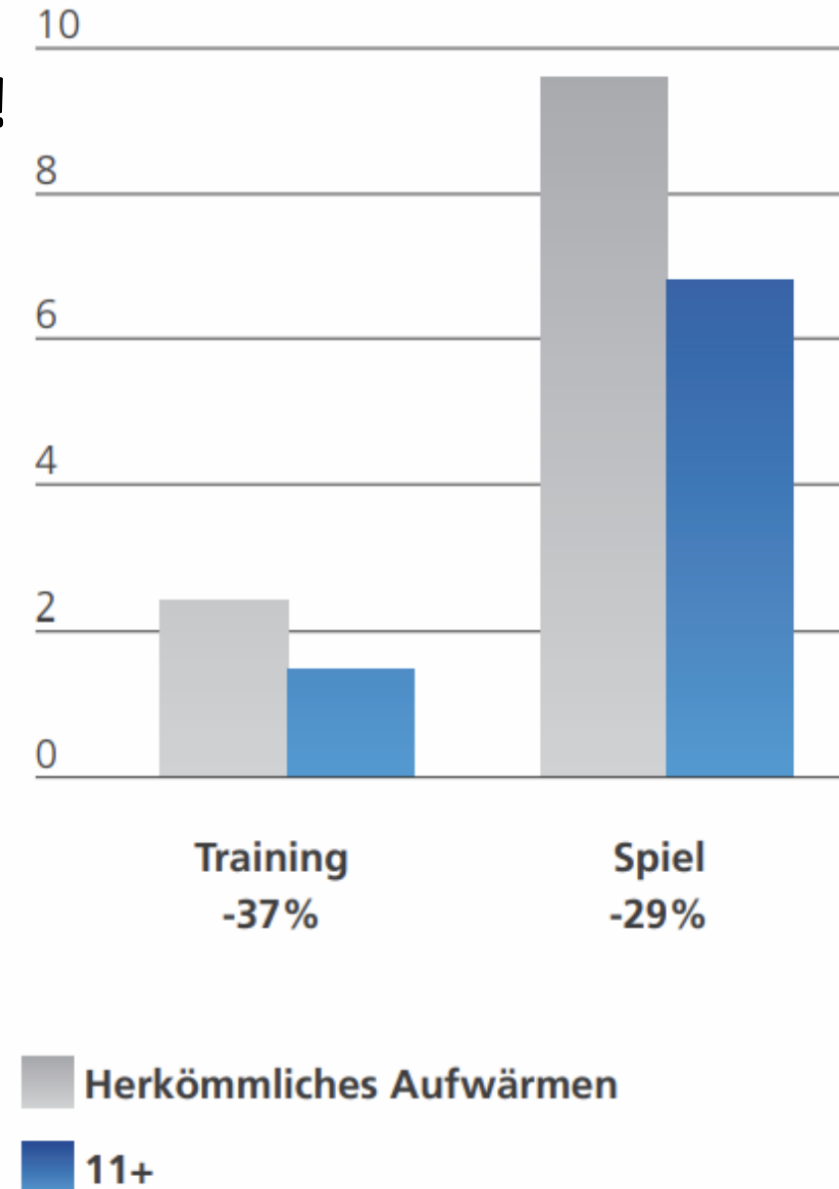
ESMA prevention program

Neuromuskuläre Programme funktionieren!

Zeigt bei den eingeschlossenen Programmen leichte Vorteile für Fifa 11+ und Knäkontroll basierend auf den vorliegenden Daten.

Magaña-Ramírez M, Gallardo-Gómez D, Álvarez-Barbosa F, Corral-Pernía JA. What exercise programme is the most appropriate to mitigate anterior cruciate ligament injury risk in football (soccer) players? A systematic review and network meta-analysis. *J Sci Med Sport*. 2024 Apr;27(4):234-242. doi: 10.1016/j.jsams.2024.02.001. Epub 2024 Feb 7. PMID: 38395699.f.

Verletzungen/1000 Std. Fussball



Quelle: DFB. Elf plus manual

Meta-Analysis of Meta-Analyses of Anterior Cruciate Ligament Injury Reduction Training Programs

Kate E. Webster & Timothy E. Hewett

Received 23 January 2018; accepted 27 April 2018

Summary meta-analysis showed an **overall 50% reduction in the risk of all ACL injuries in all athletes** and a **67% reduction for non-contact ACL injuries in females**. This paper combines all previous meta-analyses into a single source and shows conclusive evidence that ACL injury prevention programs reduce the risk of all ACL injuries by half in all athletes and non-contact ACL injuries by two-thirds in female athletes. There is insufficient data to make conclusions as to the effectiveness of ACL injury prevention programs in male athletes. 2018 Orthopaedic Research Society.

Published by Wiley Periodicals, Inc. J Orthop Res 9999:1–13, 2018.

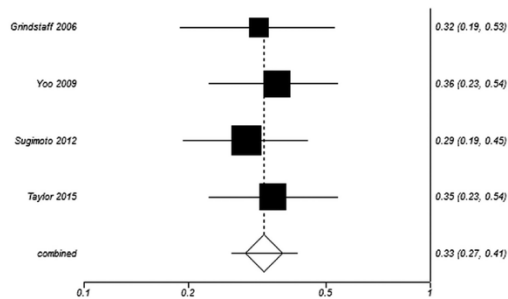


Figure 3. Summary meta-analysis of the meta-analyses for non-contact ACL injuries in females that demonstrated a 67% reduction (OR=0.33 [0.27–0.41]; $I^2=15%$) in the risk of non-contact ACL injuries.

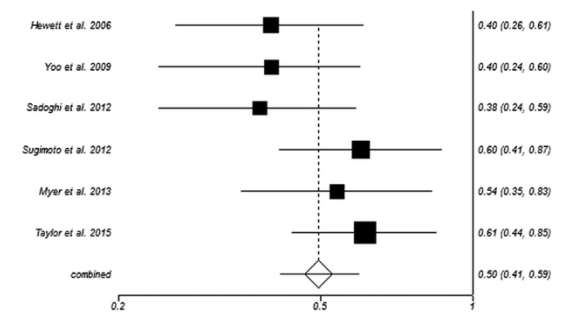
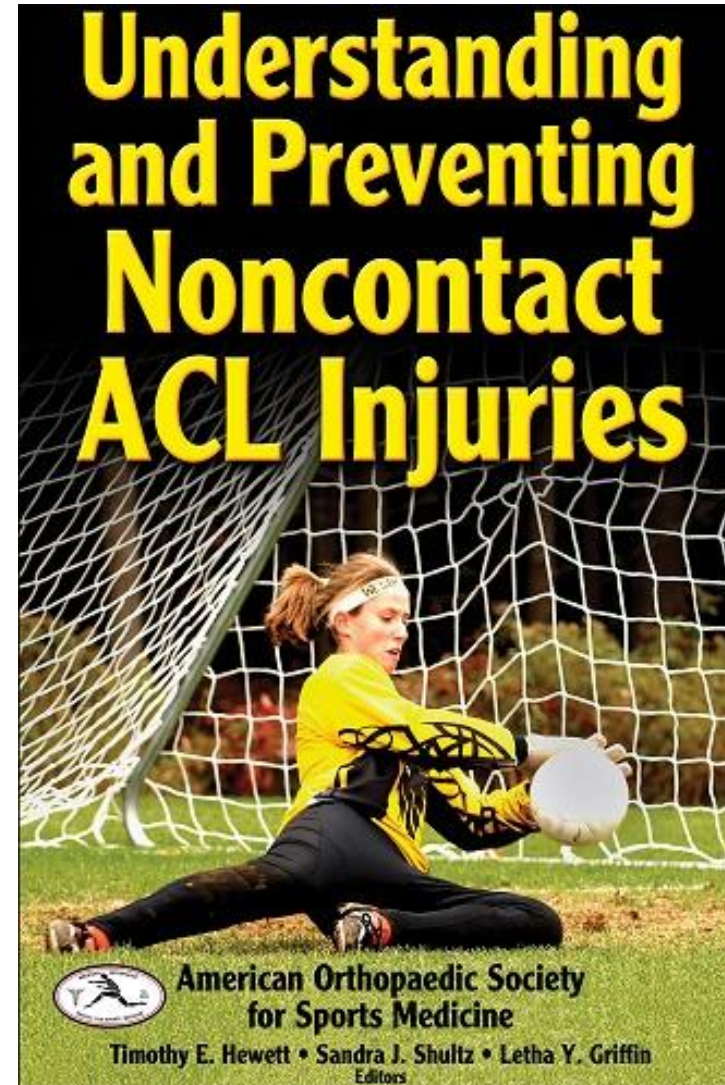


Figure 2. Summary meta-analysis of the meta-analyses for all ACL injuries in all athletes that demonstrated a 50% reduction (OR=0.5 [0.41–0.59]; $I^2=15%$) in the risk for all ACL injuries.

Inhalte

- neuromuscular training
- plyometrics
- strength
- agility
- balance



Identifikaiton von gef



GOED

FOUT



Datum: 07-06-2016
Gewicht: 59.00 kilogram

Patiëntgegevens

Geboortedatum: 25-06-2001
Sport: Hockey
Vereniging: Leonidas

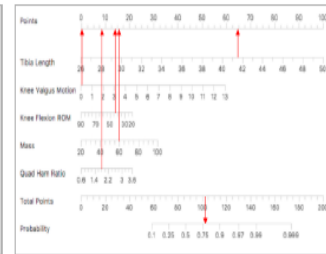
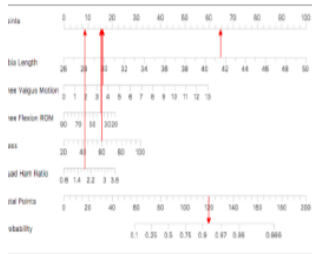
Status: Preventie
Aangedane zijde:
Diagnose

Testresultaten links

Tibia length: 41.50
Knee Valgus Motion: 3.43
Knee Flexion ROM: 40.00
Quad Ham Ratio: 1.80
Total points: 119.41
Probability: 0.93

Testresultaten rechts

Tibia length: 41.50
Knee Valgus Motion: 0.00
Knee Flexion ROM: 44.00
Quad Ham Ratio: 1.79
Total points: 102.31
Probability: 0.78



Datum: 08-09-2016
Gewicht: 47.60 kilogram

Patiëntgegevens

Geboortedatum: 28-09-2003
Sport: Hockey
Vereniging:

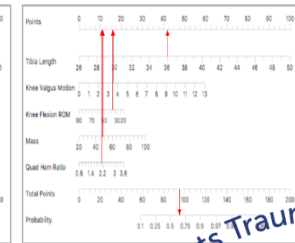
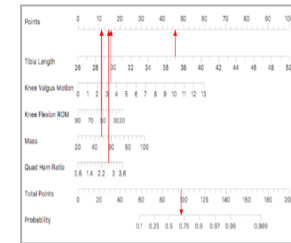
Status: Preventie
Aangedane zijde:
Diagnose

Testresultaten links

Tibia length: 37.00
Knee Valgus Motion: 3.34
Knee Flexion ROM: 54.00
Quad Ham Ratio: 2.64
Total points: 97.37
Probability: 0.70

Testresultaten rechts

Tibia length: 36.00
Knee Valgus Motion: 3.44
Knee Flexion ROM: 38.00
Quad Ham Ratio: 2.09
Total points: 94.62
Probability: 0.65



Before



After



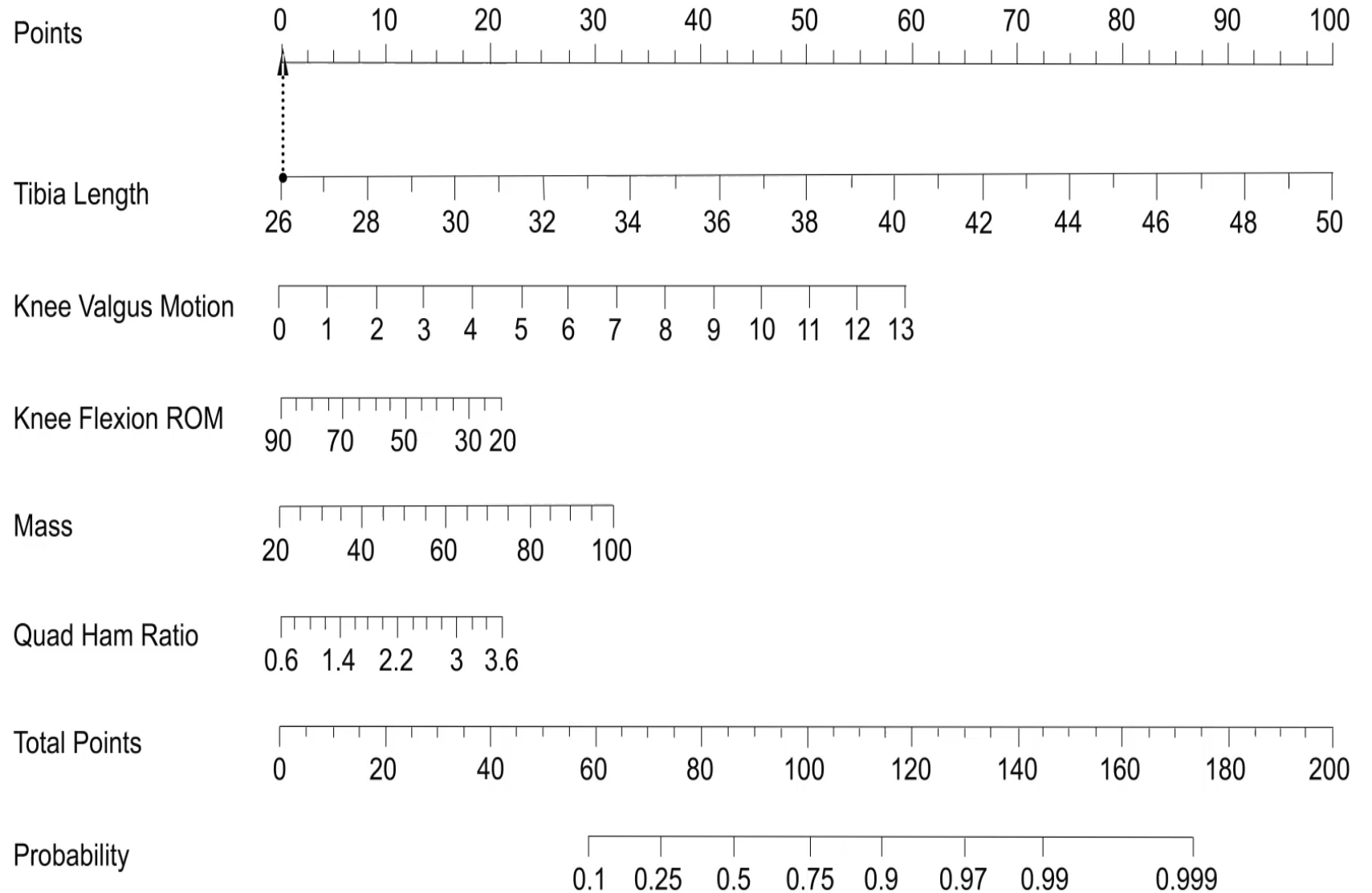
indiv. prevention Nomogram

sensitivity: 84%
specificity: 67%

Myer et al., 2010

probability of high knee load

Nomogram





Zwischenzusammenfassung

Inzidence von VKB Verletzungen +++

Inzidenz von VKB Rekonstruktionen+++

Risiko für Re-Rupturen / kontralaterale Rupturen +++

Risiko für Arthrose nach VKB-V/R +++

Risikoreduktion/ Verletzungspräventionsprogramme funktionieren +++

Physios und Trainer müssen fit für Prävention gemacht werden

Thank you for your prevention

For more information:

prevention@acl.app

For the website scan this QR-code:



ACL prevention for all!



ESMI & ESMILY





VKB-Ruptur – was nun?

OP oder keine OP?

Bei Personen mit einem ACL-Defekt im Knie wird jedoch davon ausgegangen, dass potenzielle Copers eine gute Kniestabilität und die Fähigkeit haben, nach einer Verletzung gut zu kompensieren, während Noncopers eine schlechte Kniestabilität und ein geringeres Kompensationspotenzial aufweisen.

Anamnese

Klinische Untersuchung

Keine Instabilität klingt sehr nach Coper!

Am J Sports Med. 2019 March ; 47(4): 807–814. doi:10.1177/0363546519825500.

Coper classification early after ACL rupture changes with progressive neuromuscular and strength training and is associated with two-year success: The Delaware-Oslo ACL Cohort study -

Louise M. Thoma, PT, PhD¹, Hege Grindem, PT, PhD², David Logerstedt, PT, PhD³, Michael Axe, MD⁴, Lars Engebretsen, MD, PhD^{2,5,6}, May Arna Risberg, PT, PhD^{2,5,*}, Lynn Snyder-Mackler, PT, ScD^{1,*}

Non - Coper?

- Gleichgewichtsdefizit im verletzten und scheinbar gesunden Bein der Probanden mit nichtoperiertem und operiertem ACL-D-Knie
- Erhöhte COP-Bahnlinienlänge, Schwankungsgeschwindigkeit und der Bereich der Coinfidence-Ellipse zeigten eindeutig eine gestörte Körperbalance
- Die reduzierte posturale Kontrolle der Probanden mit nicht-operativem ACL-D-Knie im bilateralen Stehen könnte ein weiterer Beweis für ihren schlechten Status der Kniestabilität sein.

The different knee joint loading patterns observed between non-copers and copers reflected the different walking strategies adopted by these groups, which may have implications for the knee joint stability.

Knee Surg Sports Traumatol Arthrosc (2011) 19:615–621
DOI 10.1007/s00167-010-1302-2

KNEE

Different knee joint loading patterns in ACL deficient copers and non-copers during walking

Tine Alkjær · Marius Henriksen · Erik B. Simonsen

Wie erkenne ich non-Copers noch?

Female non-copers demonstrated unique movement strategies following injury and perturbation training. Women may be a meaningful subgroup of non-copers, and future investigations should consider the effects of gender in the outcomes of non-copers.

Beighton Score



THE EFFECTS OF NEUROMUSCULAR TRAINING ON THE GAIT PATTERNS OF ACL-DEFICIENT MEN AND WOMEN


[Stephanie L. Di Stasi](#), PT, PhD, OCS^{1,3} and [Lynn Snyder-Mackler](#), PT, ScD, SCS, FAPTA²

Keine OP geht also auch?

Results Of 9514 records, 9 reports of three studies (320 participants in total) were included. No clinically important differences were observed at any follow-up for self-reported knee function (low to very low certainty of evidence). For radiological knee osteoarthritis, we found no effect at very low certainty of evidence in the long term (OR (95% CrI): 1.45 (0.30 to 5.17), two studies). Meniscal damage showed no effect at low certainty of evidence (OR: 0.85 (95% CI 0.45 to 1.62); one study) in the long term. No differences were observed between treatments for any other secondary outcome. Three ongoing randomised controlled trials were identified.

Conclusions There is low to very low certainty of evidence that primary rehabilitation with optional surgical reconstruction results in similar outcome measures as early surgical reconstruction for ACL rupture. The findings challenge a historical paradigm that anatomic instability should be addressed with primary surgical stabilisation to provide optimal outcomes.

Review

Primary surgery versus primary rehabilitation for treating anterior cruciate ligament injuries: a living systematic review and meta-analysis 

 Tobias Saueressig¹,  Tobias Braun^{2, 3},  Nora Steglich²,  Frank Diemer⁴,  Jochen Zebisch¹,  Maximilian Herbst¹,  Wolfgang Zinser⁵,  Patrick J Owen⁶,  Daniel L Belavy²

Non-operative Treatment: Patients who have ≤ 1 on the Lachman test and pivot-shift test have a fair ability to attain reasonable knee function with non-operative treatment!

Simonson, R., Piussi, R., Senorski, E.H. (2024). Anterior Cruciate Ligament Injury: Non-operative Treatment and Post-operative Rehabilitation. In: Sherman, S.L., Chahla, J., LaPrade, R.F., Rodeo, S.A. (eds) Knee Arthroscopy and Knee Preservation Surgery. Springer, Cham.
https://doi.org/10.1007/978-3-031-29430-3_34

Prehabilitation

Prähabilitation verbessert die Rückkehr zum Sport und die postoperative Funktion des Knies nach 2 Jahren.

Die Zeit vor der Operation reichte von 5 bis 9 Monaten, und die Prähabilitation erstreckte sich über 4 bis 6 Wochen (durchschnittlich 4,8 Wochen), 2-4 Mal pro Woche, für maximal 75 bis 120 Minuten.

[Arthrosc Sports Med Rehabil.](#) 2022 Jan; 4(1): e65–e69.

Published online 2022 Jan 28. doi: [10.1016/j.asmr.2021.11.001](https://doi.org/10.1016/j.asmr.2021.11.001)

PMCID: PMC8811524

PMID: [35141537](https://pubmed.ncbi.nlm.nih.gov/35141537/)

ACL Prehabilitation Improves Postoperative Strength and Motion and Return to Sport in Athletes

[Jamie Cunha](#), D.P.T.^a and [Daniel J. Solomon](#), M.D.^{b,*}

Table 1. Sample ACL Prehabilitation Program Beginning Six Weeks Before Reconstruction

Phase I (~0-3 weeks)		Phase II (~3-6 weeks)	
Goal	Normalize ROM	Goal	Normalize ROM
Heel slides with strap		Heel slides with strap	
Seated knee flexion stretch		Seated knee flexion stretch	
Prone hangs		Prone hangs	
Heel prop			
Semicircles on bike		Bike	
Hamstring and gastroc stretches		Hamstring and gastroc stretches	
Manual PROM from PT		Manual PROM from PT	
Goal	Decrease Swelling and Inflammation	Goal	Decrease Swelling and Inflammation
Ankle pumps		Ankle pumps	
Post-treatment cryotherapy/squid		Post-treatment cryotherapy/squid	
Manual retrograde massage from PT		Manual retrograde massage from PT	
Goal	Increase Strength	Goal	Increase Strength
Quad sets		Standing TKEs with resistance band	
SLR 4 way		Long-arc quads	
Bridging		Squats	
Hamstring curls		Hamstring ball curls	
Heel raises bilateral		Heel raises unilateral	
Side-lying clamshells		Sidestepping with TheraBand	
Step ups		Leg press	
Sit to stand or squats		Split squats or single-leg squats	
Wall slides		RDLs	
Blood flow restriction		Blood flow restriction	
Goal	Improve Balance/Proprioception	Goal	Improve Balance/Proprioception
Single-leg balance		Single-leg balance on uneven surfaces	
Tandem stance		Tandem walk	
Double-leg balance on uneven surface		Single-leg balance star taps	

OP

BTB

Semitenidnosus

Gracilles

Quadriceps

ALL

Tibia Slope

Meniscus

Welcher Sport?



Rehabilitaiton in der Frühphase nach ACLR (<6 Wochen)

Psychosoziale
Aspekte

Kniegelenks-
beweglichkeit

Allgemeine Fitness

Erfolgreiche
Frühphase der
Rehabilitation

Schmerz

- Stützen für 1-2 Wochen
- Orthese?
- MLD
- Passive und aktive
Extensionsverbesserung!
- Schmerzreduktion
(symptomatisch)
- Beidbeinige Stabiübungen
- Beweglichkeit vor Kraft!

Neuromuskuläre
Kontrolle und
Bewegungsgüte

Arthrogene
Hemmung

Schwellung

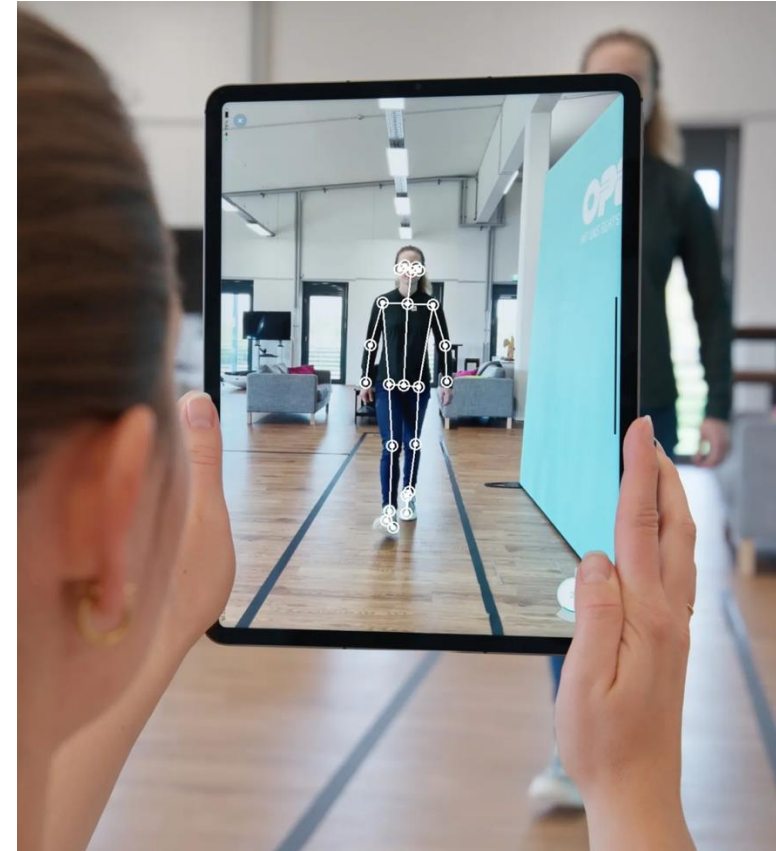
Review > Sports Med. 2024 Jan;54(1):49-72. doi: 10.1007/s40279-023-01934-w.
Epub 2023 Oct 3.

Optimising the Early-Stage Rehabilitation Process Post-ACL Reconstruction

Matthew Buckthorpe ^{1 2}, Alli Gokeler ³, Lee Herrington ⁴, Mick Hughes ⁵, Alberto Grassi ⁶,
Ross Wadey ⁷, Stephen Patterson ⁷, Alessandro Compagnin ⁸, Giovanni La Rosa ⁸,
Francesco Della Villa ⁸

Mittlere Rehabilitationsphase >6 Wochen

- Volle Extension möglichst nach drei Wochen (Arthrofibrose)
- Gangbild weitestgehend normal
- Orthesen (wenn vorhanden weg)
- Wenn Schmerz weg: Kraft!!!
 - Vorsicht mit Kraftausdauer bei Schnellkraftsportlern
 - wenn Bewegungsgüte im offenen System unauffällig, dann geschlossen und offen trainieren



Orthelligent® VISION

Mittlere Rehabilitationsphase

Muskelkraft

Veränderte
motorische
Grundmuster:
Reedukation

Erfolgreiche mittlere
Phase der
Rehabilitation

CAVE: Hohe
Verletzungs-
wahrscheinlichkeit

Fitness/
Rekonditionierung

Sports Medicine
<https://doi.org/10.1007/s40279-019-01222-6>

REVIEW ARTICLE

Optimising the 'Mid-Stage' Training and Testing Process After ACL Reconstruction

Matthew Buckthorpe^{1,2} · Francesco Della Villa¹

Im Breitensport ist
hier schon schluß

Who's Afraid of the Big Bad Wolf?

Open-Chain Exercises After Anterior CLINICAL SCIENCES

Loading Behaviors Do Not Match Loading Abilities Postanterior Cruciate Ligament Reconstruction

CHAN, MING-SHENG; SIGWARD, SUSAN M.

Author Information 

Medicine & Science in Sports & Exercise 51(8):p 1626-1634, August 2019. | DOI: 10.1249/MSS.0000000000001956

Rinaldi
Journal
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REVIEW

Open Access

The influence of gluteal muscle strength deficits on dynamic knee valgus: a scoping review



Vito Gaetano Rinaldi^{1*} , Robert Prill^{3,4}, Sonja Jahnke³, Stefano Zaffagnini^{1,5} and Roland Becker^{2,3,4}



Zugbelastung am vorderen Kreuzband nur in **offener Kette** – in **endgradiger Extension**

Escamilla et al, 1998

Bei **30 °**, **60°** und **90°** keine Veränderung der relativen Verlängerung, verglichen mit entspannter Muskulatur

Toutoungi et al. 1999

Verwendung von Übungen in **geschlossener UND in offener Kette** → **besserer Krafrückkehr** des Quadrizeps und **schnellere Rückkehr zum Sport**, als mit Übungen in geschlossener Kette allein

Mikkelsen et al. 2000

Unterschied **offene und geschlossene** vs. nur **geschlossene Kette**: Laxität identisch, **Kraftzuwachs in Gruppe 1 höher**

Forelli et al. 2023



Kniestabilisation: offene vs. geschlossene Kette

Beinstrecker	Beinpresse	Muskulatur
87,9% (MVC)	105,5% (MVC)	M. vastus lateralis
78,8% (MVC)	92,9% (MVC)	M. vastus medialis
93,8 (MVC)	69,5 (MVC)	M. rectus femoris



ad!!!



!!

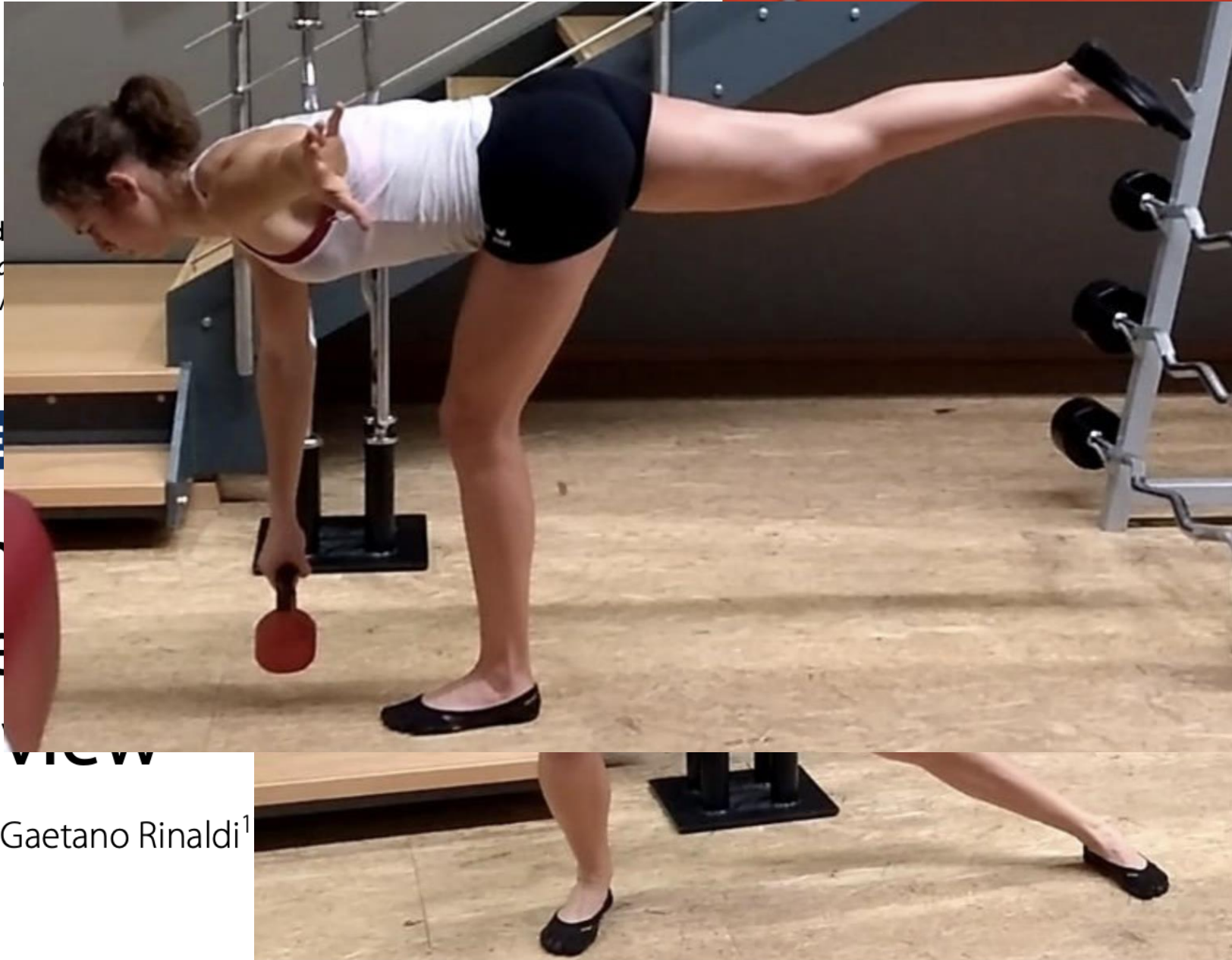
Gluc

Rinaldi
Journ
https://

RE

**The
de
review**

Vito Gaetano Rinaldi¹



Journal of
Medics

Access



Therapie-Beispiele

Exzentrik



Therapie-Beispiele

Allgemeine Stabilisation Hüftgelenk



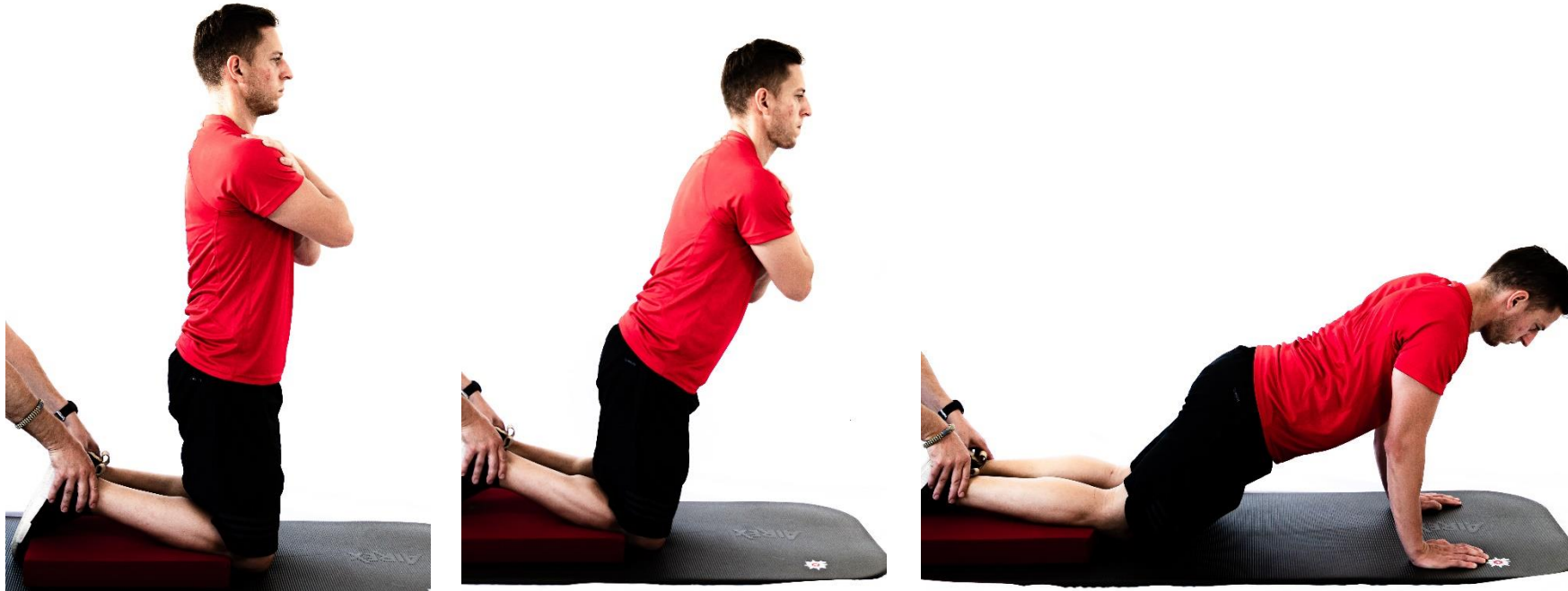
Glute Bridge



Barbell-HIP-Trust



Nordic Hamstrings



[Sci Rep.](#) 2023; 13: 10000

Published online 2023 Nov 3. doi: [10.1038/s41598-023-45817-6](https://doi.org/10.1038/s41598-023-45817-6)

PMCID: PMC10624851

PMID: [37923738](https://pubmed.ncbi.nlm.nih.gov/37923738/)

Nordic hamstring exercises in functional knee rehabilitation after anterior cruciate ligament reconstruction: a prospective, randomised, controlled study

[JiaWei Chen](#),^{#1} [TianYu Wu](#),^{#2,3} and [Ying Guo](#)⁴

Wadeln (Triceps surae)



<https://doi.org/10.1242/jeb.064527>.

Fong CM, Blackburn JT, Norcross MF, McGrath M, Padua DA. Ankle-dorsiflexion range of motion and landing biomechanics. *J Athl Train*. 2011;46(1):5–10. <https://doi.org/10.4085/1062-6050-46.1.5>.

Maniar N, Schache AG, Sritharan P, Opar DA. Non-knee-spanning muscles contribute to tibiofemoral shear as well as valgus and rotational joint reaction moments during unanticipated side-step cutting. *Sci Rep*. 2018;8:2501. <https://doi.org/10.1038/s41598-017-19098-9>.

Mokhtarzadeh H, Yeow CH, Hong Goh JC, et al. Contributions of the Soleus and Gastrocnemius muscles to the anterior cruciate ligament loading during single-leg landing. *J Biomech*. 2013;46:1913–20. <https://doi.org/10.1016/j.jbiomech.2013.04.010>.

Schlumberger A. Strength of ankle muscles in high level athletes after knee surgery. In 3rd International conference on strength

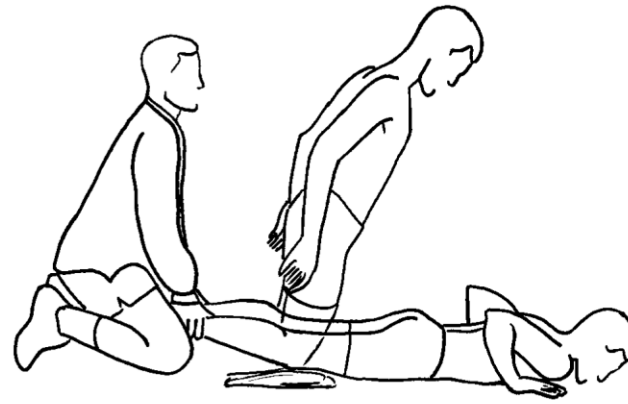
Kniestabilisation:

geführt vs. frei

**Kraftzuwachs:
kein signifikanter Unterschied!**



Take Home: DKV, Q/H,
Core, Wadeln!!!



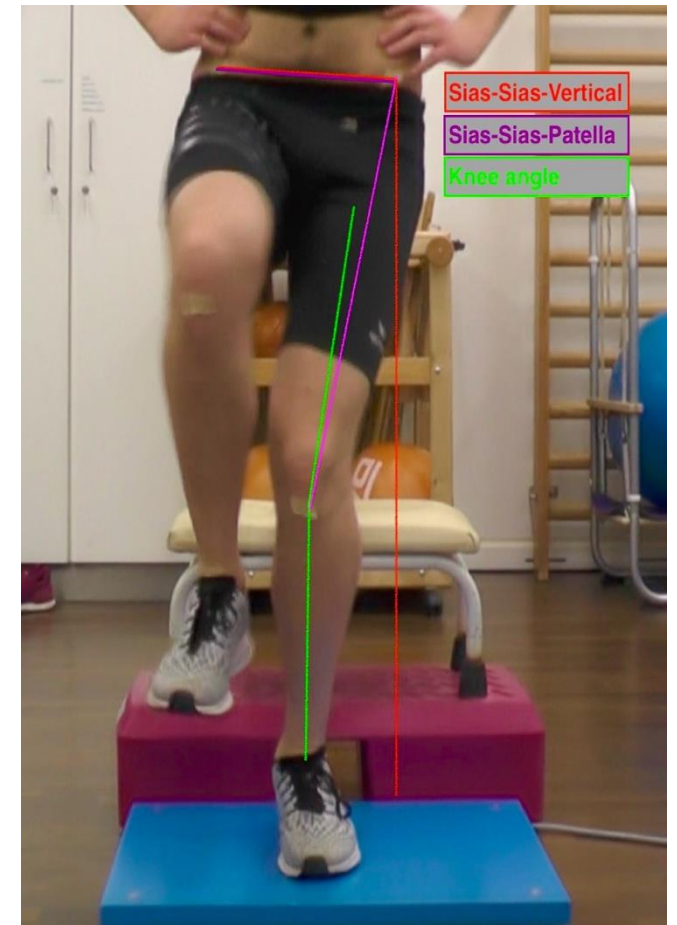
Nordic Hamstring Exercise (NHE).
Stablo I, Prill R, Martin T. WCPT 2021



Isokinetic leg press for Quadriceps and Gluteus.
Prill R, Schulz R, Michel S, Becker R. ESSKA Congress 2022



shutterstock.com · 1841370064



Landing Exercises for Gluteus and Quadriceps.
Jahnke S, Becker R, Królikowska A, Oleksy L, Prill R.
WCSPT, to be held in 2022

Arthrogene Hemmung – Was wissen wir?

- Verlust von Muskelkraft, Muskelaktivität und Muskelmasse bei Arthritis für den Quadrizepsmuskel gut beschrieben (Hurley 1997, Stokes 1984)
- Chirurgie: wochenlange Hemmung von bis zu 50% (Young 1993))
- Bereits 1965 wurde ein fortschreitender Verlust der Quadrizepskraft und eine verminderte EMG-Aktivität bei zunehmender Schwellung des Gelenks beschrieben (Deandrade 1965)
- selbst klinisch stille Schwellung => Hemmung, Vastus medialis bei 20-30ml, Rectus und Lateralis bei 50-60ml
- Dies wird auch für ACLI/ACLR entsprechend beschrieben (Schilaty. Eur Sports Science 2023)



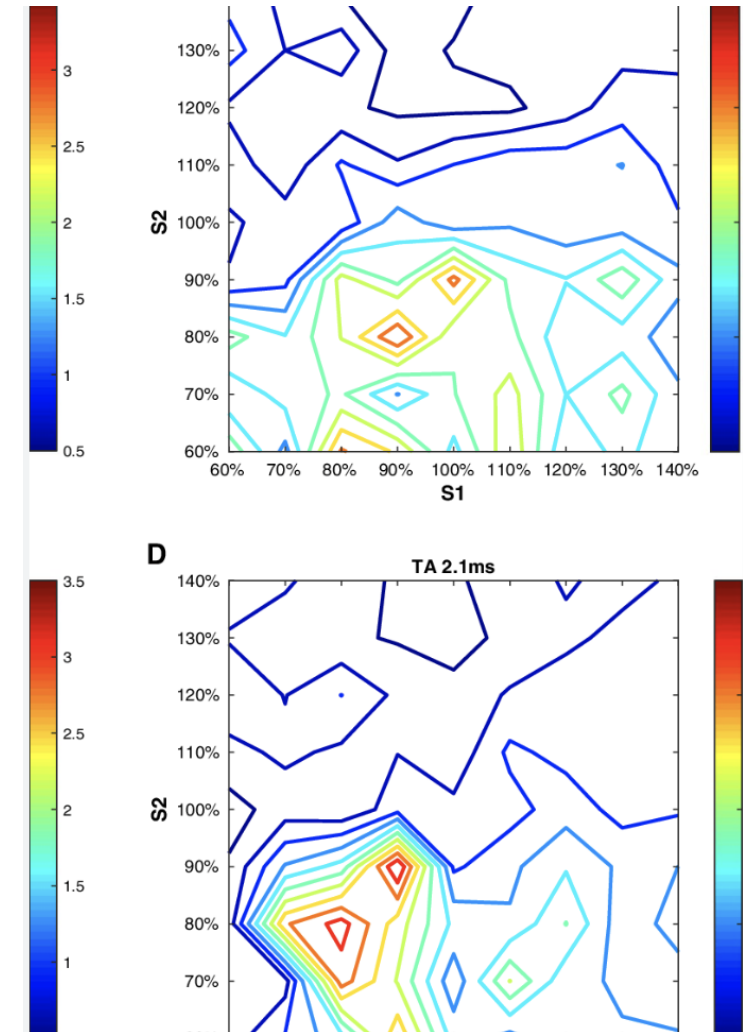
Arthrogenic Inhibition

Muscle dysfunction directly stemming from a change in joint sensory information and its integration in the central nervous system (Hopkins 2022)

Rehabilitation. Not always satisfying!

Athletes after anterior cruciate ligament reconstruction demonstrate asymmetric intracortical facilitation early after surgery

Ryan Zarzycki ¹, Susanne M Morton ^{2 3}, Charalambos C Charalambous ⁴, Brian Pietrosimone ⁵, Glenn N Williams ⁶, Lynn Snyder-Mackler ^{2 3}



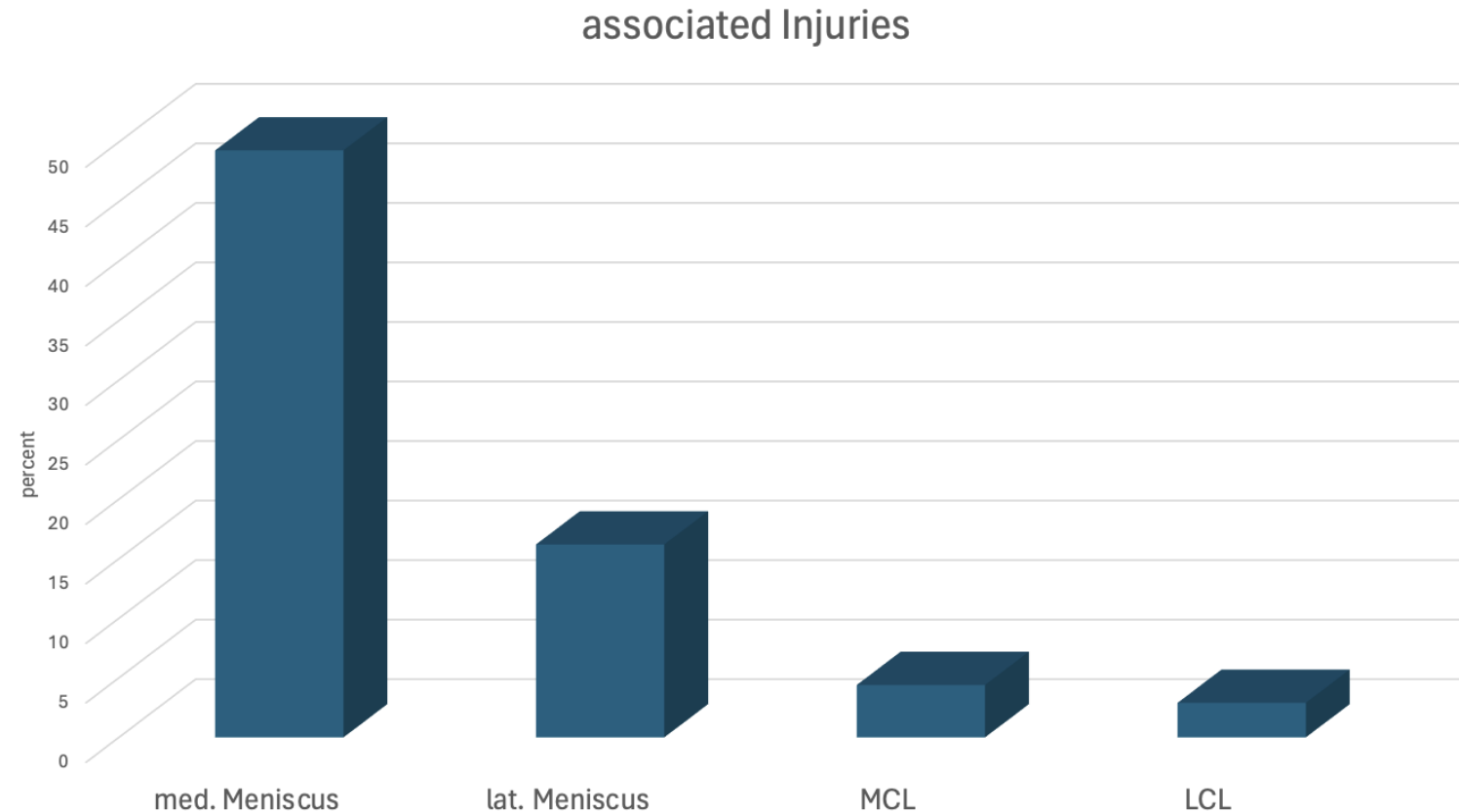
How to solve

Eine Kombination aus frühem intensivem Krafttraining (wenn es der Meniskus zulässt) in Kombination mit NMES UND in Kombination mit einer konsequenten Erguss- und Schmerztherapie könnte empfehlenswert sein!



Ausflug - Begleitverletzungen

- mediale Meniskus war bei etwa der Hälfte (49,3 %) der Patienten
- Lateraler Meniscus 16,2%
- Innenband (MCL) 4,4%
- Außenband 2,9%
- Beide Kollateralbänder 2,2%



ACL + meniscus injury	medial	lateral	medial + lateral
Potter HG, <i>AJSM</i> 2012	25 – 45%	31 % - 65%	
Salem HS, <i>Arthroscopy</i> 2017	29%	43%	15%
Prentice HA, <i>BJSM</i> 2018	15 – 34%	11 – 42%	5 -16%
Magosch A, <i>KSSTA</i> 2020	22%	26%	18%

- No difference in type of tear between contact versus noncontact ACL injuries (Salem et al. *Arthroscopy* 2017)
- Lateral meniscus root tears more frequently in pivoting sports -Level 1 (Magosch et al. *KSSTA* 2020)
- Lateral meniscus root tears more frequently in contact sport (7.8% vs 4.5%) (Praz et al. *AJSM* 2019)
- Degree of anterior instability no risk factor
- Postrolateral root tears in 7-12% of ACL injuries

Meniscus injuries

- 25 - 40% of sport injuries¹ 97.720 meniscus injuries diagnosed per year (2011, Germany)
- 119 per 100.000 inhabitants / year in Germany²



<http://www.spoX.com>

The Formal EU-US Meniscus Rehabilitation Consensus. An ESSKA-AOSSM-AASPT Initiative

ESSKA



Knee - Meniscus
Consensus Symposium
Brown 3

Friday, May 10, 11:50 – 12:50

CS05 The formal EU-US Meniscus Rehabilitation Consensus. An ESSKA-AOSSM-AASPT Initiative

Know more here!

Chair: Nicolas Pujol (Le chesnay, France)
Chair: Robert Prill (Brandenburg an der Havel, Germany)
Chair: Airelle Giordano (Newark, DE, United States)
Chair: Ben Ma (San Francisco, United States)



- The formal EU-US Meniscus Rehabilitation Consensus. An ESSKA-AOSSM-AASPT Initiative



The formal EU-US Meniscus Rehabilitation Consensus.
An ESSKA-AOSSM-AASPT Initiative.

Chairpersons: Airelle Giordano, Benjamin Ma, Robert Prill, Nicolas Pujol.
Consensus Advisor: Philippe Beaufils.

While two ESSKA consensuses already addressed the management of degenerative meniscus lesions and traumatic meniscus tears, focusing on the concept of meniscus preservation, rehabilitation management remained unaddressed. This consensus aims to provide recommendations for rehabilitation, including physical therapy, for patients undergoing non operative or surgical treatment for degenerative meniscus lesions or traumatic meniscus tears. It also explores the impact of concomitant pathologies, the role of prevention programs, and return-to-sport protocols.



ill, A. Giordano, B. Ma , N. van



The "The formal EU-US Meniscus Rehabilitation Consensus. An ESSKA-AOSSM-AASPT Initiative" summary and complete report are available below.

Summary

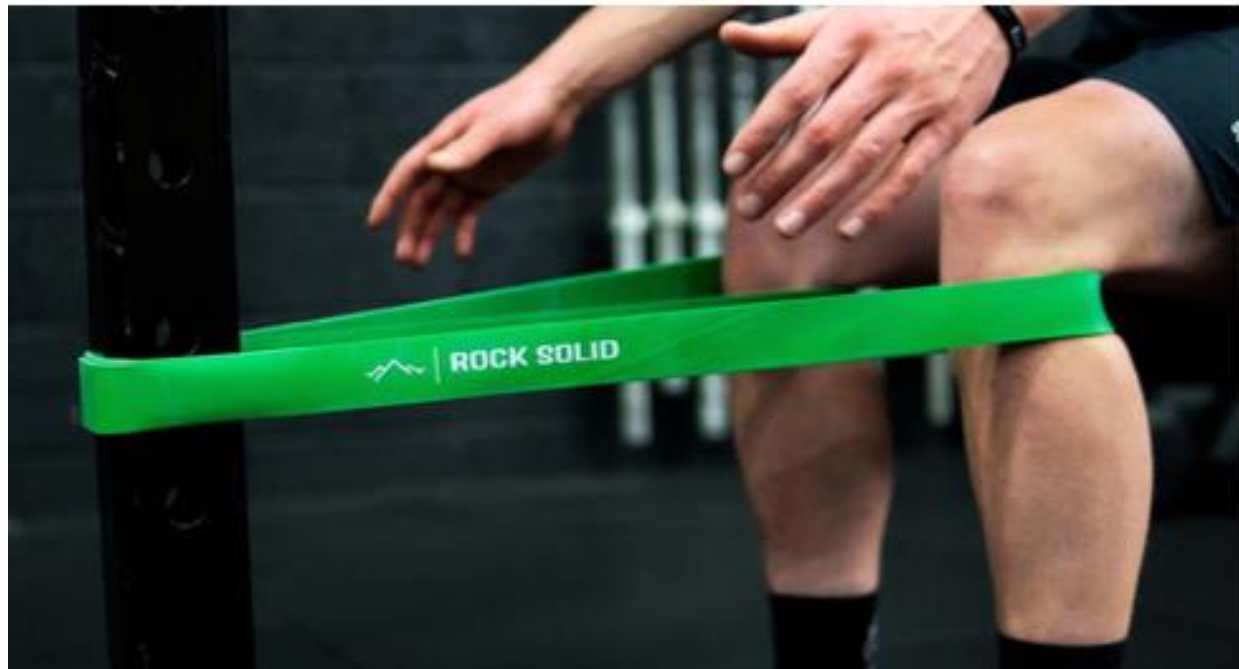
<https://www.esska.org/general/custom.asp?page=Consensus>

Complete Report



Meniskus-Läsion

Übungsbeispiele: Meniskus-Hinterhorn



“Spanish Squats”

Meniscus Rehabilitation

	Weight bearing (WB)	Crutches	Range of motion restriction	Knee brace
Stable vertical meniscal tear	Full WB	No	No	No recommendation
Complex vertical meniscal tear repairs	Full WB	Yes	Yes	No recommendation
Complete oblique and radial tears	No WB for 4 to 6 weeks	Depending on WB	0-90° for 4 to 6 weeks	No recommendation
Horizontal lesions in the young athlete	Partial or no WB for 4 weeks	Depending on WB	0-90° for 4 weeks	No recommendation
Ramp lesions	No recommendation	No recommendation	No recommendation	No recommendation
Root tears	No WB for 6 weeks	Depending on WB	0-90° for 4 weeks	No recommendation

Zusammenfassung: Most conflicting

ACRL: Immediate ROM progression, 2 weeks limited weight bearing

MCL (conservative): 6 weeks ROM restriction, immediate weight bearing if possible

Meniscus (e.g. Complete oblique and radial tears): 4-6 weeks limited ROM and 4-6 weeks no weight bearing

On-field Rehabilitation Part 2: A 5-Stage Program for the Soccer Player Focused on Linear Movements, Multidirectional Movements, Soccer-Specific Skills, Soccer-Specific Movements, and Modified Practice

AUTHORS ^

[Matthew Buckthorpe, PhD¹](#), [Francesco Della Villa, MD¹](#), [Stefano Della Villa, MD¹](#), [Giulio Sergio Roi, MD¹](#)

AFFILIATIONS v

Journal of Orthopaedic & Sports Physical Therapy

Published Online: July 31, 2019 | Volume 49 Issue 8 | Pages 570-575

<https://www.jospt.org/doi/10.2519/jospt.2019.8952>

Zusätzliche Faktoren

Angst

mangelnde
Erwärmung

Druckbedingungen

- Leistungs-
- Trainings-
- Konkurrenzdruck

Umstellung techn. Takt.
Kampfkonzepzion

Wettkampf-
abläufe

Hormon-
schwankungen

Feedforward and Feedback

Back to Golf?

Back to running?

Back to Kyte?

Back to Soccer?

Back to Judo?



Neurokognitives Training

<https://www.youtube.com/watch?v=QdPvj4AQe2g>



Low rates of patients meeting return to sport criteria 9 months after anterior cruciate ligament reconstruction: a prospective longitudinal study

Wouter Welling^{1 2}, Anne Benjaminse^{3 4}, Romain Seil^{5 6}, Koen Lemmink³, Stefano Zaffagnini⁷, Alli Gokeler³



Editor's choice
Scan to access more
free content

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

Hege Grindem,¹ Lynn Snyder-Mackler,² Håvard Moksnes,³ Lars Engebretsen,^{3,4} May Arna Risberg^{1,4}

Results Patients who returned to level I sports had a 4.32 ($p=0.048$) times higher reinjury rate than those who did not. The reinjury rate was significantly reduced by 51% for each month RTS was delayed until 9 months after surgery, after which no further risk reduction was observed. 38.2% of those who failed RTS criteria suffered reinjuries versus 5.6% of those who passed (HR 0.16, $p=0.075$). More symmetrical quadriceps strength prior to return significantly reduced the knee reinjury rate.

or Anterior Cruciate action: A Criterion- Based Rehabilitation Progression

Return to sport

- Rückkehr zum Sport nach einer VKB-R liegt je nach Studie bei etwa 70-90 %.
- Webster et al. fanden heraus, dass nur 24 % der Patienten zu ihrem vor der Verletzung erreichten Sportniveau zurückkehrten, obwohl 91 % vor der Operation angaben, dass sie dies erwarteten.



Patients who returned to level I sports had a 4.32 ($p=0.048$) times higher reinjury rate than those who did not. The reinjury rate was ...

Conclusion: These analyses shows that there are equivocal findings in terms of the validity of current RTS test batteries in relation to reduction of the risk of graft rupture and contralateral ACL injuries. These findings have implications for RTS advice given to patients based on the results of RTS test batteries, and further work is needed to validate the criteria currently used and determine the true value.


Meta-Analysis > [Sports Med.](#) 2019 Jun;49(6):917-929. doi: 10.1007/s40279-019-01093-x.

What is the Evidence for and Validity of Return-to-Sport Testing after Anterior Cruciate Ligament Reconstruction Surgery? A Systematic Review and Meta-Analysis


Kate E Webster ¹, Timothy E Hewett ^{2 3 4 5}

Re-Ruptur

- nach einer VKB-Rekonstruktion bei Patienten im Alter von ≤ 18 Jahren trat bei 1 von 3 Patienten über 15 Jahre eine weitere VKB # auf.
- das ACL-Transplantat und das kontralaterale ACL waren in den ersten 5 Jahren nach der Rekonstruktion am anfälligsten.
- + Eine ACL-Ruptur in der Familienanamnese erhöhte signifikant das Risiko für ACL
- Transplantatrisse, und eine CACL-Verletzung trat häufiger bei denjenigen auf, die zum Mannschaftssport zurückkehrten.

 Restricted access | Research article | First published online April 21, 2014

Incidence of Second ACL Injuries 2 Years After Primary ACL Reconstruction and Return to Sport

[Mark V. Paterno, PT, PhD, SCS, ATC](#) , [Mitchell J. Rauh, PT, PhD, MPH, FACSM](#), [...], and [Timothy E. Hewett, PhD, FACSM](#)  [View all authors and affiliations](#)

[Volume 42, Issue 7](#) | <https://doi.org/10.1177/0363546514530088>



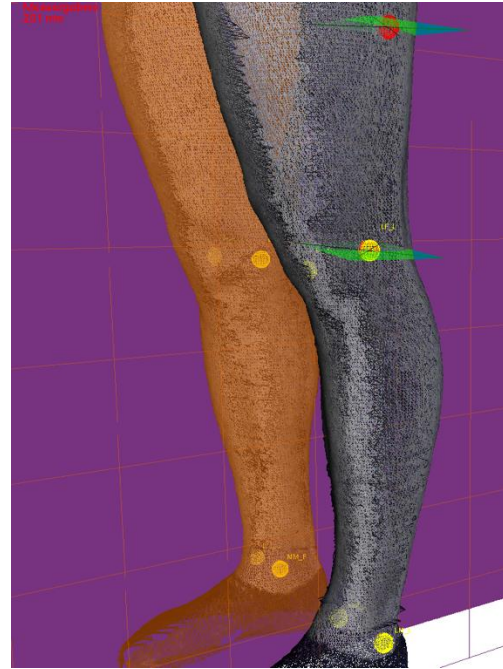
Diese Daten stützen die Hypothese, dass Patienten in den 24 Monaten nach einer VKB-Resektion und einem RTS ein höheres Risiko haben, eine weitere VKB-Verletzung zu erleiden, als junge Sportler ohne VKB-Verletzungen in der Vergangenheit.

Darüber hinaus scheint die kontralaterale Extremität von weiblichen Patienten am stärksten gefährdet zu sein.

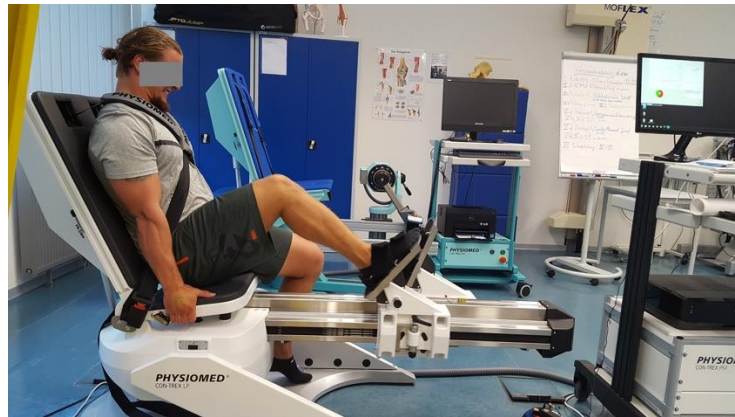
Muscle status – Quadriceps/Hamstrings



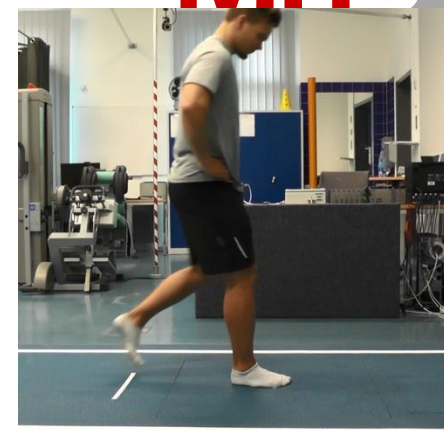
Tanita Body Composition



Vitronic 3D Body Scanner



Contrax Leg Press



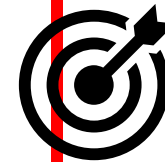
a) Stabilizing after forward jump



c) Single leg CMJ

LIMB SYMMETRY INDEX (LSI)

$$\frac{\text{Value obtained in the involved limb}}{\text{Value obtained in the uninjured limb}} * 100$$



LSI > 90

110 > LSI > 90

Clin Biomech (Bristol, Avon). 2007 Jun;22(5):543-50. Epub 2007 Mar 27.

Contralateral limb strength deficits after anterior cruciate ligament reconstruction using a hamstring tendon graft.

Hiemstra LA¹, Webber S, MacDonald PB, Kriellaars DJ.

Orthopaedics & Traumatology: Surgery & Research 103 (2017) 947–951

Also, the LSI hasn't been proven to be predictive!



Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en



Original article

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

A. Gokeler^{a,*}, W. Welling^{a,b}, A. Benjaminse^{a,c}, K. Lemmink^a, R. Seil^d, S. Zaffagnini^e



Is hamstrings-to-quadriceps torque ratio useful for predicting anterior cruciate ligament and hamstring injuries? A systematic and critical review

Eleftherios Kellis^{a,*}, Chrysostomos Sahinis^a, Vasilios Baltzopoulos^b

^a *Laboratory of Neuromechanics, Department of Physical Education and Sport Sciences at Serres, Aristotle University of Thessaloniki, Serres 62100, Greece*

^b *Research Institute for Sport and Exercise Sciences (RISES), Faculty of Science, Liverpool John Moores University, Liverpool L3 5UX, UK*

$$\frac{\text{Hamstring Strength}}{\text{Quadriceps Strength}} = \text{H:Q Ratio}$$



Conclusion: The H:Q ratio has limited value for the prediction of ACL and hamstring injuries. Monitoring strength imbalances along with other modifiable factors during the entire competitive season may provide a better understanding of the association between H:Q ratio and injury.

Article

Composite Score of Readiness (CSR) as Holistic Profiling of Functional Deficits in Footballers Following ACL Reconstruction

Lukasz Oleksy ^{1,2,3,*}, Anna Mika ⁴, Aleksandra Królikowska ⁵, Maciej Kuchciak ⁶, Magda Stolarczyk ⁷, Renata Kielnar ⁸, Henryk Racheńiuk ⁹, Jan Szczegielniak ⁹, Edyta Łuszczki ⁸ and Artur Stolarczyk ¹

Article

A Compound Hop Index for Assessing Soccer Players' Performance

Lukasz Oleksy ^{1,2,3,4,*}, Aleksandra Królikowska ^{5,*}, Anna Mika ⁶, Maciej Kuchciak ⁷, Daniel Szymczyk ⁸, Marian Rzepko ⁷, Grzegorz Bril ⁴, Robert Prill ⁹, Artur Stolarczyk ¹ and Paweł Reichert ¹⁰

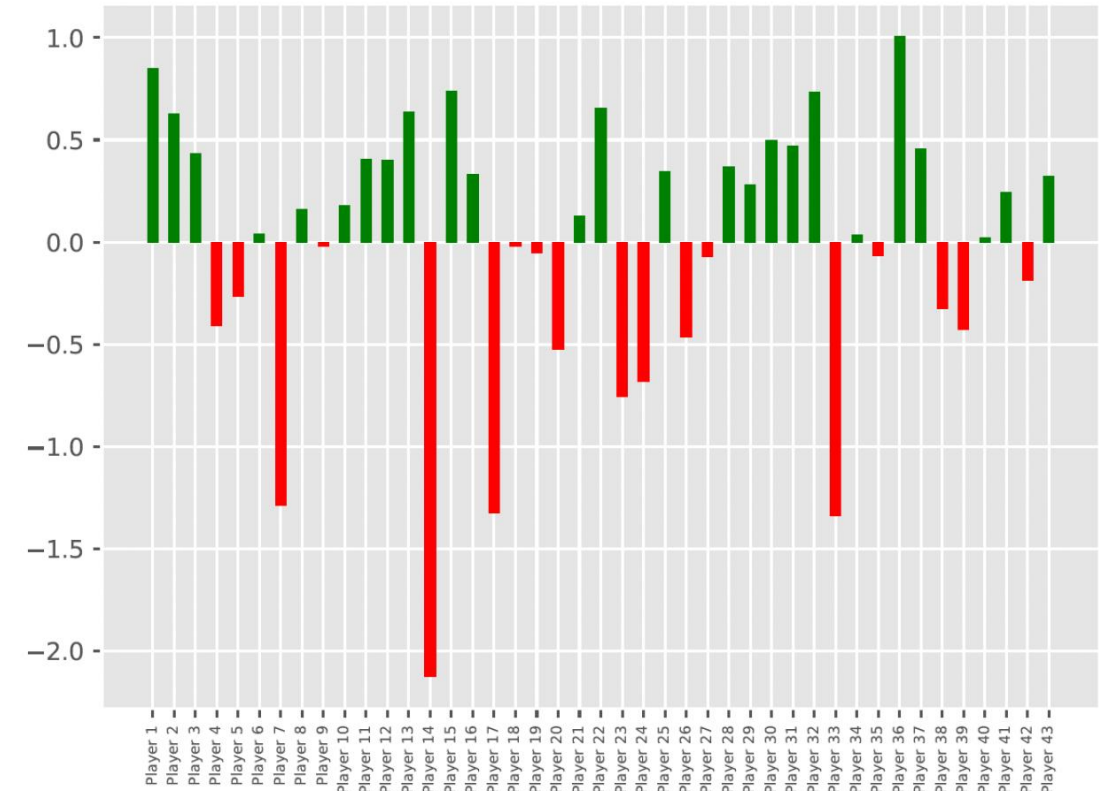


Figure 2. Visualization of the comparative analysis of CHI.b obtained among players in the team with CHI.a color-coded according to the RAG rating. Zero represents the team mean in terms of hop performance. Bars above the zero line represent athletes better than mean, while bars below zero indicate worse-than-mean athletes.



Beinachse:
Q-Winkel



Korrekt

Seitneigung

Becken

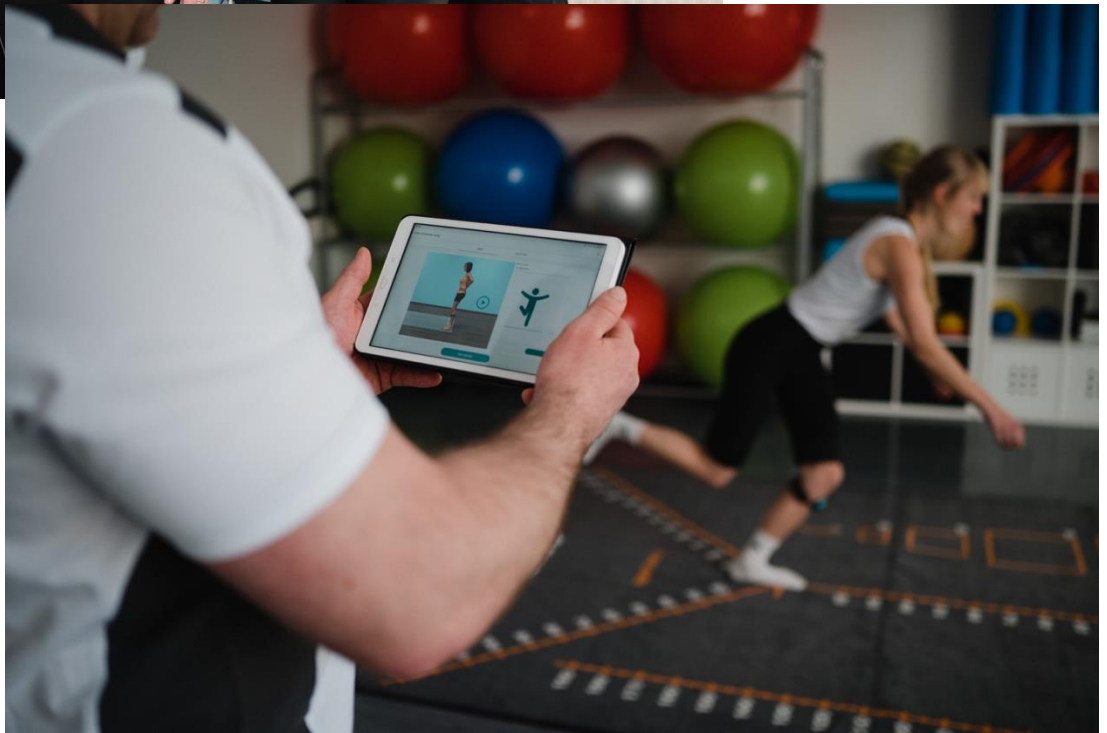
valgus

**Maximal
mögliche
Kniebeuge**

**5 Durchgänge
2 Sek. / Squat**

**Stand auf 20cm
erhöhter Stufe**

(3x Üben erlaubt)



Single leg squat Test

- **Vergleich Probanden vs. Patienten (♂ + ♀), n=80**

- **Intervention:**

- Kinematik Oberkörper, Becken, Hüfte, Knie und Aktivität M. gluteus maximus während Kniebeuge im Einbeinstand.
- Exzentrische Kraft Hüftabduktion und Außenrotation

- **Resultat: Patienten hatten...**

- mehr ipsilaterale Seitneigung Oberkörper
- mehr kontralaterale „Pelvic Drop“
- mehr Hüftadduktion
- mehr Knieadduktion

- 18% weniger Hüftabduktionskraft, und 17% weniger Außenrotationskraft
- Frauen mit patellofemorale Schmerzen: mehr Innenrotation Hüfte und geringere Aktivierung des M. gluteus medius



Langzeitdefizite: 5 years post ACLR

V1V2: $r = 0,87 - 0,95$

Relevant LSI differences in all strength tests..

Type of movement

isokinetic

0,6m/s concentric

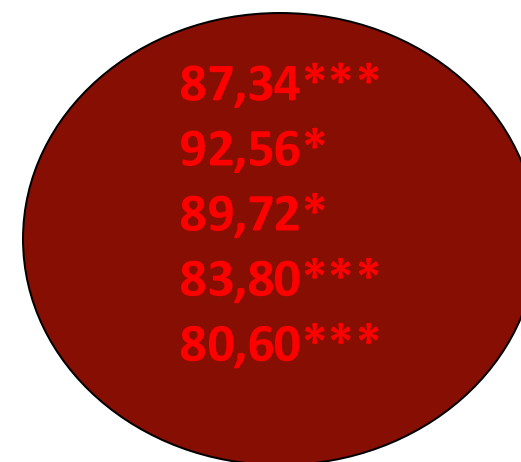
0,2m/s concentric

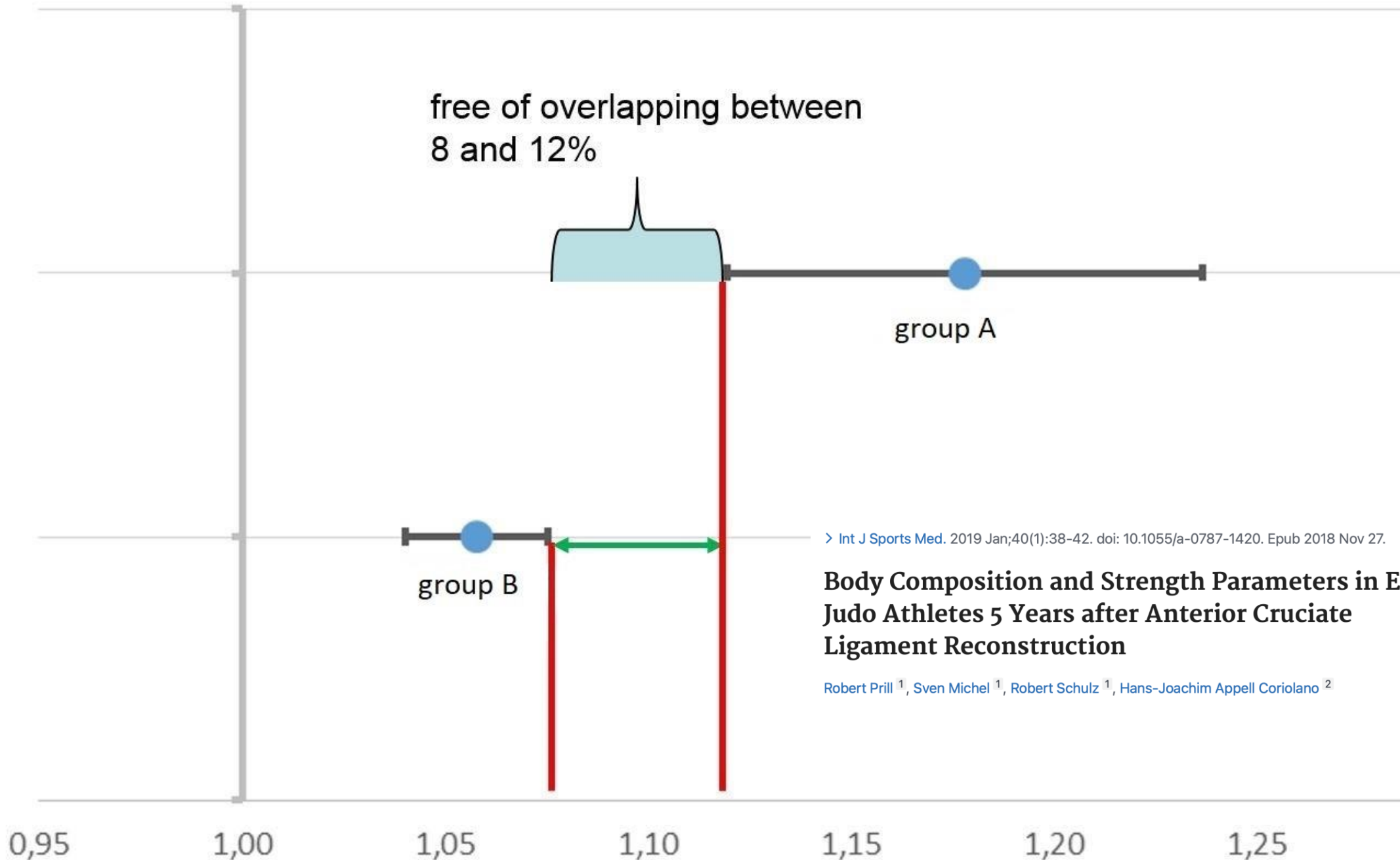
0,2m/s excentric

isoinertial (CMJ)

isometric

ACLR in Prozent von niL





free of overlapping between
8 and 12%

group A

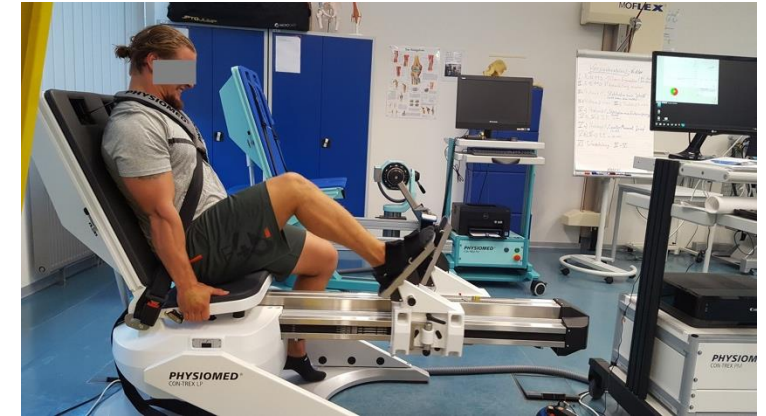
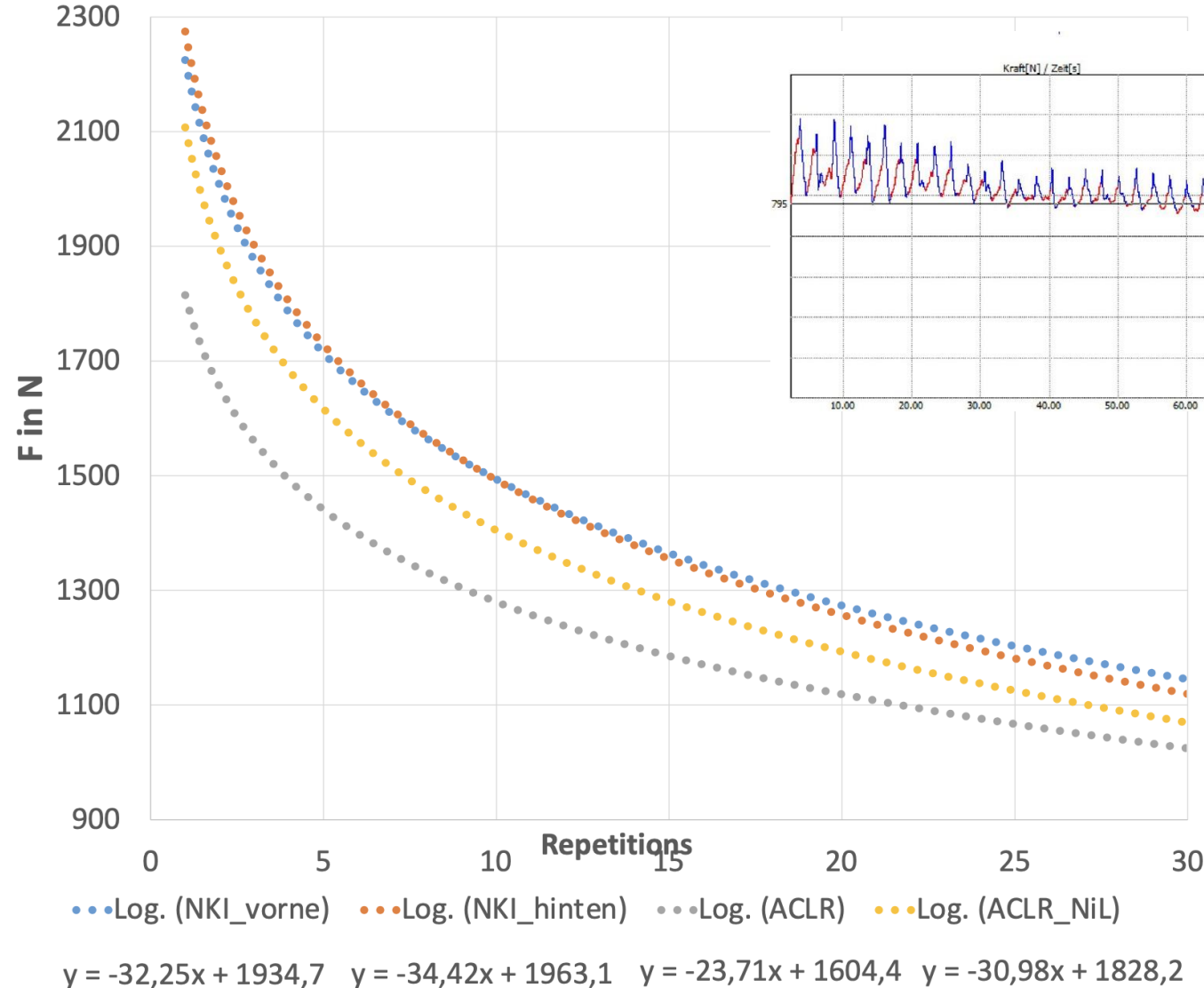
group B

> [Int J Sports Med.](#) 2019 Jan;40(1):38-42. doi: 10.1055/a-0787-1420. Epub 2018 Nov 27.

Body Composition and Strength Parameters in Elite Judo Athletes 5 Years after Anterior Cruciate Ligament Reconstruction

Robert Prill ¹, Sven Michel ¹, Robert Schulz ¹, Hans-Joachim Appell Coriolano ²

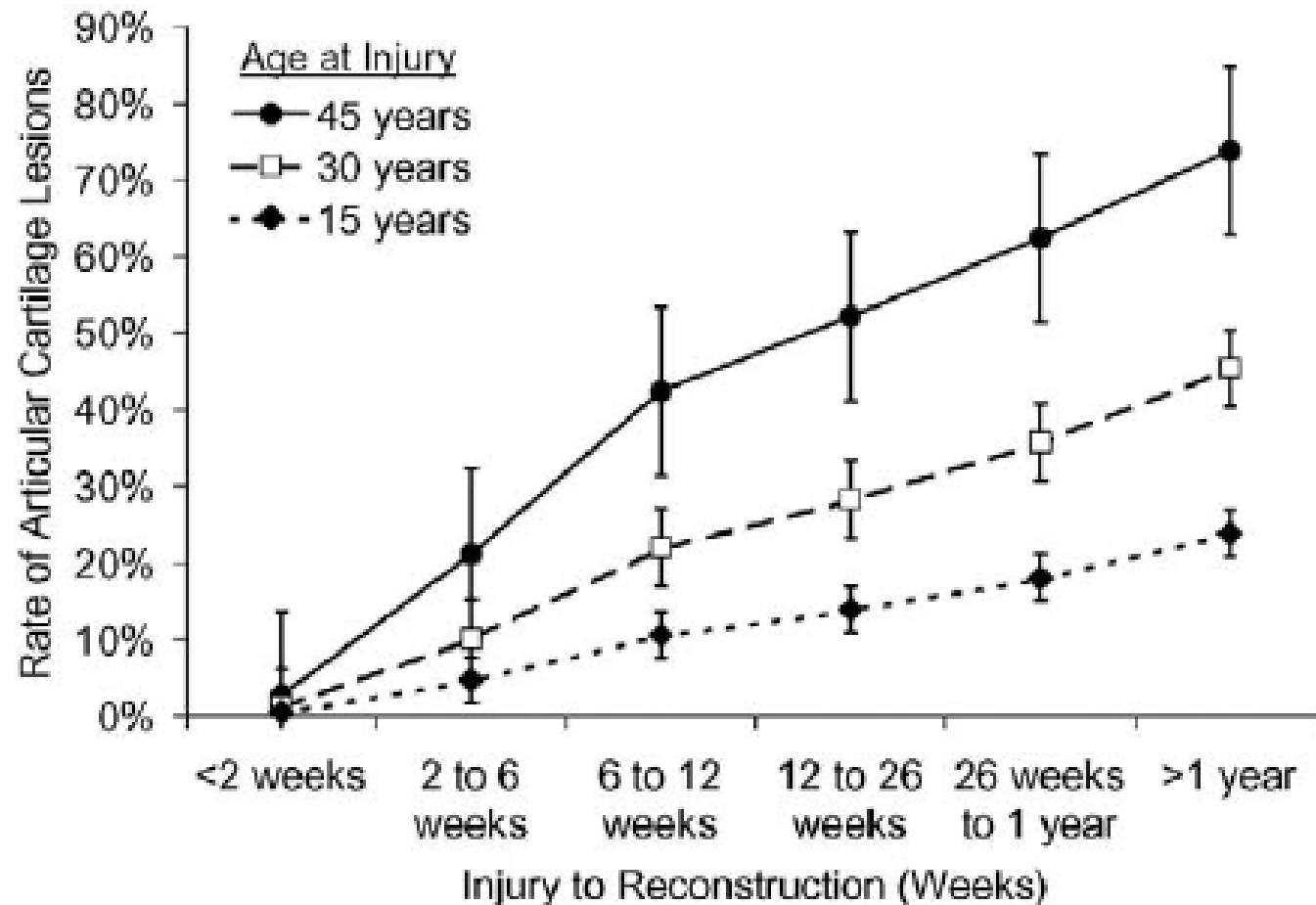
Logarithmic regression model of a maximum force endurance test



30 max reps in Isokinetic leg press showed less fatigue in the injured leg (5 years post)

Type 1 Muscle fibres

Incidence of cartilage lesions after ACL tear



› [Br J Sports Med.](#) 2022 Dec;56(24):1393-1405. doi: 10.1136/bjsports-2022-106299.
Epub 2022 Nov 15.

OPTIKNEE 2022: consensus recommendations to optimise knee health after traumatic knee injury to prevent osteoarthritis

Aspetar ACL

Rehabilitation Protocol

Coming up: The formal EU-US ACL Rehabilitation Consensus

Chairs: Robert Prill (GER, ESSKA), Thomas Patt (NED, ESSKA), Volker Musahl (US, AOSSM), Mark Paterno (US, AASPT)

Steering Group (30 people), e.g.: Bertrand Sonnery-Cottet, Francesco della Villa, Mathew Buckthorpe, Nicky van Melick, Kristin Briem, Aleksandra Krolikowska

Literature Advisory Board (10 p): Ali Gokeler, Alberto Grassi, ...

Rating Group (50 people): Timothy Hewett, Kate E. Webster,

Peer Review Group (40 Nations): GER, DAN, NED, US, ESP, ITA, ...

..

See you at #ESSKA2026 in Prague and AOSSM in Denver!



KGG by IAOM in Berlin:

The screenshot shows the IAOM website interface. At the top, there are navigation buttons: 'Weiterbildung' (blue), 'Specials' (red), 'Kontakt' (red), 'Anmelden / Log-in' (red), and the IAOM logo (red). Below the navigation, there are four icons representing different course types: 'Weiterbildung Kurse Kursdaten' (grey), 'Inhouse Seminare Kursdaten' (light blue), 'Themenkurse Kursdaten' (teal), and 'KGG Kursdaten' (yellow). To the right, a grey box displays course dates: '15.02. - 16.02.2025' and '08.03. - 09.03.2025', with 'KGG Teil1' and 'KGG Teil2' listed below. A blue 'Anmelden' button is positioned at the bottom right of this box. A red arrow points from the 'KGG Kursdaten' icon to the 'Anmelden' button.

Kursorte

Deutschland

- Berlin
- Fellbach
- Friedberg (bei Augsburg)
- Regensburg
- Wittlich (bei Trier)
- Wurselen

KGG by IAOM - EVIDENCE INFORMED

Individuelle Übungsprotokolle, Rehabilitationskonzepte für Physiotherapeut*innen und Sportwissenschaftler*innen -wissenschaftlich unterbaut und praxisnah!

Es werden Grundlagen der Trainingslehre vermittelt, und die trainingswissenschaftlichen Inhalte werden mit Bezug auf konkrete Krankheitsbilder erarbeitet. Die Kursteilnehmer können die vorgeschlagenen Übungskonzepte selbst ausprobieren und lernen neben der Einführung an Trainingsgeräten auch Behandlungs- und Reha-Konzepte kennen, wie z.B. nach Kreuzband-OP, nach Rotatorenmanschetten-OP oder zur Gelenks- bzw. Wirbelsäulenstabilisation.

Vielen Dank!

robert.prill@mhb-fontane.de