# Vigastuste *(ja haiguste)* ennetamine läbi koormuse planeerimise ja monitoorimise?

**Mati Arend**

FysioCentrum

Tartu Ülikool – treeningteaduste labor;

Tartu Ülikooli kliinikum

Kääriku Spordikeskus

Tartu Ülikool 1632

Tartu Ülikoolist võrsunud teadusmahukas firma

FysioCentrum

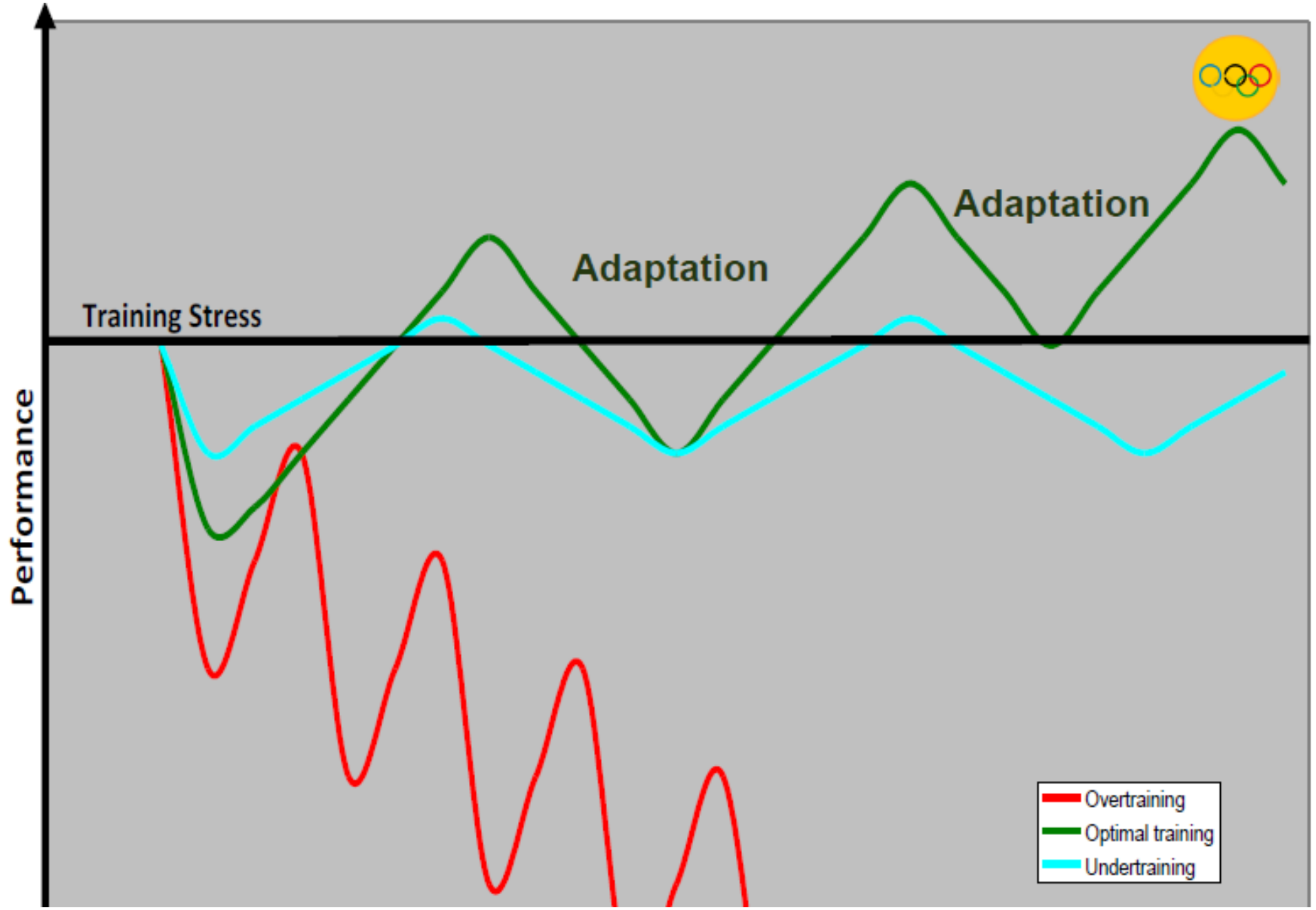
Prehab, prevention & performance

# Tänase loengu ülesehitus:

1. Enamlevinud vigastused ja vigastuste kaardistamine
2. Treeningute monitooring
3. Jõutreening kui vigastuste ennetamise võimalus
4. Kehaliste võimete testimine

# Spordi ilu

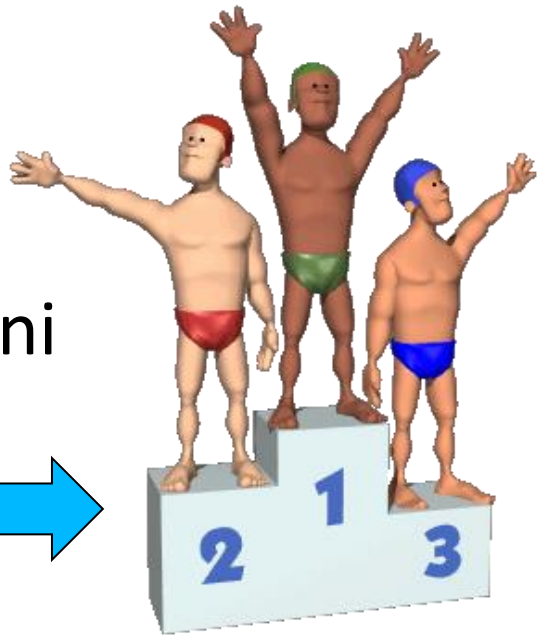
# Spordi valu

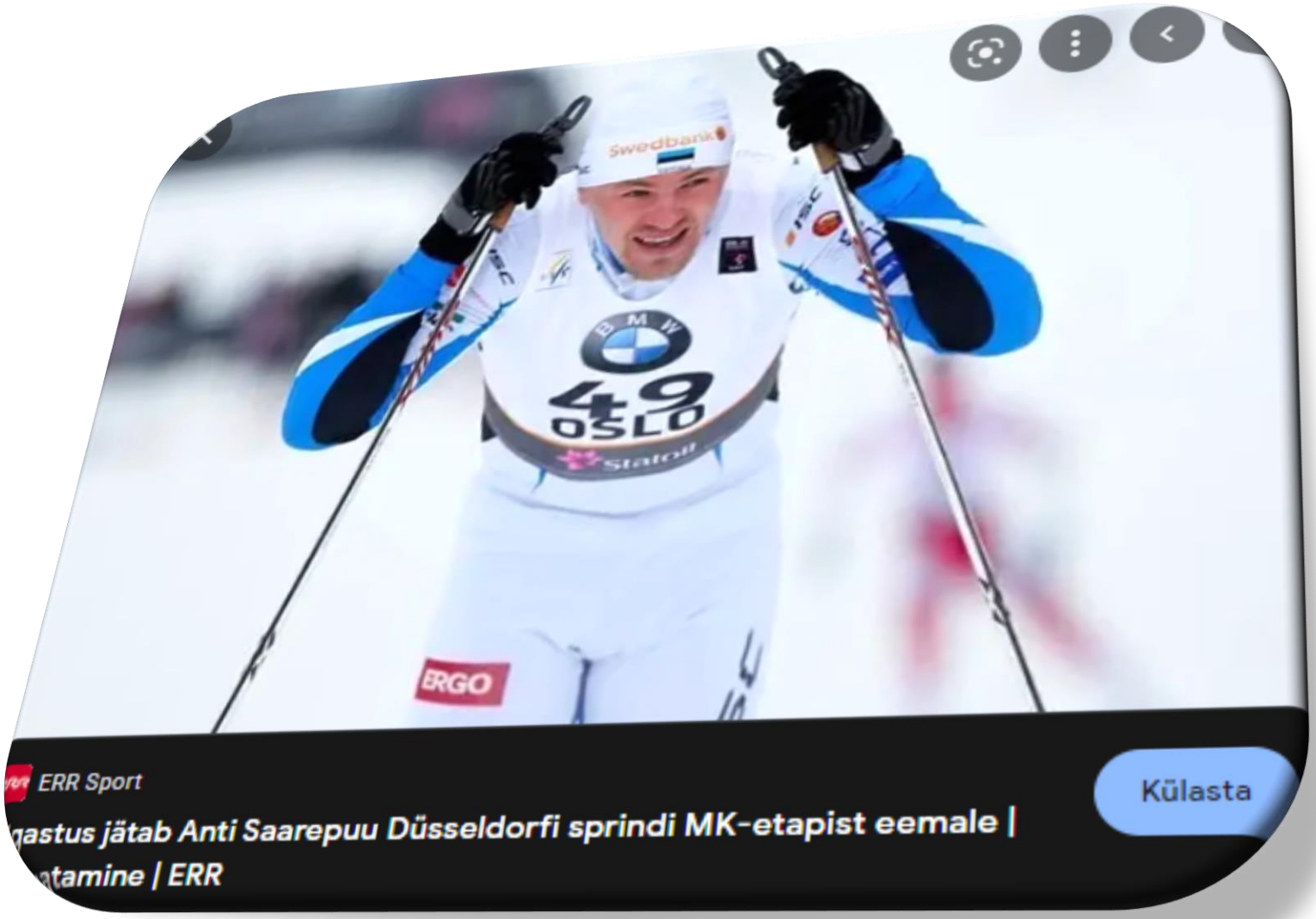

Jonathan Leeder

# Mis on sportlase jaoks kõige olulisem?

- Kui sportlane püsib terve, saab ta treenida.
- Kui sportlane saab treenida, saab ta ka areneda.
- Kui sportlane saab areneda, saab ta edukalt võistelda ja jõuda tulemuseni



# Küsimus nr 1: kas kaardistame vigastusi ja haiguseid süstemaatiliselt?


Swedbank
BMW
49
OSLO
Statoil
ERGO
ERR Sport
gastus jätab Anti Saarepuu Düsseldorfi sprindi MK-etapist eemale |
tamine | ERR
Külasta

# Doktor Rahu: Kelly Sildaru vigastus on vasaku põlve eesmise ristatisideme venitus

*Siim Kaasik*, reporter

3. veebruar 2021, 10:56

Kergejõustik


Gerd Kanter. Foto: Marko Saarm/Sakala

# Gerd Kanter on MMi eel taas hädas eljavigastusega

2013 22:32

Postimees.ee
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LONDON 2012

# Novosjolovit häirib seljavalu

30.07.2012 21:46

Peep Pahv, London, *sporditoimetuse juhataja*

Kommenteeri | Prindi

Londoni olümpial Eesti üks suurim medalilootus epeevehkleja Nikolai Novosjolov, peab kolmapäeval rajale minnes võitlema lisaks vastastele ka oma pisivigastustega.

Juba varasemast ajast teevad talle häda

# Vigastus võib sundida Ksenija Baltat hooajast loobuma (4)


Ksenija Balta (Foto: ETV/ERR SPORT)

24.05.2011 21:32

Rubriik: Peauudis

**Ksenija Balta põlvevigastus pole kolme kuu jooksul paranenud. Doktor Mihkel Mardna sõnul tuleb üha rohkem arvestada võimalusega, et Balta peab hooaja**

SPORT SPORT I KERGEJÕUSTIK

# Kaire Leibakul rebenes kannakõõlus

Like 0 JAGA LUGU!

**Toimetas Deivil Tserp**, 15. september 2010, 11:49

SPORT SPORT I KERGEJÕUSTIK

# Kaire Leibak pärast lõikust: "Tahan august välja ronida, hing ihkab olümpiale." (0)

Like 37 JAGA LUGU! LISA TVIIT

**Deivil Tserp**, 23. märts 2011, 06:59

# Self-reported sports injuries and later-life health status in 3357 retired Olympians from 131 countries: a cross-sectional survey among those competing in the games between London 1948 and PyeongChang 2018

Debbie Palmer ,[1,2] Dale J Cooper ,[3] Carolyn Emery ,[4,5] Mark E Batt,[6,7]
Lars Engebretsen ,[8,9] Brigitte E Scammell,[2,7] Patrick Schamasch,[10] Malay Shroff[10]
Torbjørn Soligard ,[9] Kathrir
Richard Budgett[9]

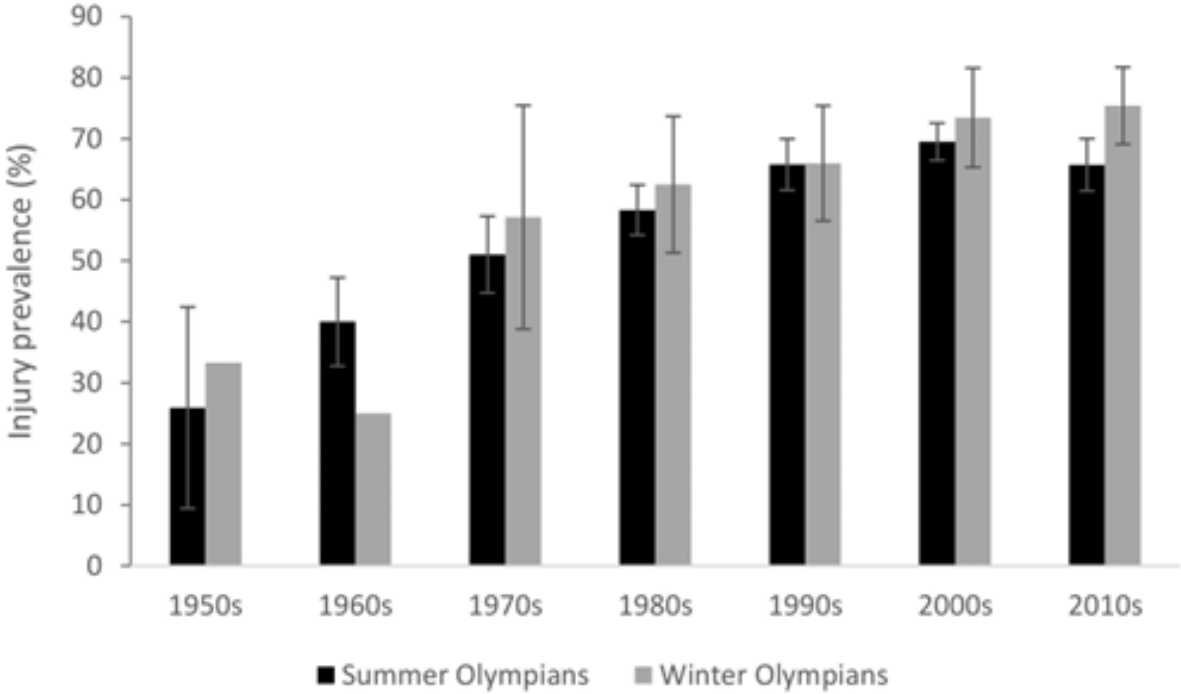



**Figure 1** Injury prevalence by decade of Olympic Games participation. (decade of participation denoted by first Olympic Games if multiple Games competed in).

# Self-reported sports injuries and later-life health status in 3357 retired Olympians from 131 countries: a cross-sectional survey among those competing in the games between London 1948 and PyeongChang 2018

Debbie Palmer [1,2] Dale J Cooper [3] Carolyn Emery [4,5] Mark E Batt,[6,7] Lars Engebretsen [8,9] Brigitte E Scammell,[2,7] Patrick Schamasch,[10] Malav Shroff,[10] Torbjørn Soligard [9] Kathrin Steffen [8] Jackie L Whittaker [11,12] Richard Budgett[9]

**Conclusions** Almost two-thirds of Olympians who completed the survey reported at least one Olympic-career significant injury. The knee, lumbar spine and shoulder/clavicle were the most commonly injured anatomical locations. One-third of this sample of Olympians attributed current pain and functional limitations to Olympic-career injury.

75% sportlastest raporteeris vähemalt 1 vigastuse, mis selgelt segas nende karjääri!
33% segas vastav vigastus/terviseprobleem ka praegu!

# Musculoskeletal Injuries in Cross-Country Skiing

Diego F. Lemos, MD[1] Matthew G. Geeslin, MD[2] Christopher Kanner, DO[2] Mark E. Lach, MD[2]
Roar R. Pedersen, MD[3]

[1] Division of Musculoskeletal Imaging, Department of Radiology, T
University of Vermont Medical Center, Burlington, Vermont
[2] Department of Radiology, The University of Vermont Medical
Center, Burlington, Vermont
[3] Department of Radiology, Unilabs Radiology, Oslo, Norway

Semin Musculoskelet Radiol 2022;26:69–81.

More recently, a prospective longitudinal cohort study was conducted between 2014 and 2015 at the University of Vermont in the United States. Participants were professional or collegiate elite cross-country skiers with monthly injury, training, and racing reports over a surveillance period of 12 months. They found 3.81 injuries per subject per 1,000 training/exposure hours. Overuse injuries were higher than acute traumatic injuries (2.76 and 1.05 per subject per 1,000 training hours, respectively). Similarly, there was a higher incidence of lower extremity injuries than upper extremity or trunk injuries.[18,19]

Saavutussportlaste/ suusatajate seas on viimasel 12a vigastuste ja ülekoormusvigastuste hulk suurenenud:

0,2-->3,81 vigastust/ 1000 treeningtunni kohta

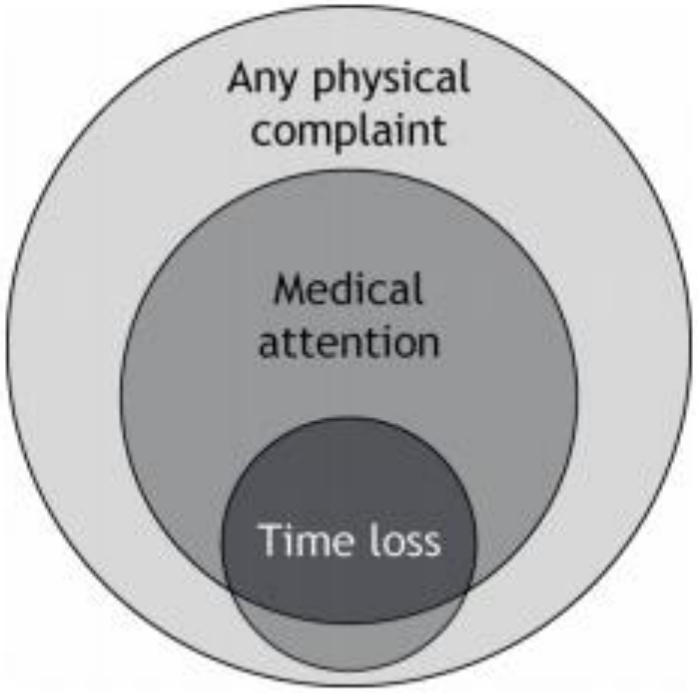



*Figure 3. Interactions between various definitions of injury recommended in the F-MARC consensus statement. Circle-size represents the relative number of incidents likely to be registered (not to scale).*

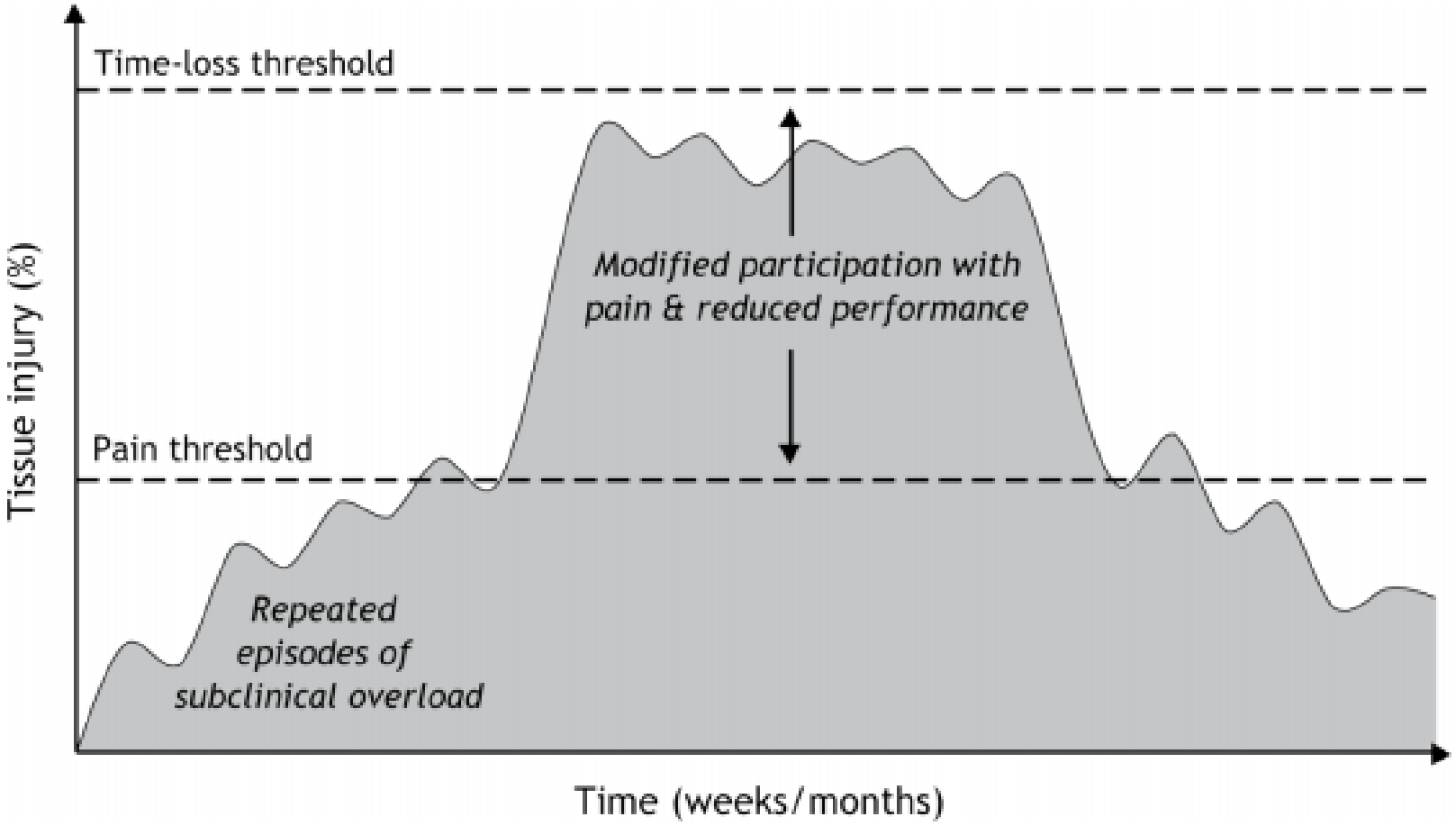



*Figure 4. Hypothetical model of overuse injury (adapted from Bahr, 2009 and Leadbetter, 1992)*

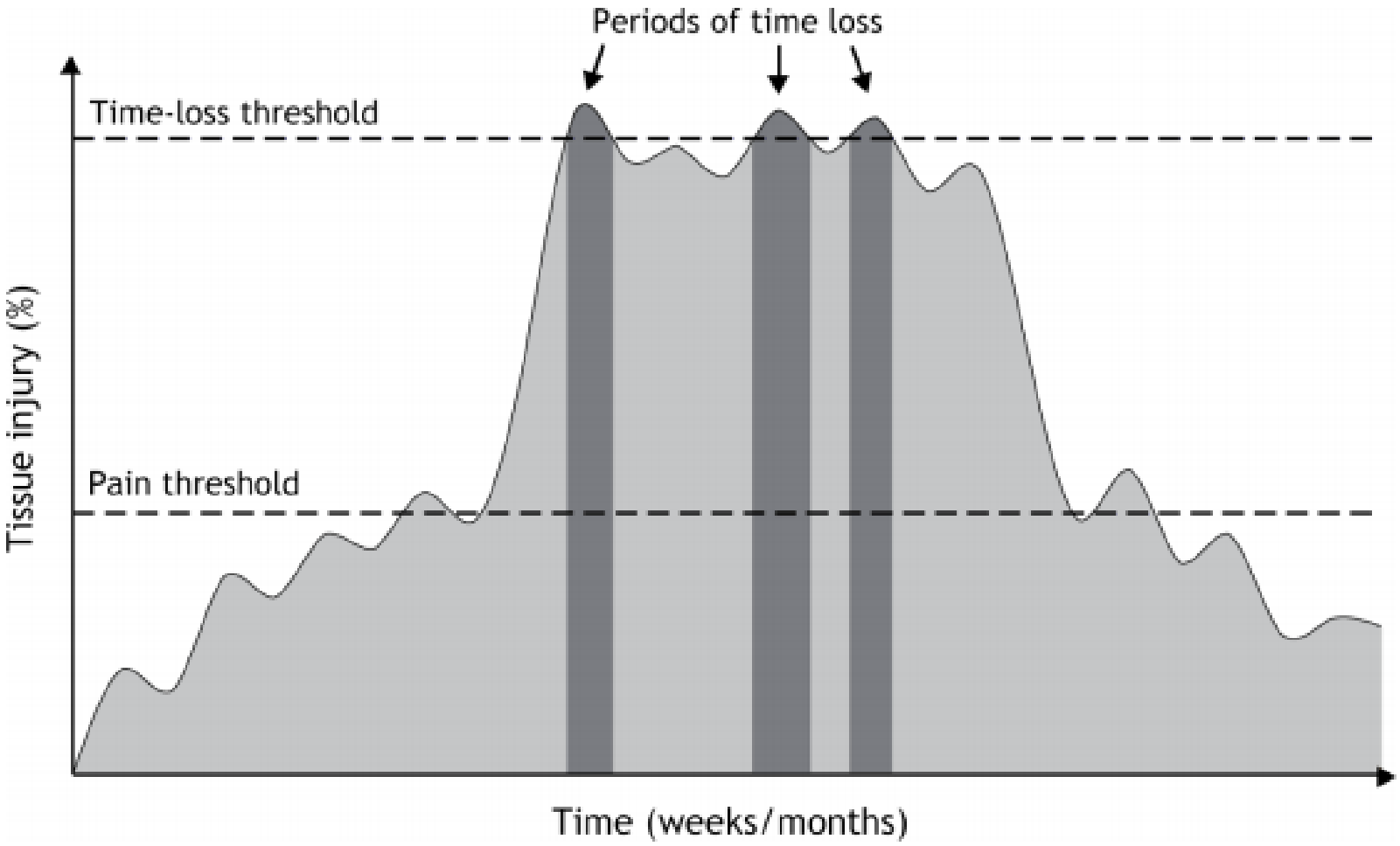



*Figure 6. Hypothetic model of an overuse injury that leads to three periods of time loss (dark areas)*

# Vigastused noortel?

# The burden of hospitalized sports-related injuries in children: an Australian population-based study, 2005–2013

Francisco J. Schneuer,[1] Jane C. Bell,[1] Susan E. Adams,[2,3,4] Julie Brown,[2] Caroline Finch,[5] and Natasha Nassar[1]

## Tõsisemad vigastused noortel:

- Poistel > tüdrukutel
- Vanuses 13-15ea esineb kõige rohkem vigastusi!
- Enamik vigastusi juhtub spordiareenil/-saalis jne.
- Enam vigastatakse nädala sees.

Demographic characteristics of children's hospitalizations for sports-related injuries in NSW, Australia, 2005–2013

| All | N = 20,034<br>n (%) |
|---|---|
| Sex | |
| Male | 16,260 (81.2) |
| Female | 3774 (18.8) |
| Age | |
| 5–8 years | 1900 (9.5) |
| 9–12 years | 4158 (20.8) |
| 13–15 years | 13,976 (69.8) |
| Patient residence[a] | |
| Major Cities | 14,140 (70.8) |
| Inner Regional | 4304 (21.6) |
| Outer regional / remote | 1517 (7.6) |
| Injury location | |
| Sports facility or area | 15,621 (78.0) |
| School | 2601 (13.0) |
| Farm or outdoors area | 702 (3.5) |
| Unspecified place | 455 (2.3) |
| Home | 346 (1.7) |
| Public place, road or highway | 309 (1.5) |
| Day of occurrence | |
| Weekday | 13,244 (66.1) |
| Weekend | 6790 (33.9) |
| Length of hospital stay (days) | |
| 1 | 14,376 (71.8) |
| 2 | 4508 (22.5) |
| 3+ | 1150 (5.7) |

# The burden of hospitalized sports-related injuries in children: an Australian population-based study, 2005–2013

Francisco J. Schneuer,[1] Jane C. Bell,[1] Susan E. Adams,[2,3,4] Julie Brown,[2] Caroline Finch,[5] and Natasha Nassar[1]

- Enamik vigastusi noortel vanuses 13-15ea.
- Miks?

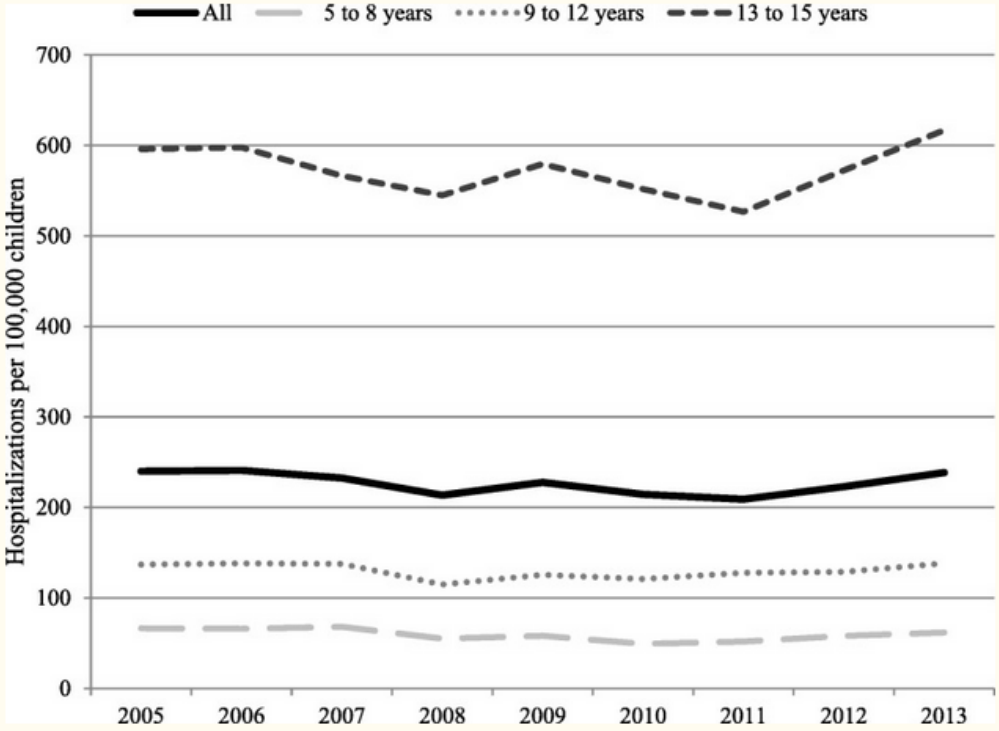


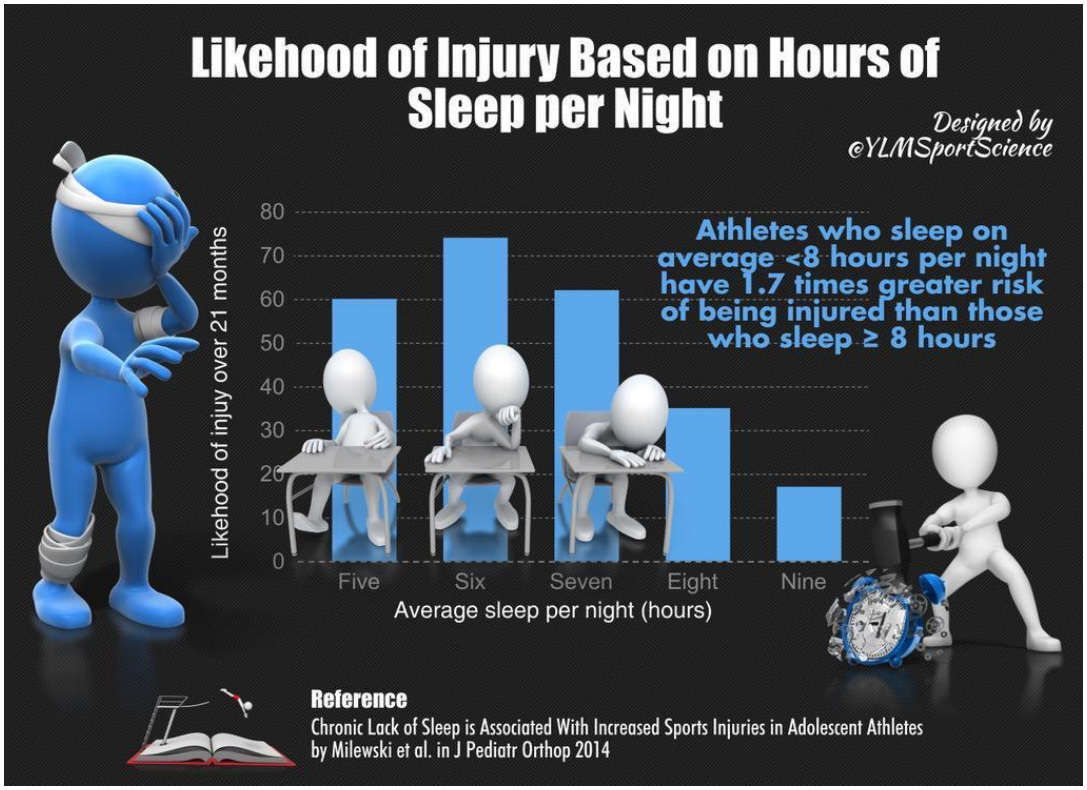

Fig. 1

Trend of sports-related injuries hospitalizations by age groups in children in NSW, Australia, 2005–2013. Relative risk RR (95% CI) for trend in population prevalence: all RR 0.99 (0.98–1.00); 5 to 8 years RR 0.98 (0.96–1.00); 9 to 12 years RR 1.00 (0.98–1.00) and 13 to 15 years: RR 1.00 (0.99–1.01)

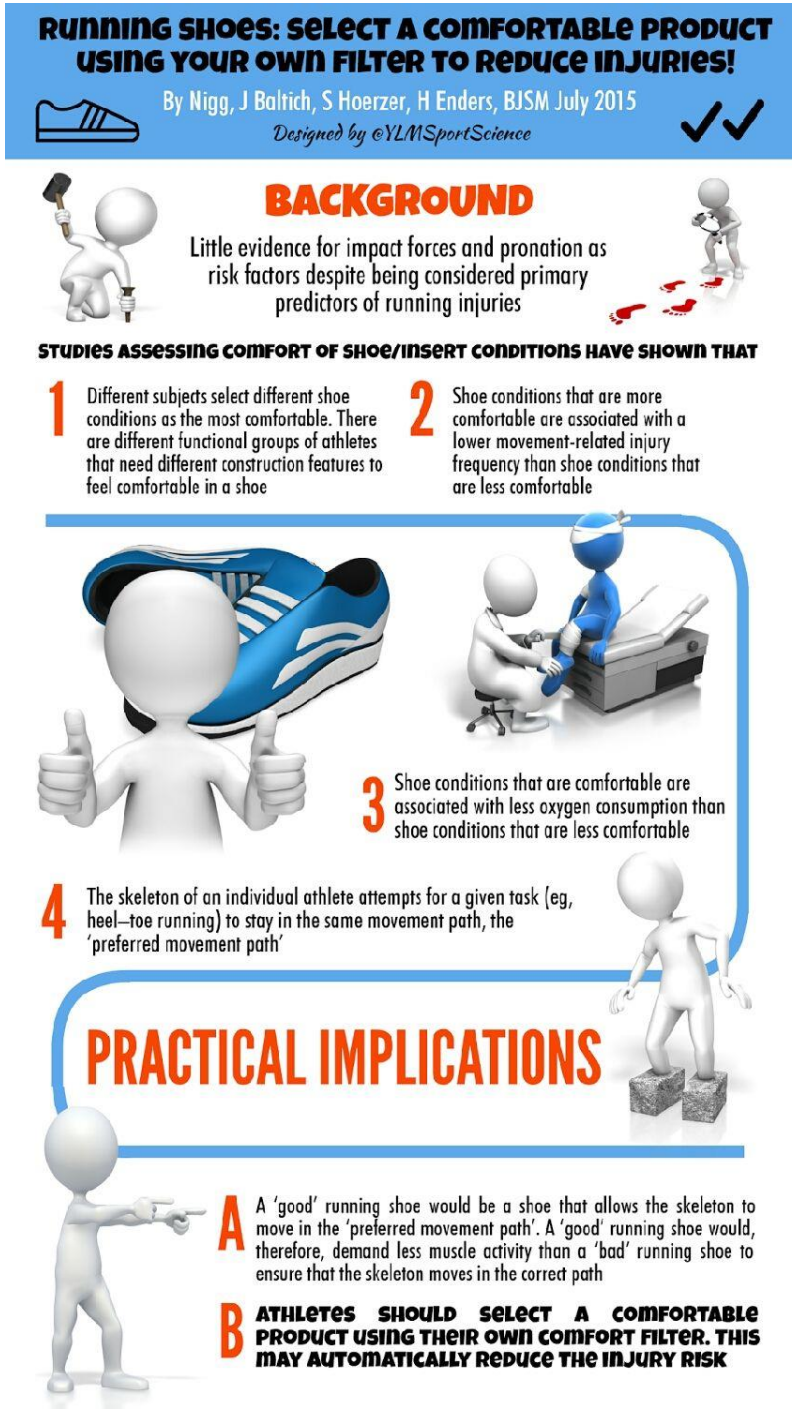
# Magamine ja vigastused?

1. Kas saan minimaalselt 8h und?

2. Kas une kvaliteet on hea? Sügav uni ja REM uni?



# Jooksujalanõud ja vigastused???



# Ülekoormusvigastused

**pikaajaline submaksimaalne (üle)koormus skeletilihassüsteemile ebapiisava taastumisajaga.**

**Ülekoormus-vigastused:**
37-54%

**vs**

**Kontaktvigastused:**
46-63%

**<u>Ühekülgne treening ja liiga kiire progresseerumine treeningkoormustes (10% reegel)</u>**

# Vigastuste hulk 20 aasta jooksul Austraalia jalgpallis

Key Indicators for All Injuries Over a 21-Year Period: 1992-2012

| All Injuries, 1992-2002 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Incidence (new injuries per club per season) | 35.4 | 30.3 | 33.7 | 38.2 | 38.9 | 40.1 | 40.3 | 36.9 | 37.4 | 35.8 | 34.4 |
| Incidence (recurrent) | 8.8 | 7.3 | 6.0 | 6.2 | 4.9 | 8.0 | 7.6 | 5.2 | 5.9 | 5.5 | 4.4 |
| Incidence (total) | 44.2 | 37.6 | 39.7 | 44.4 | 43.8 | 48.1 | 47.9 | 42.1 | 43.3 | 41.3 | 38.7 |
| Prevalence (missed matches per club per season) | 145.9 | 122.5 | 116.3 | 133.1 | 140.0 | 151.2 | 141.9 | 135.9 | 131.8 | 136.4 | 134.7 |
| Average injury severity (number of missed matches) | 4.1 | 4.0 | 3.5 | 3.5 | 3.6 | 3.8 | 3.5 | 3.7 | 3.5 | 3.8 | 3.9 |
| Recurrence rate, % | 25 | 24 | 18 | 16 | 13 | 20 | 19 | 14 | 16 | 15 | 13 |
| Clubs participating | 12/15 | 14/15 | 15/16 | 15/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 |
| Average players per club | 46.1 | 44.6 | 42.5 | 42.3 | 44.1 | 44.2 | 41.7 | 41.7 | 41.4 | 43.4 | 43.0 |

| All Injuries, 2003-2012 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Incidence (new injuries per club per season) | 34.1 | 34.8 | 35.3 | 34.0 | 34.6 | 36.9 | 37.8 | 38.7 | 38.4 | 38.1 |
| Incidence (recurrent) | 4.6 | 3.7 | 4.8 | 4.1 | 5.6 | 5.4 | 3.6 | 4.7 | 3.6 | 3.5 |
| Incidence (total) | 38.7 | 38.5 | 40.1 | 38.2 | 40.3 | 42.3 | 41.4 | 43.3 | 42.0 | 41.7 |
| Prevalence (missed matches per club per season) | 118.7 | 131.0 | 129.2 | 138.3 | 146.7 | 147.1 | 151.2 | 153.8 | 157.1 | 147.7 |
| Average injury severity (number of missed matches) | 3.5 | 3.8 | 3.7 | 4.1 | 4.2 | 4.0 | 4.0 | 4.0 | 4.1 | 3.9 |
| Recurrence rate, % | 14 | 11 | 14 | 12 | 16 | 15 | 10 | 12 | 9 | 9 |
| Clubs participating | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 17/17 | 18/18 |
| Average players per club | 42.2 | 42.8 | 43.3 | 43.9 | 44.2 | 44.6 | 46.1 | 46.4 | 46.9 | 46.7 |

Orchard, Seward, Orchard, 2013

British Journal of
Sports Medicine
An international peer-reviewed journal of sport and exercise medicine

*Br J Sports Med* doi:10.1136/bjsports-2015-095543

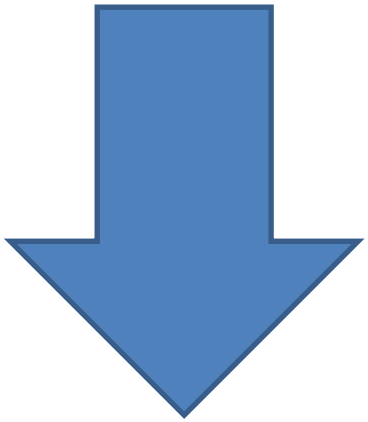
# Time to bin the term 'overuse' injury: is 'training load error' a more accurate term?

M K Drew[1,2,3], C Purdam[1,2,3]

| | MINOR | MODERATE | SEVERE |
|---|---|---|---|
| Cervical disc prolapse (Slipped disc) | | | 6 weeks + |
| Whiplash | 1-2 days | 5-7 days | 2 weeks |
| Rotator cuff (muscle problems) | 2 weeks | 4-6 weeks | 8-12 weeks |
| Anterior Cruciate Ligament (ACL) | | | 4-6 months |
| Calf muscle strain | 1-2 weeks | 3-4 weeks | 6-8 weeks |
| Cartilage Tear (meniscal tear) | 2-4 weeks | 4-6 weeks | 2 months + |
| Hamstring strain | 1-2 weeks | 3-4 weeks | 6-8 weeks |
| Lateral Collateral Ligament Sprain | 2-3 weeks | 4-6 weeks | 3 months |
| Medial Collateral Ligament Sprain | 2-4 weeks | 4-8 weeks | 3 months |
| Achilles tendonitis | 6 weeks | 3 months | 6 months + |
| Ankle sprain | 2-3 weeks | 4-6 weeks | 6-8 weeks |
| Calf muscle strain | 1-2 weeks | 3-4 weeks | 6-8 weeks |

**Ei ole olemas kerget hüppeliigese vigastust!!!!**

**KAS ÜLEKOORMUSVIGASTUSI ON VÕIMALIK ENNETADA?**



**KAS VALE TREENINGMETOODIKA VIGASTUSI ON VÕIMALIK ENNETADA?**

# Sporditegemise lõpetamise põhjused?

- **Ainult 7%** Inglismaa parimaid U15 kergejõustiklasi (*N*=560) jõudsid U23 vanuseklassi (Shibli & Barrett, 2011).
- Uuringud on näidanud, et peamiseks spordist loobumise põhjuseks on **vigastused**, mille põhjustasid ebakorrektsed treeningkoormused ja suur võistluskoormus noores eas (Brenner, 2007; Difori, 2010, Dixon & Fricker, 1993)

# KÜSIMUS NR 2: KUI HÄSTI ME PLANEERIME OMA TREENINGUID JA KUIDAS ME JÄLGIME DÜNAAMIKAT?

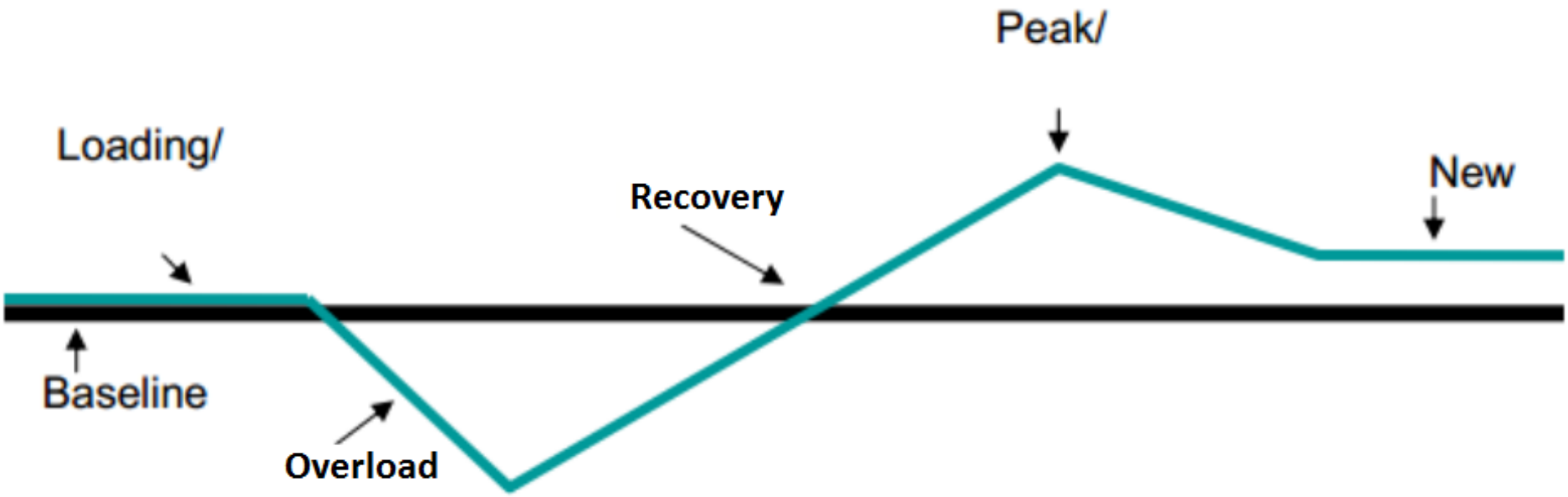
# The Injury Prevention Pyramid

The Sports Physio @adammeakins

# Treeningute korrektne ülesehitus!

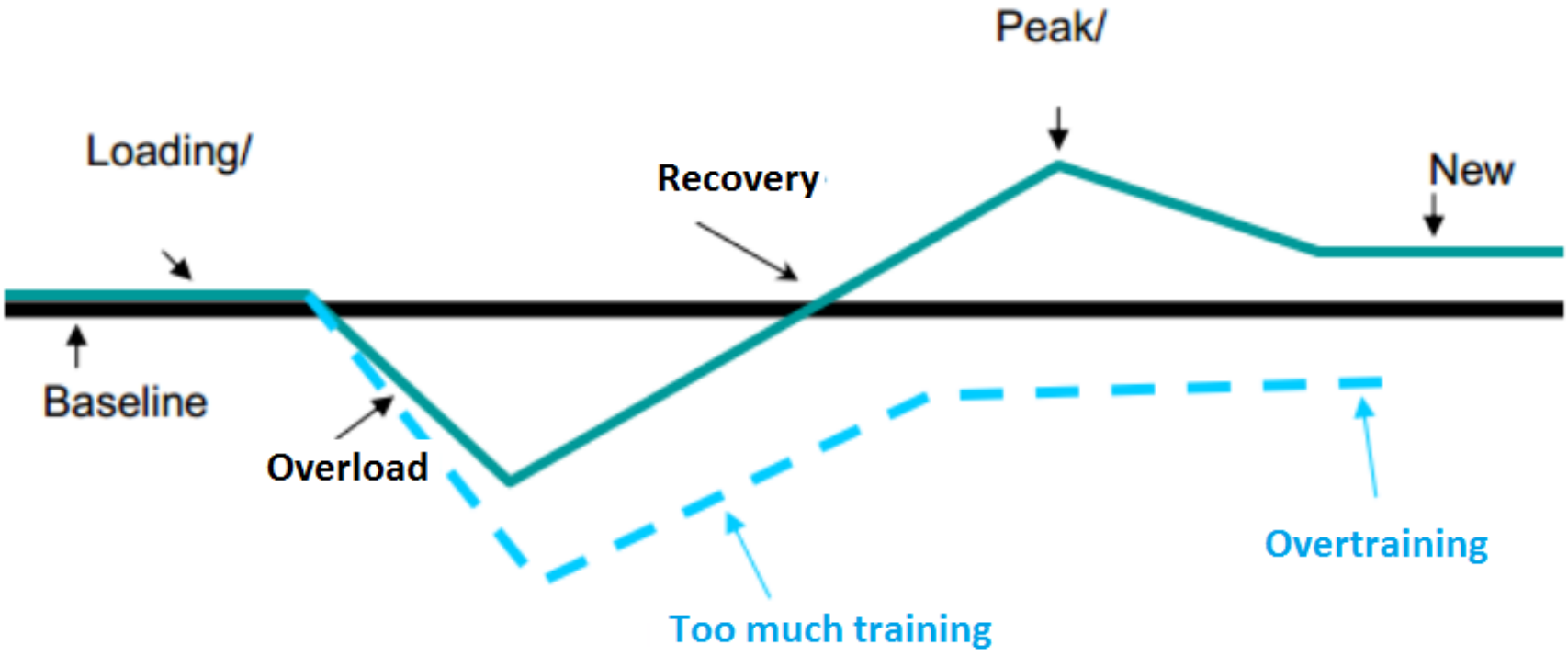
## Treeningplaan

## treeningpäevik

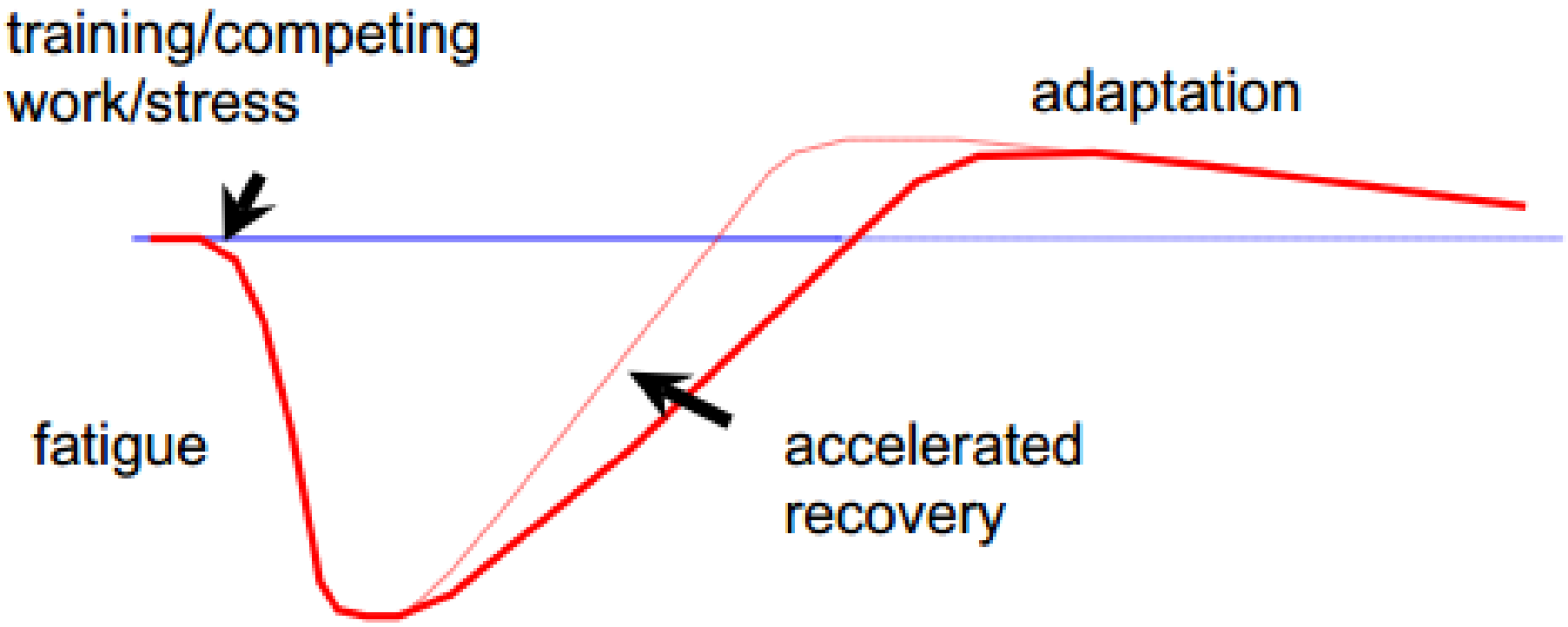



# TREENINGUTE PLANEERIMINE!!!!

# Ülekoormus


Peak/
Loading/
Recovery
New
Baseline
Overload
Too much training
Overtraining

# Taastumise tähtsus



# Training-related risk factors in the etiology of overuse injuries in endurance sports.

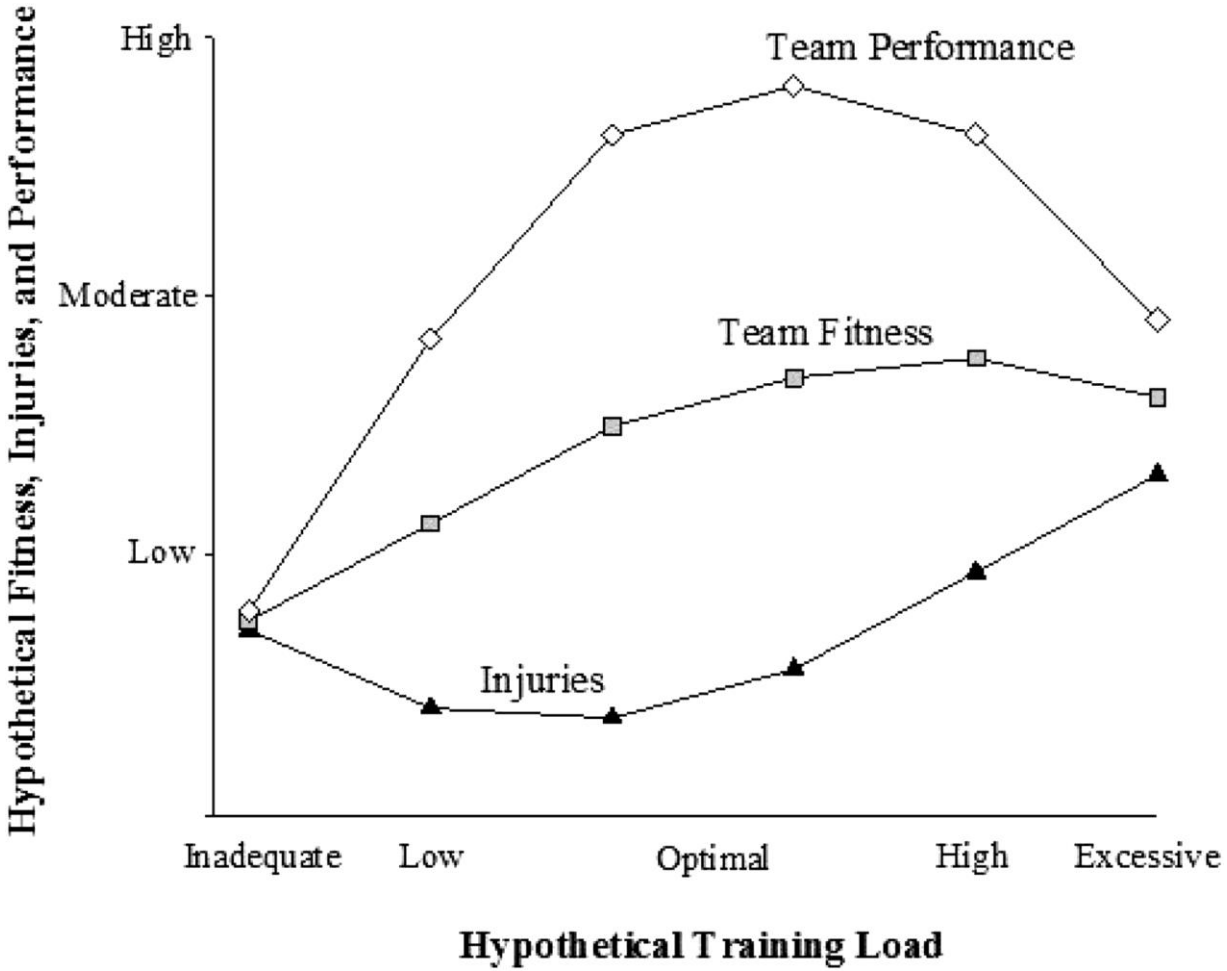
Ristolainen L, Kettunen JA, Waller B, Heinonen A, Kujala UM

ORTON Orthopaedic Hospital ORTON Foundation, Helsinki, Finland - leena.ristolainen@orton.fi.

The Journal of Sports Medicine and Physical Fitness [2014, 54(1):78-87]

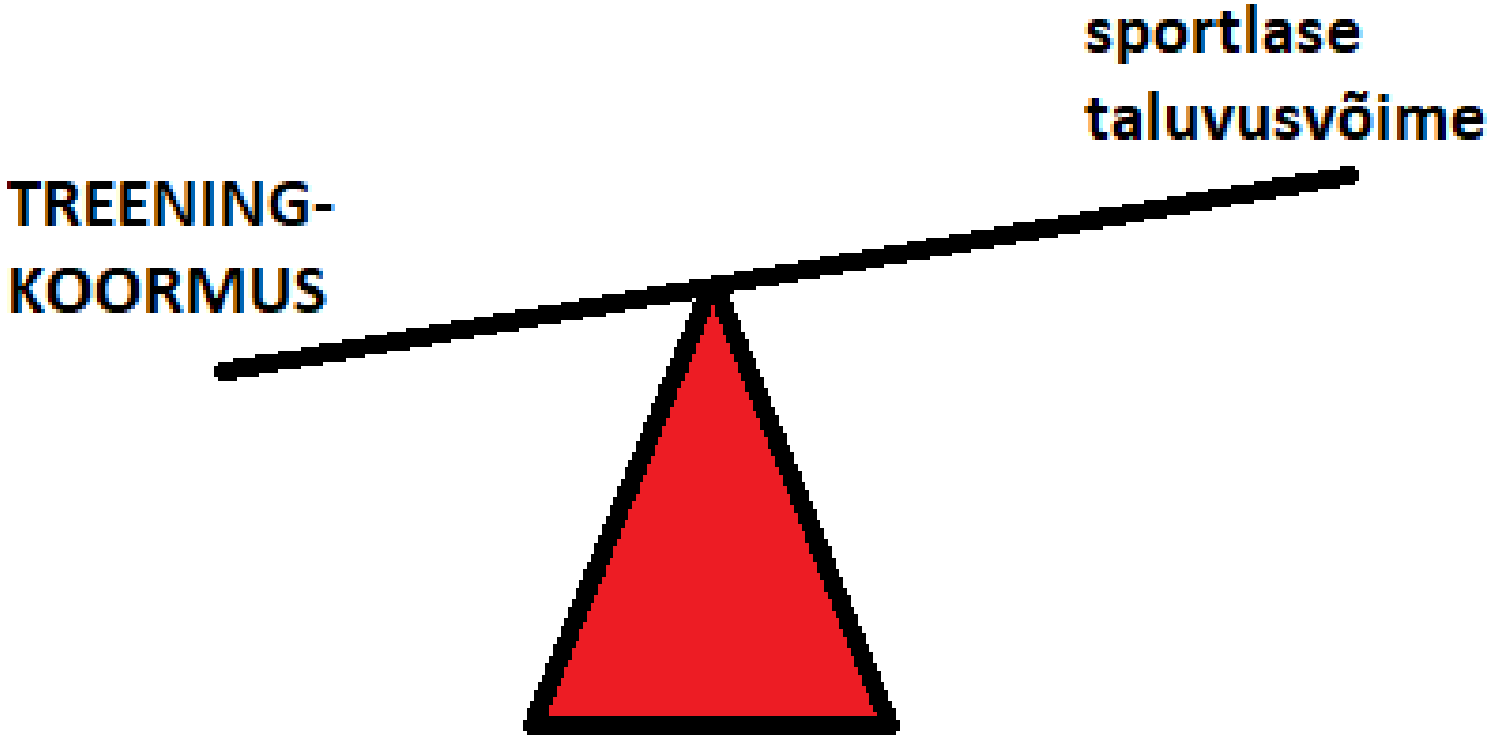
RESULTS: Athletes with less than 2 rest days per week during the training season had 5.2-fold risk (95% confidence intervals [CI] 1.89-14.06, P=0.001) for an overuse injury, and athletes who trained more than 700 hours during a year had 2.1-fold risk (95% CI 1.21-3.61, P=0.008) for an overuse injury compared to the others. Athletes who reported a tendon injury were on average two years older than athletes without such an injury (P<0.001).

**Sportlased, kellel on planeeritud <2 puhkepäeva nädalas, on 5,2x suurem tõenäosus ülekoormusvigastuste tekkimiseks**

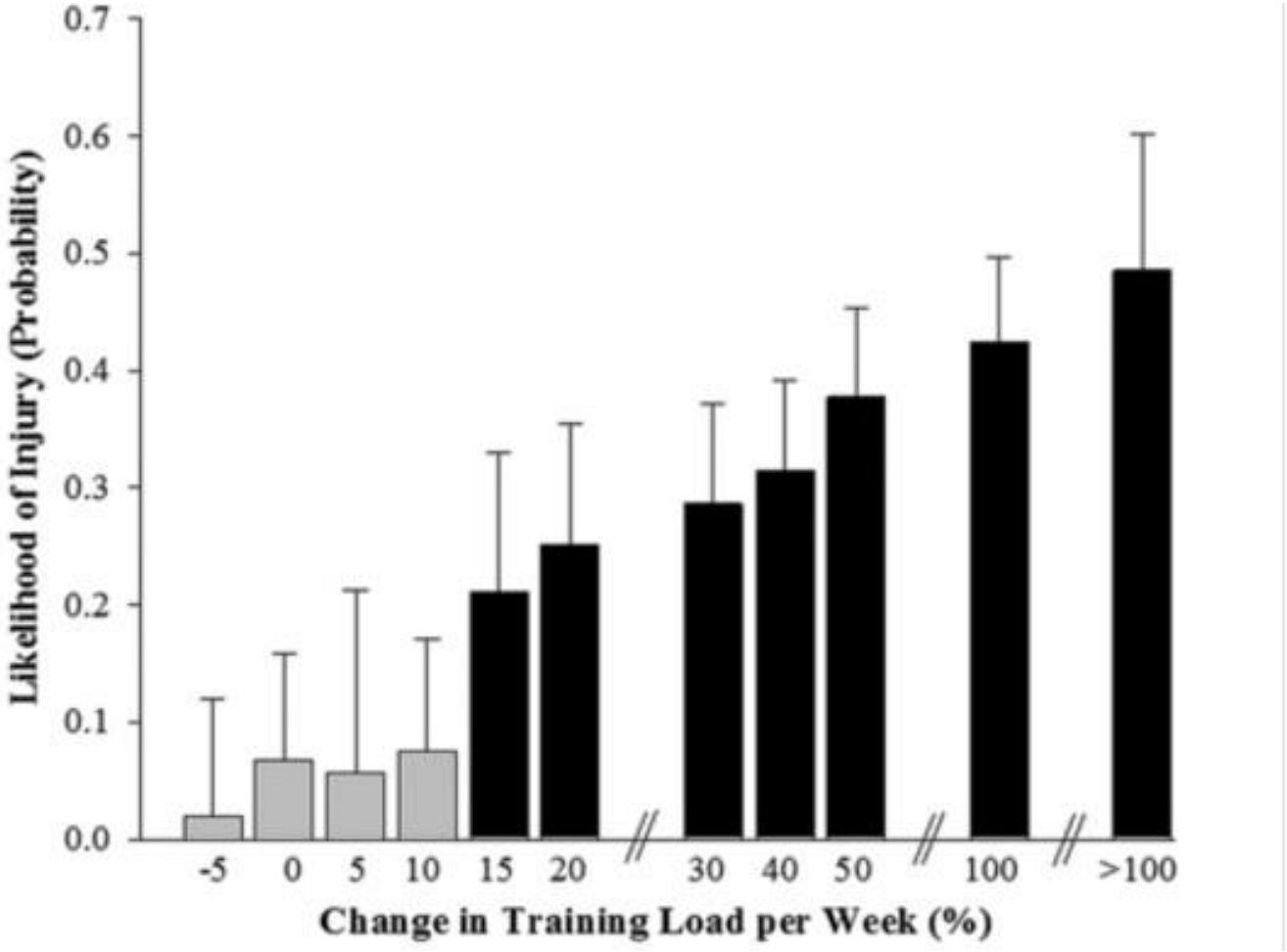



Tim J Gabbett Br J Sports Med 2016;50:273-280

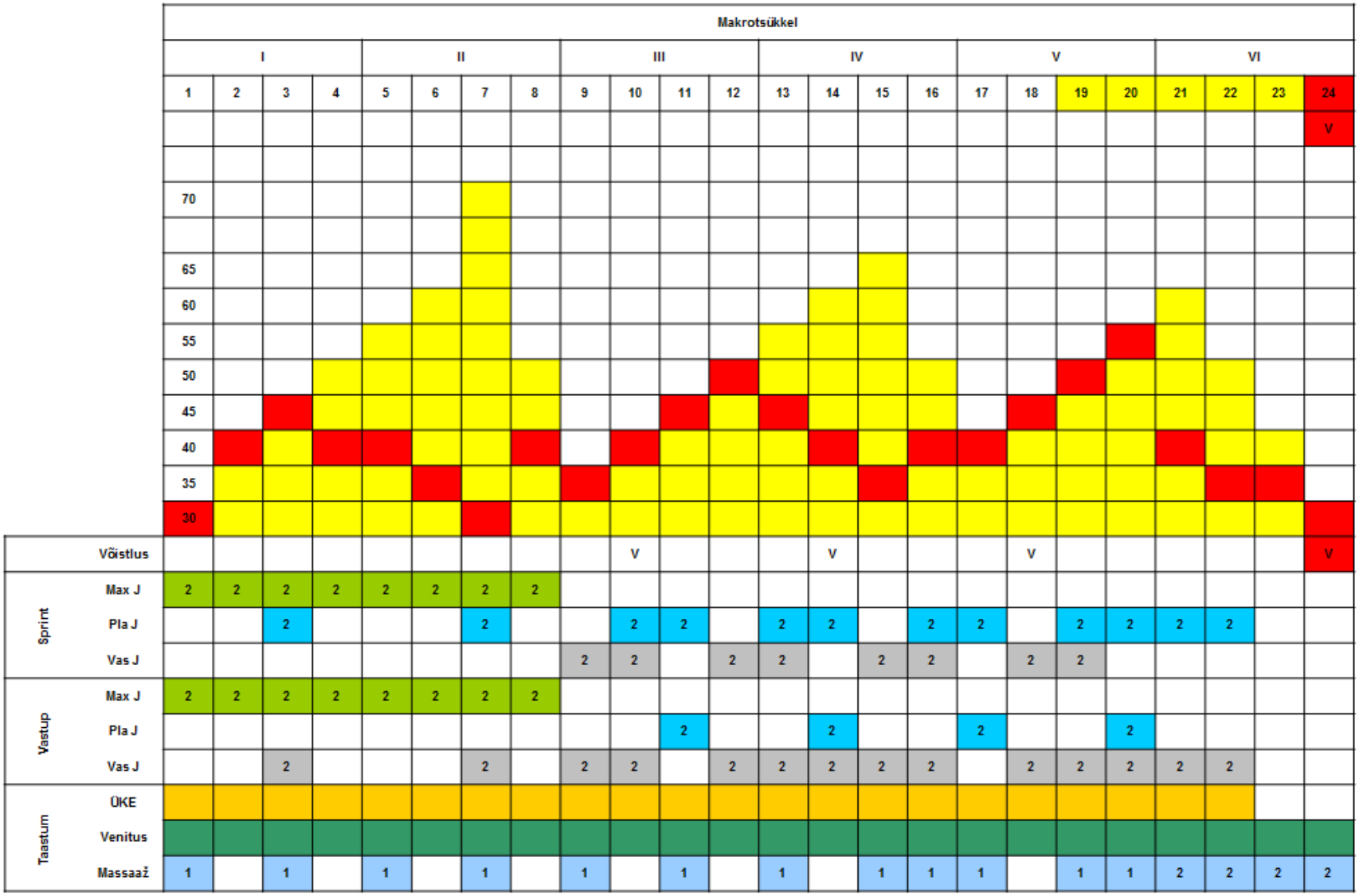
**Hypothetical relationship between training loads, fitness, injuries and performance.**


sportlase
taluvusvõime
TREENING-
KOORMUS

# Koormuse tõstmine?




Gabbett , 2015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# Sportlaste online monitooring!
# Ehk saame sportlasi jälgida ka eemalt.

Vastamise kuupäev *

Date

pp.kk.aaaa

Nimi *

Your answer

Mitu tundi Te möödunud nädalal treenisite? *

Ujumis- ja muud treeningud kokku

Your answer

Mitu kilomeetrit Te möödunud nädalal ujusite? *

Your answer

Mitu võistlust ja võistlusstarti Teil eelmise nädala joo

Kirjeldage iga päeva treeningu raskus korrutatuna treeningu kestusega minutites. Näiteks: E hommik 6 (punkti) x 90 (min), õhtu 4 (punkti) x100 (min). Võistluste kohta võiksite kasutada 9p x 100min (raskem) või 8p x 90min (kergem võistlus) Kirjutage kõikide päevade kohta oma treeningpäevikust siia allolevasse lahtrisse. *

Treeningute raskuse hindamine 1-10p skaalal, kus 10p on kõige raskem treening ja 1p on puhkus; võistlus 9-10p

| Rating of Perceived Exertion (RPE Scale) | |
|---|---|
| 10 | Maximal |
| 9 | Really, Really, Hard |
| 8 | Really Hard |
| 7 | |
| 6 | Hard |
| 5 | Challenging |
| 4 | Moderate |
| 3 | Easy |
| 2 | Really Easy |
| 1 | Rest |

**Põlveprobleemid**

Põlveprobleem tähendab valu, vaevust, jäikust, kangust, turset, ebastabiilsust, "alt minemise" tunnet või lukku jäämist ühes või mõlemas põlves

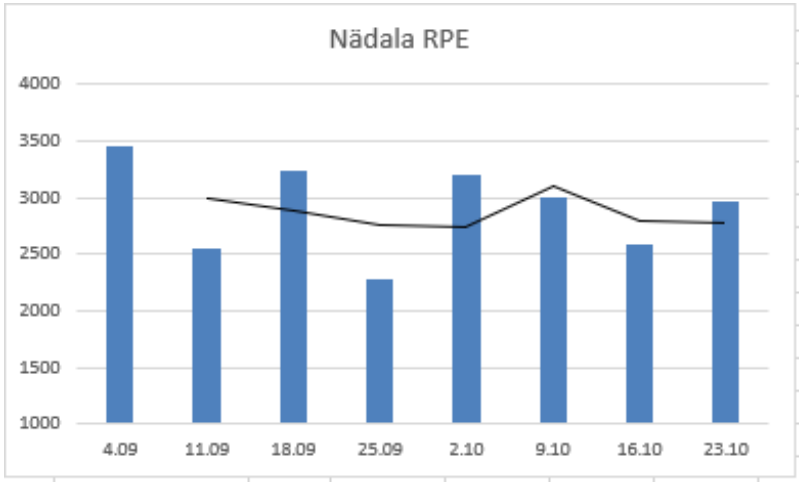
1.1 Kas Te olete pidanud loobuma oma tavatreeningutest ja võistlustest möödunud nädalal põlveprobleemide tõttu? *

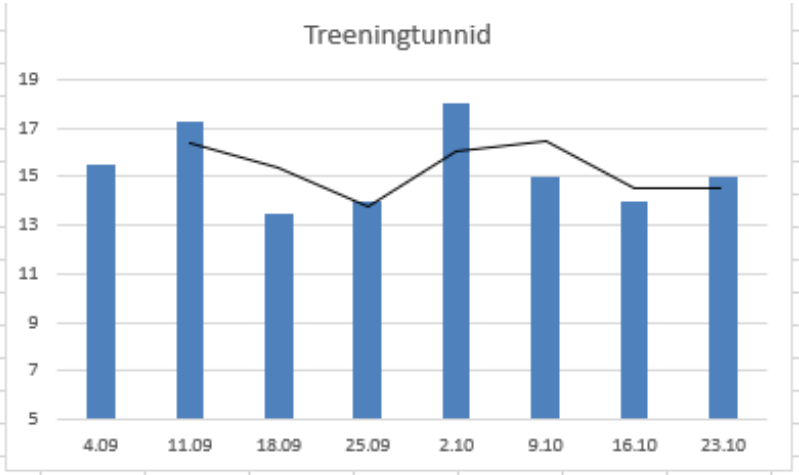
- ○ Sain treenida ja võistelda täielikult
- ○ Treenisin ja võistlesin täielikult, kuid läbi põlvevalude
- ○ Vähendasin treeninguid/võistlusi põlvevalude tõttu
- ○ Ei saanud osaleda treeningutel ja võistlustel põlvevalude tõttu

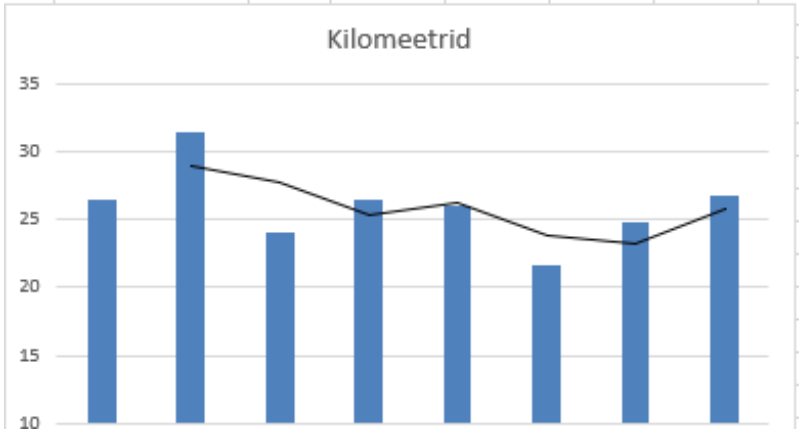
# Online monitooringu tagasiside andmine

| Vastamise kuupäevad: | | 4.09 | 11.09 | 18.09 | 25.09 | 2.10 | 9.10 | 16.10 | 23.10 |
|---|---|---|---|---|---|---|---|---|---|
| NIMI | Tunnid (h) | 15.5 | 17.25 | 13.5 | 14 | 18 | 15 | 14 | 15 |
| | Muutuse% | | 11.30% | -21.70% | 3% | 28.50% | -16.60% | -6.60% | 7% |
| | Kilom. (km) | 26.4 | 31.4 | 24 | 26.5 | 26 | 21.6 | 24.8 | 26.7 |
| | Muutuse% | | 18.9% | -23.6% | 10.4% | -1.8% | -17% | 14.81% | 7.6% |
| | võistlusstardid | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | nädala RPE | 3450 | 2550 | 3230 | 2280 | 3210 | 3000 | 2580 | 2970 |
| | acute:chronic suhe ehk viimane nädal / 4-nädala keskmine (Normi vahemik 0.8-1.3) | | | | **0.79** | **1.12** | **1.06** | **0.93** | **1.07** |
| | Muutuse% | | | | | 18.0% | -5.5% | -12.3% | 15.0% |
| | õlavalu | ei | ei | ei | ei | ei | ei | ei | ei |
| | alaseljavalu | ei | ei | jah | jah | jah | jah | jah | jah |
| | põlvevalu | ei | ei | ei | ei | ei | ei | jah | ei |
| | muud kaebused | pole | Torked südame piirkonna trenni ajal? | pole | pole | pole | pole | pole | pole |
| | Soovitused | | spordiarst? | selja stabilisaat orite harjutused | selja stabilisaat orite harjutused | Jätkata seljaharj utustega-->progres | Jätkata seljaharj utustega | Jätkata seljaharj utustega | |

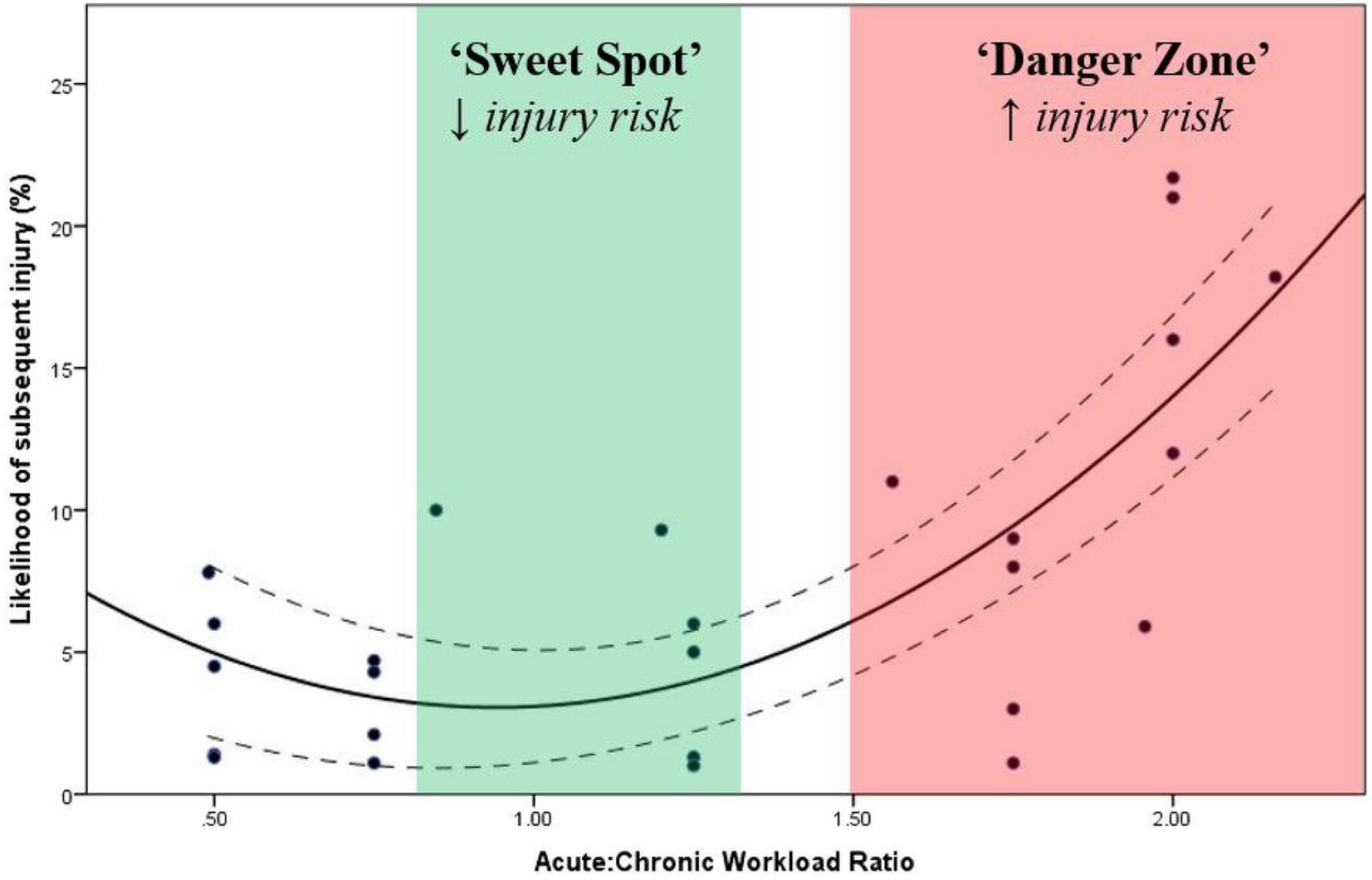
# Monitoorime treeningkoormuse muutust



# Akuutne:krooniline koormus
# =
# 1 nädal : 4 nädalat



# Koormuse intensiivsuse hindamine (0-10p x treeningu aeg)

**0p =puhkus**

**10p = kõige raskem treening/pingutus**

Skaala pingutuse raskuse hindamiseks.

"Kui raske oli sinu viimane treening?"

0- Puhkus
1- Väga kerge
2- Kerge
3-
4- Keskmine
5- Raske
6-
7- Väga raske
8- Väga, väga raske
9- Peaaegu maksimaalne
10- Maksimaalne

# Treeningkoormuse subjektiivne raskuse hindamine RPE-10 skaalal

Keskmine ettev.näd kodus:

- E
- T
- K
- N
- R
- L
- P

| Rating | Descriptor |
|---|---|
| 1 | Very, very easy |
| 2 | Easy |
| 3 | Moderate |
| 4 | Somewhat hard |
| 5 | Hard |
| 6 | Harder |
| 7 | Very Hard |
| 8 | Intense |
| 9 | Very intense |
| 10 | Maximal |

Esimene laagrinädal:

- E
- T
- K
- N
- R
- L
- P

| Rating | Descriptor |
|---|---|
| 1 | Very, very easy |
| 2 | Easy |
| 3 | Moderate |
| 4 | Somewhat hard |
| 5 | Hard |
| 6 | Harder |
| 7 | Very Hard |
| 8 | Intense |
| 9 | Very intense |
| 10 | Maximal |

# Treeningu intensiivsuse hindamine

- Borgi skaala kasutamine: 0p – 10p x tr.aeg (min)

- Kerged treeningud peaks olema kuni 4p
- Rasked treeningud üle 7p

**•Kas treeneri ja sportlase hinnangud lähevad kokku?**


Rasmus Pind, doktoritöö
Kaitstud 4.05.2022

# Quantification of internal training load and its use in different practical training applications

PhD, Rasmus Pind

Juhendaja: kaasprofessor Jarek Mäestu

TARTU ÜLIKOOL
1632

# Conclusions

1. Training with a similar external training load, with matched training volume and intensity, resulted in a significant variation in internal load (sRPE) in young XC skiers indicating different strain from similarly prescribed trainings (Paper II).
2. Subjects who accumulated higher internal load in low-intensity sessions had higher effects on improvement of maximal performance after a 1-week training period (Paper II).

# The Injury Prevention Pyramid

The Sports Physio @adammeakins

## Position statement on youth resistance training: the 2014 International Consensus

Rhodri S Lloyd,[1] Avery D Faigenbaum,[2] Michael H Stone,[3] Jon L Oliver,[1] Ian Jeffreys,[4] Jeremy A Moody,[1] Clive Brewer,[5] Kyle C Pierce,[6] Teri M McCambridge,[7] Rick Howard,[8] Lee Herrington,[9] Brian Hainline,[10] Lyle J Micheli,[11,12,13] Rod Jaques,[14] William J Kraemer,[15] Michael G McBride,[16] Thomas M Best,[17] Donald A Chu,[18,19] Brent A Alvar,[18] Gregory D Myer[7,13,20]

- **Lihastreening** = erinevat takistust kasutav treening lihasjõu ja –vastupidavuse tõstmiseks (oma keharaskus, kummilindid, jõumasinad, vabad raskused, topispallid jne)
- **Jõutõstmine ja klassikaline tõstmine** – spordiala, kus kasutatakse erinevaid spetsiifilisi liigutusi võistlemiseks – jõutõmme, kükk, rinnalt surumine, rebimine, tõukamine, rinnalevõtt.

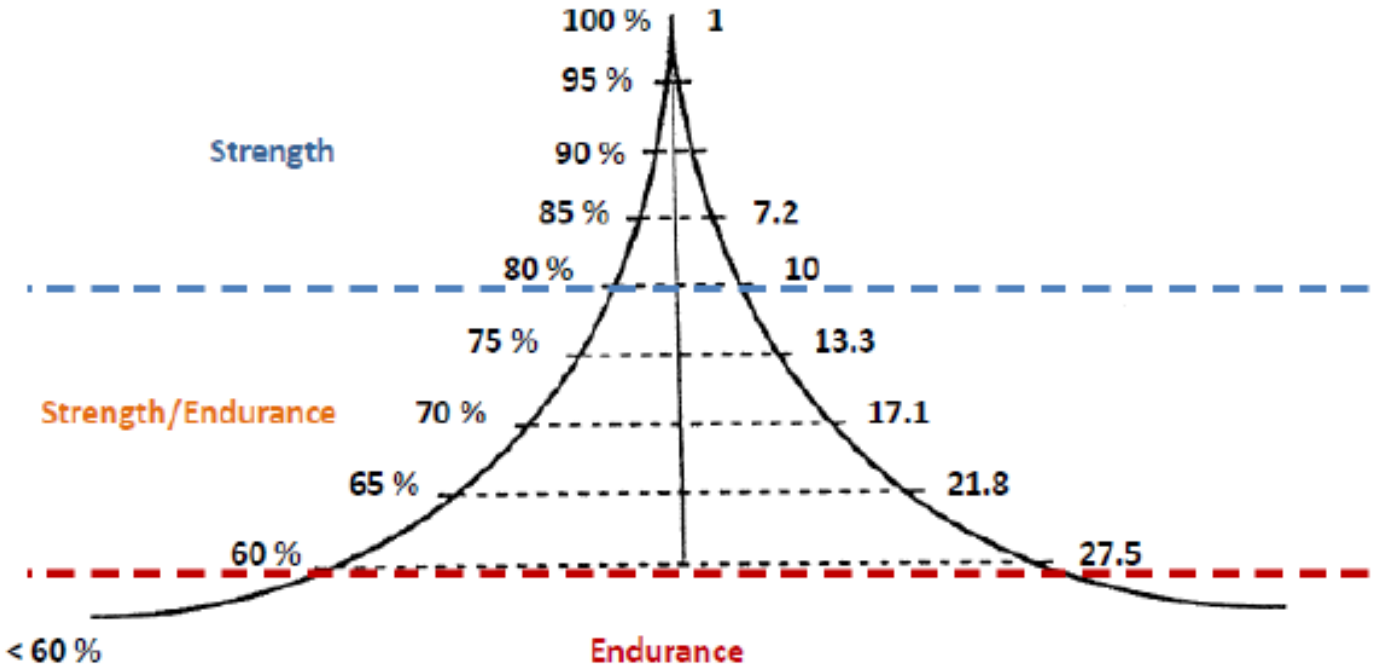
# Jõutreening vastupidavusalal?????

- Varasemad uuringud on näidanud vähenenud kardiorespiratoorset võimekust ja lihaskonna adaptatsiooni, kui jõutreening on lisatud vastupidavustreeningutele juurde.
- Samas järgnevad uuringud on näidanud, et kombineeritud jõu ja vastupidavuse treening viib täpselt samasuguste positiivsete kardiorespiratoorsete võimekuste muutusteni nagu ainult vastupidavuse treenimine!

P. Aagaard; J. L. Andersen. **Effects of strength training on endurance capacity in top-level endurance athletes**

- Ajalooliselt esimesed uuringud (Hickson jt, 1980) jõutreeningu osas vastupidavuse kontekstis näitasid, et 10-nädalane jõutreening parandab vastupidavuslikku sooritusvõimet 12-47% varasemalt mittetreenitud meestel.
- Hicksoni jt (1988) järgnev uuring hästi treenitud harrastussportlastel näitas, et 10-nädalane kõrgema intensiivsusega (ehk suurema raskusega) jõutreeningu lisamine parandas vastupidavuslikku sooritusvõimet 11-13% (4-8min jooksulindi test).
- Støren jt (2008) uuring tõi välja, et treenitud mees- ja naisjooksjad ($VO_{2max}$~56–61 mL/min/kg) parandasid 21% jooksulindi testi tulemusi (jooks väsimuseni, mõõdeti aega/distantsi) 8-nädalase kõrgema intensiivsusega jõutreeningu järgselt.

# Oddvar Holten Diagram




Medical Exercise Therapy; Oddvar Holten

# Mis juhtub, kui osad vastupidavustreeningud asendada jõutreeninguga?

- Bastiaans jt (2001) uuringus asendati 30% vastupidavustreeningutest jõutreeningutega (well-trained runners ($VO_{2max}$ of 68 mL/min/kg) ja nähti 5000m jooksu tulemuse paranemist 18,3min→17,8min (**Paavolainen et al., 1999**).

# Füsioloogilised mehhanismid

Kõrge intensiivsusega jõutreeningu füsioloogilisi muutuseid vastupidavussportlastel jälgisid uuringud (Aagaard jt, 2007, 2010), kus nähti lühiajalise ja pikaajalise jõutreeningu tulemusena kõrgel tasemel ratturite osas:

1. 45-min vastupidavustestide paranemine
2. IIA ehk kiirete lihasrakkude proportsiooni suurenemine, kuid lihashüpertroofiat ei esinenud!
3. maksimaalne jõud suurenes, kuid see ei vähendanud kapillaaride hulka/tihedust!
4. jõu rakendamise kiirus suurenes (*rate of force development*)

J Strength Cond Res. 2016 Aug;30(8):2361-8. doi: 10.1519/JSC.0000000000001316.

# Effects of Strength Training on Running Economy in Highly Trained Runners: A Systematic Review With Meta-Analysis of Controlled Trials.

Balsalobre-Fernández C[1], Santos-Concejero J, Grivas GV.

**Author information**

1 1Department of Physical Education, Sport and Human Movement, Autonomous University of Madrid, Madrid, Spain; 2Department of Physical Education and Sport, University of the Basque Country UPV/EHU, Vitoria-Gasteiz, Spain; and 3Department of Physical Education and Sport Science, University of Thessaly, Trikala, Greece.

**Abstract**

Balsalobre-Fernández, C, Santos-Concejero, J, and Grivas, GV. Effects of strength training on running economy in highly trained runners: a systematic review with meta-analysis of controlled trials. J Strength Cond Res 30(8): 2361-2368, 2016-The purpose of this study was to perform a systematic review and meta-analysis of controlled trials to determine the effect of strength training programs on the running economy (RE) of high-level middle- and long-distance runners. Four electronic databases were searched in September 2015 (PubMed, SPORTDiscus, MEDLINE, and CINAHL) for original research articles. After analyzing 699 resultant original articles, studies were included if the following criteria were met: (a) participants were competitive middle- or long-distance runners; (b) participants had a V[Combining Dot Above]O2max >60 ml·kg·min; (c) studies were controlled trials published in peer-reviewed journals; (d) studies analyzed the effects of strength training programs with a duration greater than 4 weeks; and (e) RE was measured before and after the strength training intervention. Five studies met the inclusion criteria, resulting in a total sample size of 93 competitive, high-level middle- and long-distance runners. Four of the 5 included studies used low to moderate training intensities (40-70% one repetition maximum), and all of them used low to moderate training volume (2-4 resistance lower-body exercises plus up to 200 jumps and 5-10 short sprints) 2-3 times per week for 8-12 weeks. The meta-analyzed effect of strength training programs on RE in high-level middle- and long-distance runners showed a large, beneficial effect (standardized mean difference [95% confidence interval] = -1.42 [-2.23 to -0.60]). In conclusion, a strength training program including low to high intensity resistance exercises and plyometric exercises performed 2-3 times per week for 8-12 weeks is an appropriate strategy to improve RE in highly trained middle- and long-distance runners.

**2-3x nädalas madala ja ka kõrge intensiivsusega jõutreeningud ning plüomeetriline treening 8-12 nädalat aitasid parandada jooksu ökonoomsust!**

Sports Med (2018) 48:1117–1149
https://doi.org/10.1007/s40279-017-0835-7

SYSTEMATIC REVIEW

# Effects of Strength Training on the Physiological Determinants of Middle- and Long-Distance Running Performance: A Systematic Review

**Richard C. Blagrove[1,2] · Glyn Howatson[2,3] · Philip R. Hayes[2]**

Published online: 16 December 2017


**Abstract**

*Background* Middle- and long-distance running performance is constrained by several important aerobic and anaerobic parameters. The efficacy of strength training (ST) for distance runners has received considerable attention in the literature. However, to date, the results of these studies have not been fully synthesized in a review on the topic.

*Objectives* This systematic review aimed to provide a comprehensive critical commentary on the current literature that has examined the effects of ST modalities on the physiological determinants and performance of middle- and long-distance runners, and offer recon best practice.

*Methods* Electronic databases were sea variety of key words relating to ST exercise and distance running. This search was supplemented with citation tracking. To be eligible for inclusion, a study was required to meet the following criteria: participants were middle- or long-distance runners with ≥ 6 months experience, a ST intervention (heavy resistance training, explosive resistance training, or plyometric training) lasting ≥ 4 weeks was applied, a running only control group was used, data on one or more physiological variables was reported. Two independent assessors deemed that 24 studies fully met the criteria for inclusion. Methodological rigor was assessed for each study using the PEDro scale.

*Results* PEDro scores revealed internal validity of 4, 5, or 6 for the studies reviewed. Running economy (RE) was measured in 20 of the studies and generally showed improvements (2–8%) compared to a control group,

Key Points

Strength training (ST) appears to provide benefits to running economy, time trial performance and maximal sprint speed in middle- and long-distance runners of all abilities

Maximal oxygen uptake, blood lactate parameters, and body composition appear to be unaffected by the addition of ST to a distance runner's program

Adding ST, in the form of heavy resistance training, explosive resistance training, and plyometric training performed, on 2–3 occasions per week is likely to positively affect performance.

- 6-20näd kestev jõutreening parandab jooksu ökonoomsust 2-8%
- Suure raskusega jõutreening (ca 80% 1KM, kuni 9x seerias) parandab jooksjate sooritusvõimet!

Review

# Effects and dose–response relationships of resistance training on physical performance in youth athletes: a systematic review and meta-analysis

Melanie Lesinski, Olaf Prieske, Urs Granacher

**Results** 43 studies met the inclusion criteria. Our analyses revealed moderate effects of resistance training on muscle strength and vertical jump performance ($SMD_{wm}$ 0.8–1.09), and small effects on linear sprint, agility and sport-specific performance ($SMD_{wm}$ 0.58–0.75). Effects were moderated by sex and resistance training type. Independently computed dose–response relationships for resistance training parameters revealed that a training period of >23 weeks, 5 sets/exercise, 6–8 repetitions/set, a training intensity of 80–89% of 1 repetition maximum (RM), and 3–4 min rest between sets were most effective to improve muscle strength ($SMD_{wm}$ 2.09–3.40).

**Parim viis noortel sportlastel jõunäitajaid parandada: >23 nädala regulaarseid treeninguid, 5 seeriat, 6-8x @80-89% 1KM, puhkepaus 3-4min**

# Kokkuvõte

- Kõrgem intensiivsus ja pikaajaline ehk >10 nädala kestev jõutreening parem (85–95% 1 RM)
- Baasjõu ja kiirusliku jõutreeningu mõju kõrgelt treenitud vastupidavussportlastel parem tulemus erialasele sooritusvõimele!

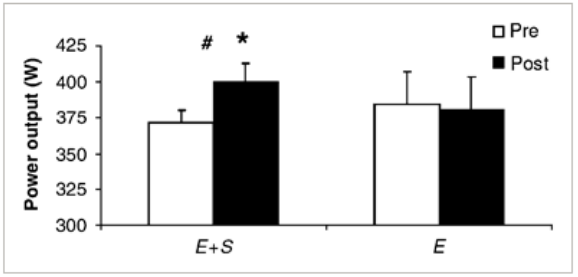


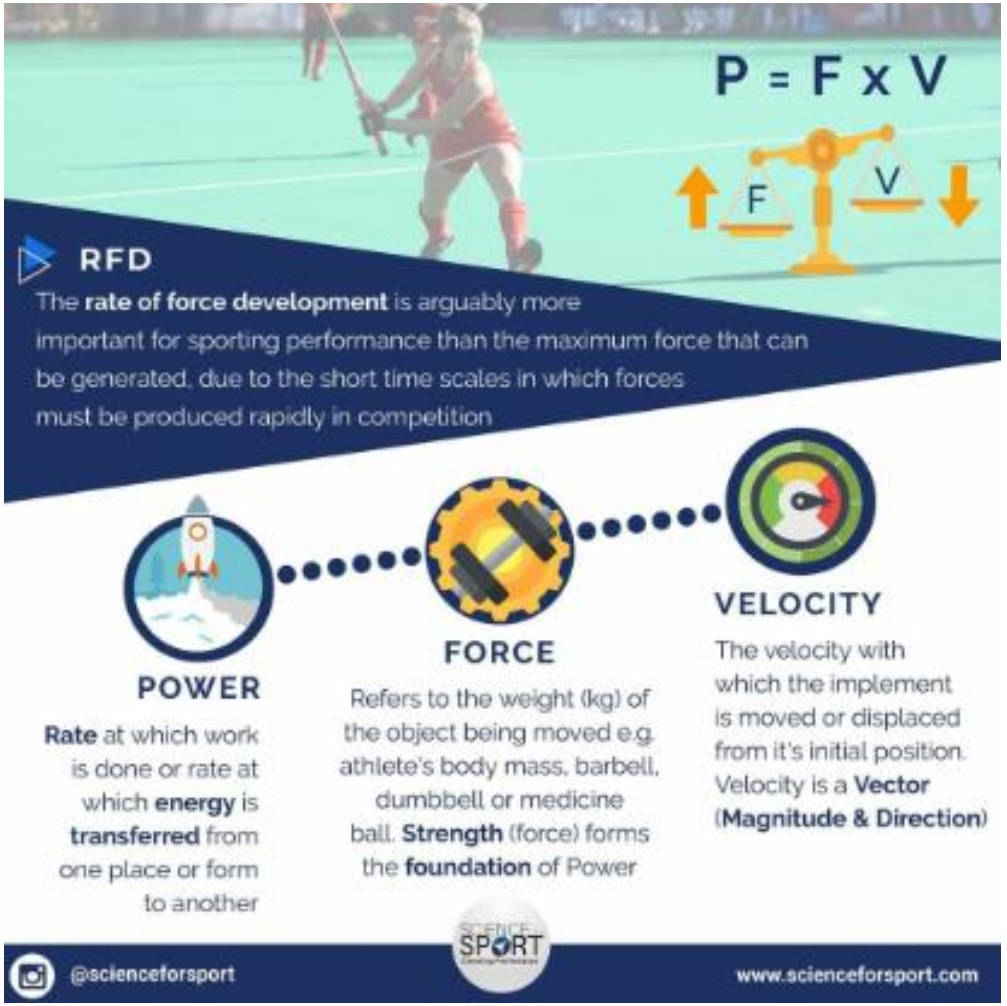

**Figure 3**

Mean power output during a 5-min all-out trial performed following 185 min of cycling at 44% of baseline $W_{max}$ before (Pre) and after (Post) 12 weeks of concurrent endurance (cycling) and strength training (E+S) or endurance (cycling) training alone (E). *Post different from pre ($P$ <0.01). #Difference between E+S and E in relative change from pre-test to post-test ($P$ <0.01). Data adapted from Rønnestad et al. (2010).

**Hoff et al., 1999, 2002; Aagaard et al., 2007, 2010; Støren et al., 2008; Rønnestad et al., 2010; Sunde et al., 2009, Paavolainen et al., 1999; Mikkola et al., 2007**

*Ehk miks tegeleda jõutreeninguga?!*

Power = Force * Velocity



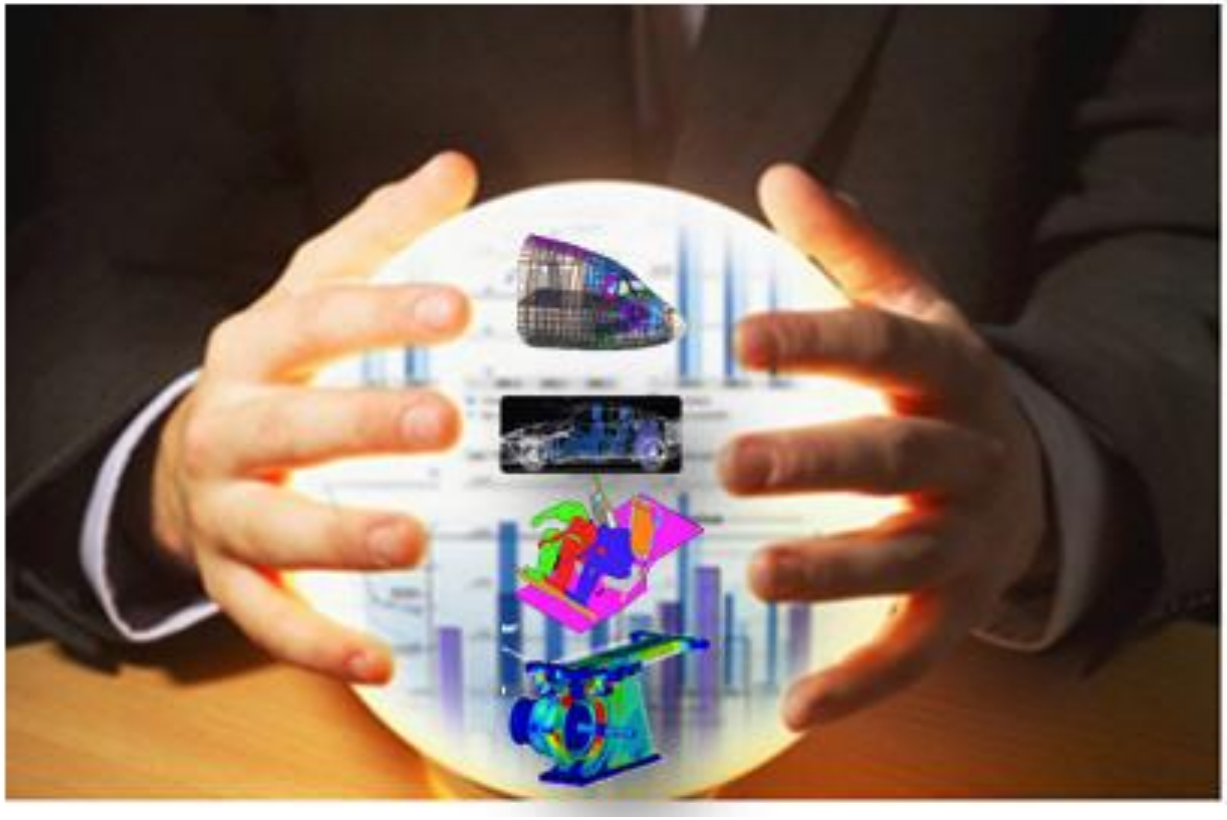
# Jõutreening ehk lihastreening

1. Jõutreening parandab tahtejõudu ja **pingutamise oskust**!?
2. **Sooritusvõime parandamiseks** ja spetsiifilise liigutusliku võimekuse arenguks on tarvis progresseeruvat lihaskonna koormamist!
3. **Aitab tõhustada närvi- ja lihasaparaadi omavahelist koordinatsiooni**
4. **Aitab tugevdada luustikku** (kui ei ole ühekülgne
   - koormus)
5. **Aitab muuta kõõlused tugevamaks** (10 nädalat)

# KÜSIMUS NR 4: KUIDAS HINDAME OMA SPORTLASTE KEHALIST VÕIMEKUST?

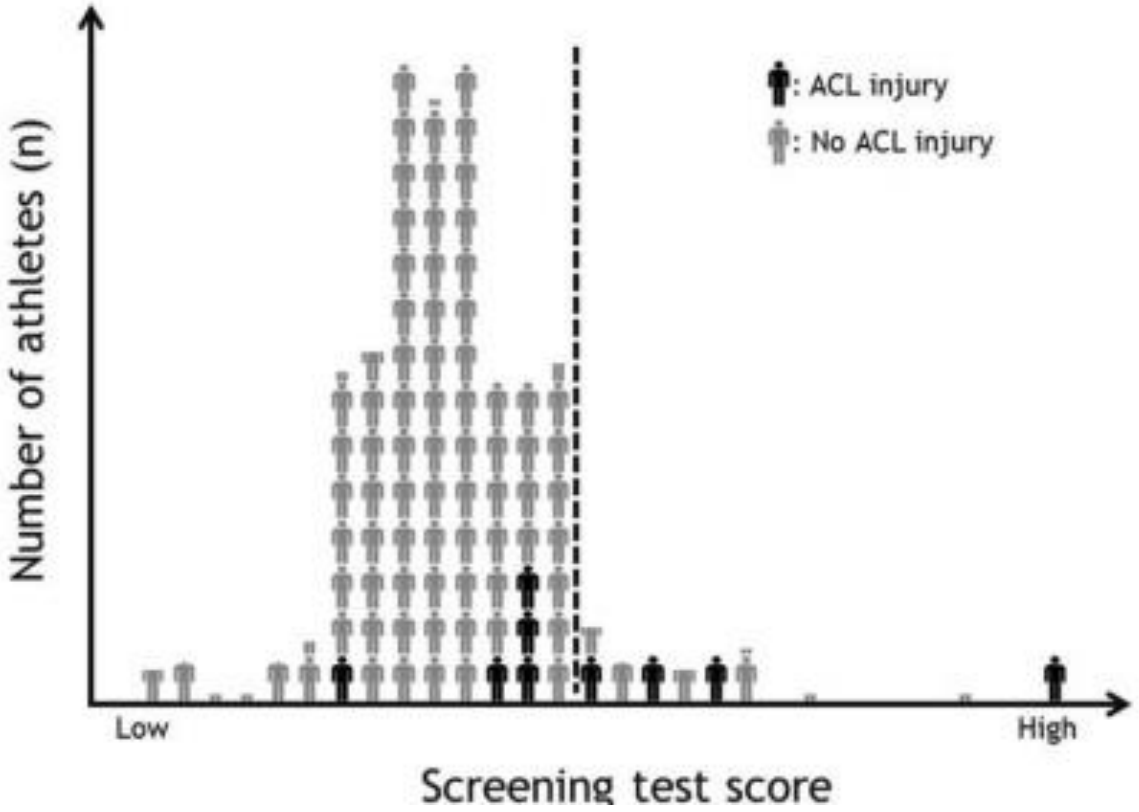
1. Kas Te käite perioodilises hambakontrollis?
2. Spordiarsti juures?

# Kas saame ennustada tulevikku?



# Why screening tests to predict injury do not work—and probably never will…: a critical review

Roald Bahr[1,2]




Bahr R. Br J Sports Med 2016;50:776–780. doi:10.1136/bjsports-2016-096256

# Sportlaste testimine vigastuste ennetamiseks?

1) Functional Movement Screen

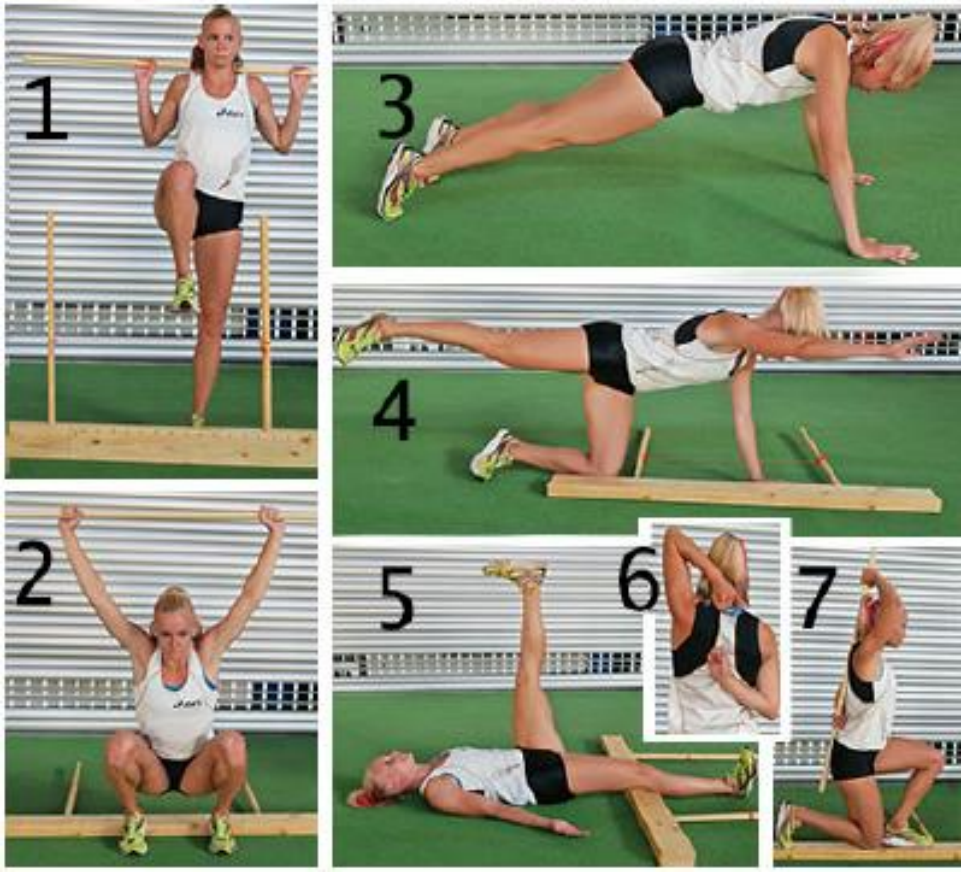
2) Y-balance test

3) Hamstring and adductor muscle isometric strength

4) Hamstring and gastrocnemius muscle endurance

5) Drop jump Landing Error Scoring System

# Functional Movement Screen®
# (põhiliigutuslik analüüs)




- 7 testi
- 0-3p (0=valu)
- Max 21p
- Skoore <15= 4x suurem tõenäosus ülekoormusvigastus eks antud treeninghooajal.

## Functional Movement Screen : Deep Squat

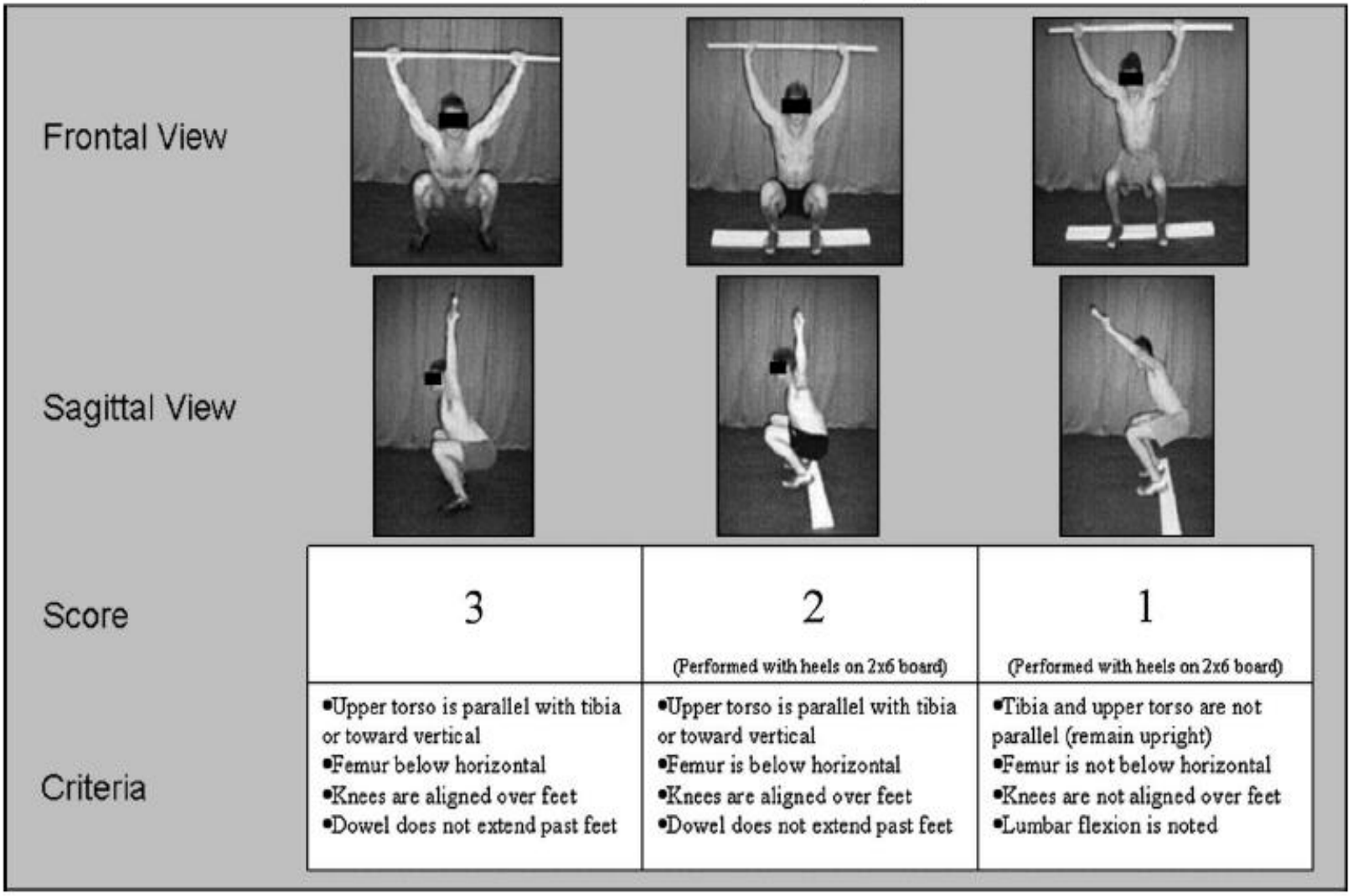
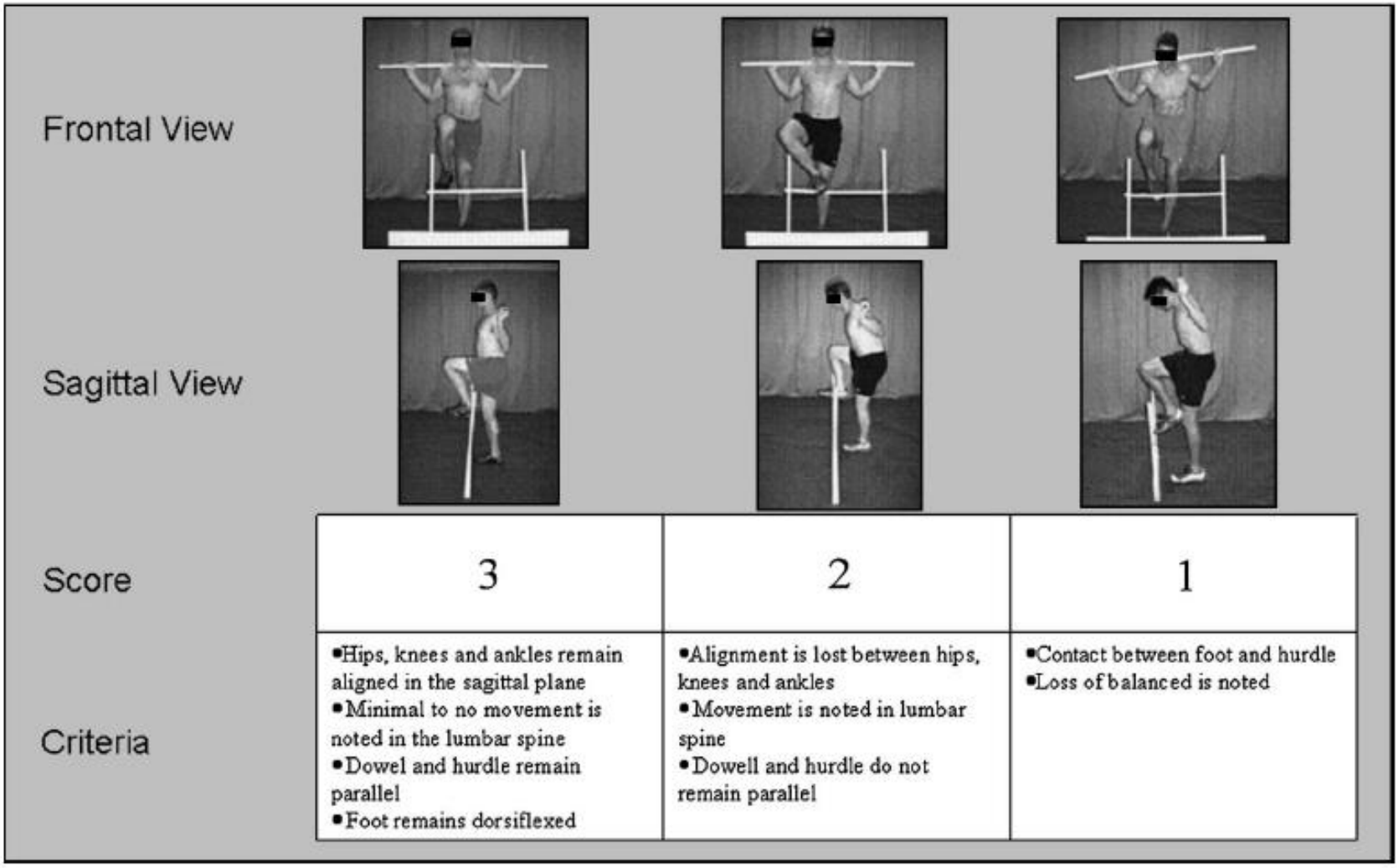



**Figure 1.** Description of the scoring criteria used for the deep squat component of the FMS.

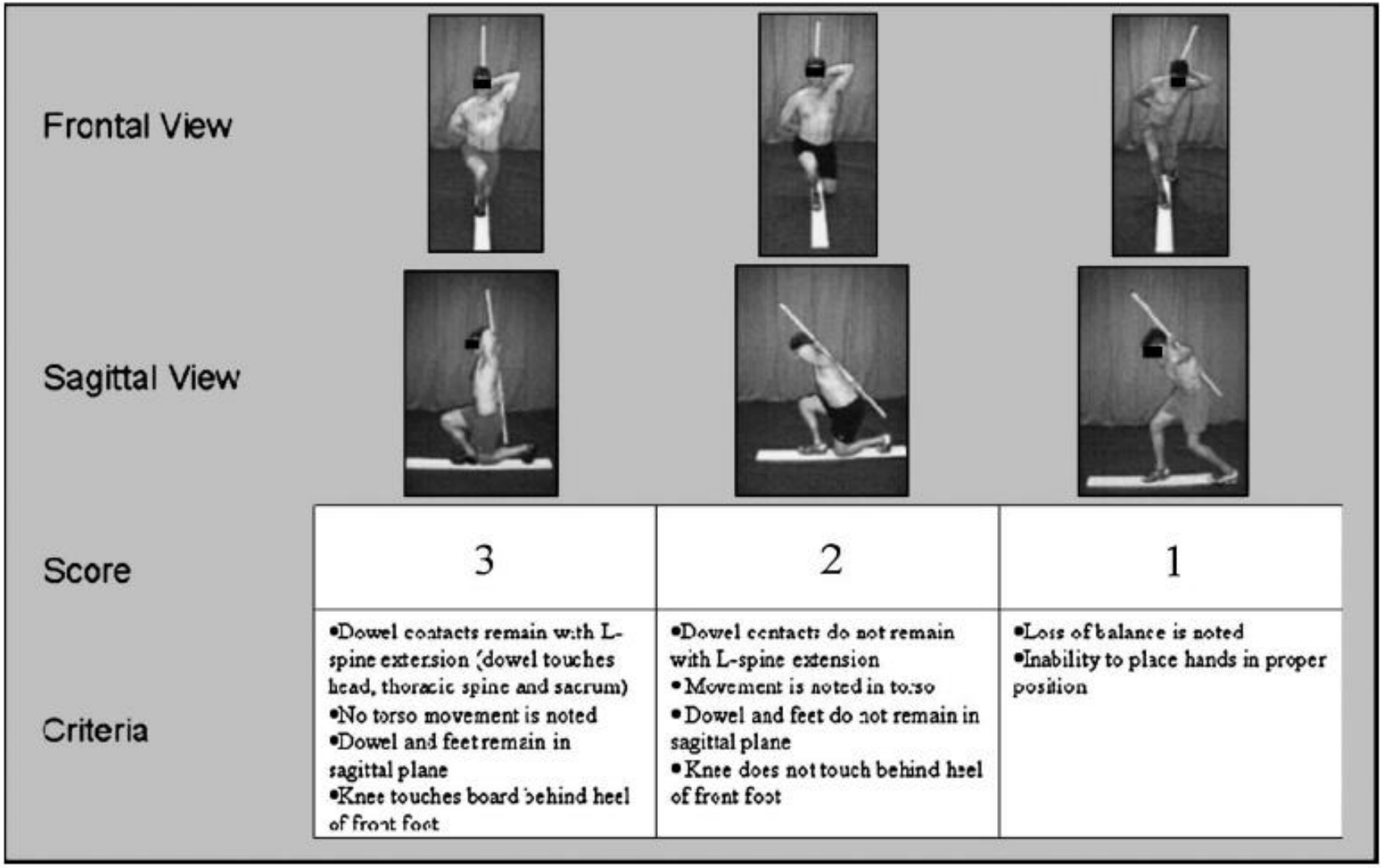
## Functional Movement Screen : Hurdle Step




| Score | 3 | 2 | 1 |
|---|---|---|---|
| Criteria | •Hips, knees and ankles remain aligned in the sagittal plane<br>•Minimal to no movement is noted in the lumbar spine<br>•Dowel and hurdle remain parallel<br>•Foot remains dorsiflexed | •Alignment is lost between hips, knees and ankles<br>•Movement is noted in lumbar spine<br>•Dowell and hurdle do not remain parallel | •Contact between foot and hurdle<br>•Loss of balanced is noted |

**Figure 2.** Description of the scoring criteria used for the hurdle step component of the FMS.

## Functional Movement Screen : In-Line Lunge




| Score | 3 | 2 | 1 |
|---|---|---|---|
| Criteria | •Dowel contacts remain with L-spine extension (dowel touches head, thoracic spine and sacrum)<br>•No torso movement is noted<br>•Dowel and feet remain in sagittal plane<br>•Knee touches board behind heel of front foot | •Dowel contacts do not remain with L-spine extension<br>•Movement is noted in torso<br>•Dowel and feet do not remain in sagittal plane<br>•Knee does not touch behind heel of front foot | •Loss of balance is noted<br>•Inability to place hands in proper position |

**Figure 3.** Description of the scoring criteria used for the in-line lunge component of the FMS.

## Functional Movement Screen : Shoulder Mobility

Frontal View

| Score | 3 | 2 | 1 |
|---|---|---|---|
| Criteria | •Fists are within one hand length | •Fists are within one and a half hand lengths | •Fists are not within one and a half hand lengths |

**Figure 4.** Description of the scoring criteria used for the shoulder mobility component of the FMS.

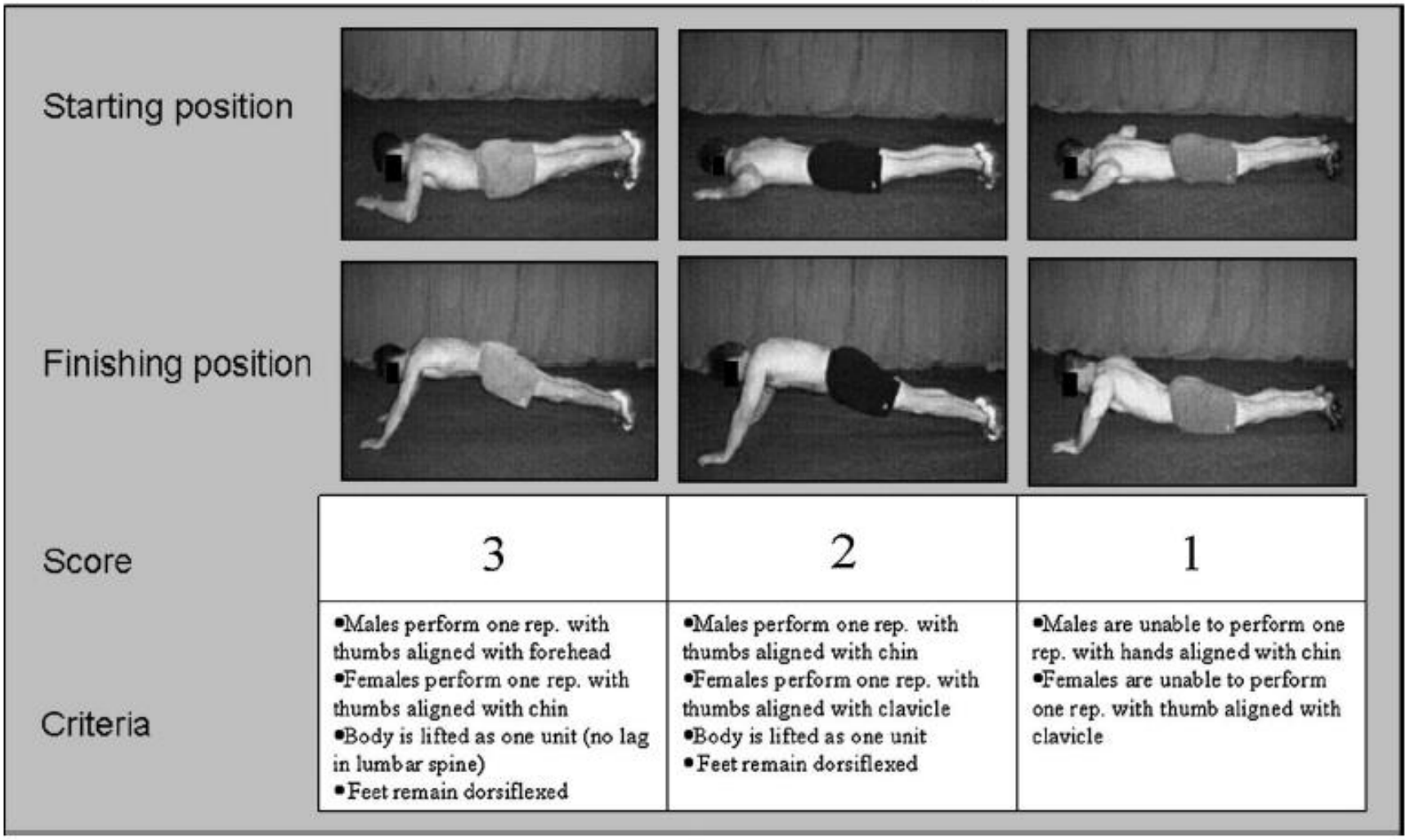
## Functional Movement Screen : Active Straight Leg Raise

Sagittal View

| Score | 3 | 2 | 1 |
|---|---|---|---|
| Criteria | •Ankle/Dowel resides between mid-thigh and ASIS<br>•Opposite hip remains neutral (does not externally rotate), toes remain pointing up<br>•Knees remain in contact with board | •Ankle/Dowel resides between mid-thigh and mid-patella | •Ankle/Dowel resides below mid-patella |

**Figure 5.** Description of the scoring criteria used for the active straight leg raise component of the FMS.

## Functional Movement Screen : Push Up




| Score | 3 | 2 | 1 |
|---|---|---|---|
| Criteria | •Males perform one rep. with thumbs aligned with forehead<br>•Females perform one rep. with thumbs aligned with chin<br>•Body is lifted as one unit (no lag in lumbar spine)<br>•Feet remain dorsiflexed | •Males perform one rep. with thumbs aligned with chin<br>•Females perform one rep. with thumbs aligned with clavicle<br>•Body is lifted as one unit<br>•Feet remain dorsiflexed | •Males are unable to perform one rep. with hands aligned with chin<br>•Females are unable to perform one rep. with thumb aligned with clavicle |

**Figure 6.** Description of the scoring criteria used for the trunk stability push-up component of the FMS.

## Functional Movement Screen : Rotary Stability

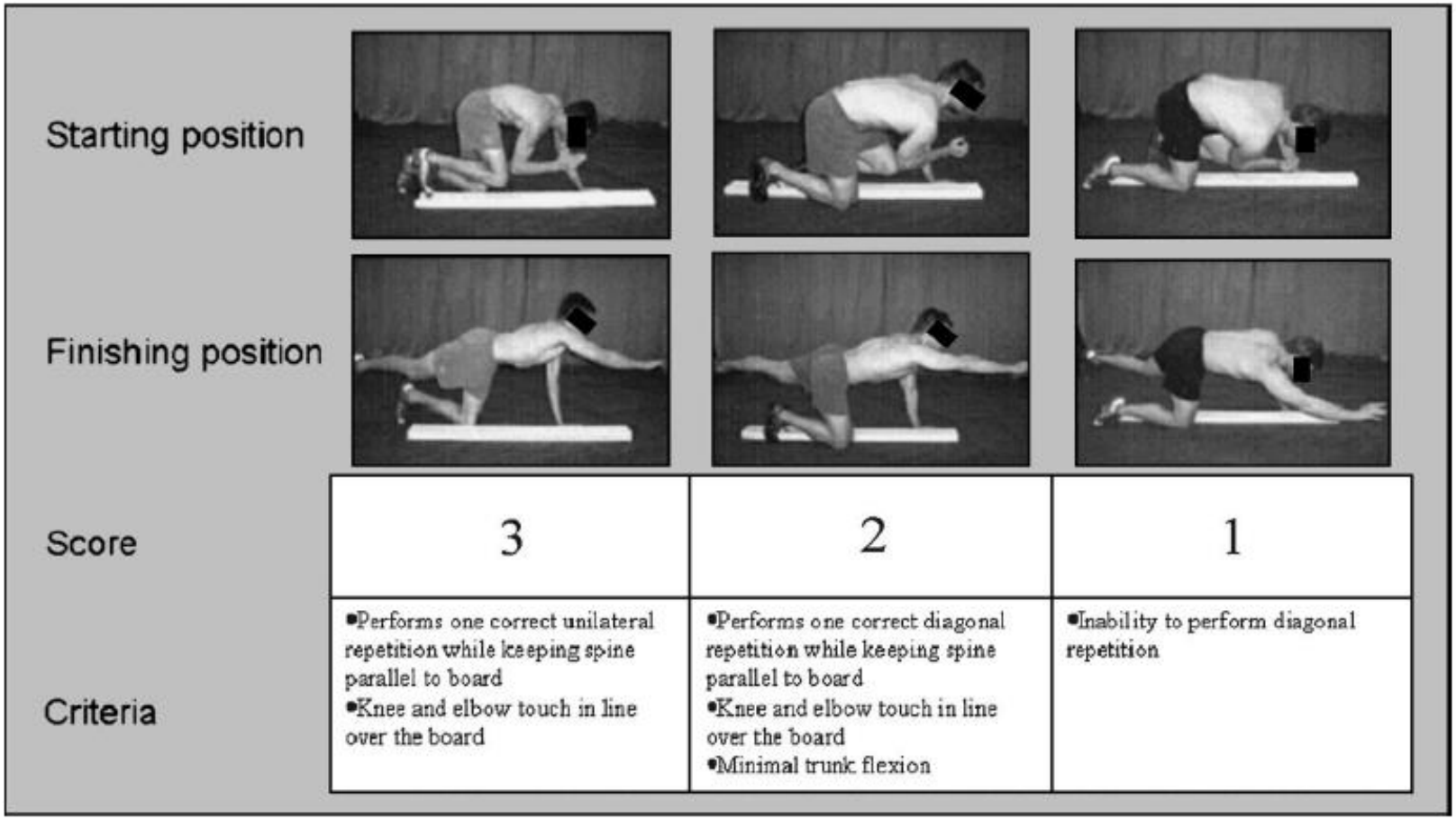
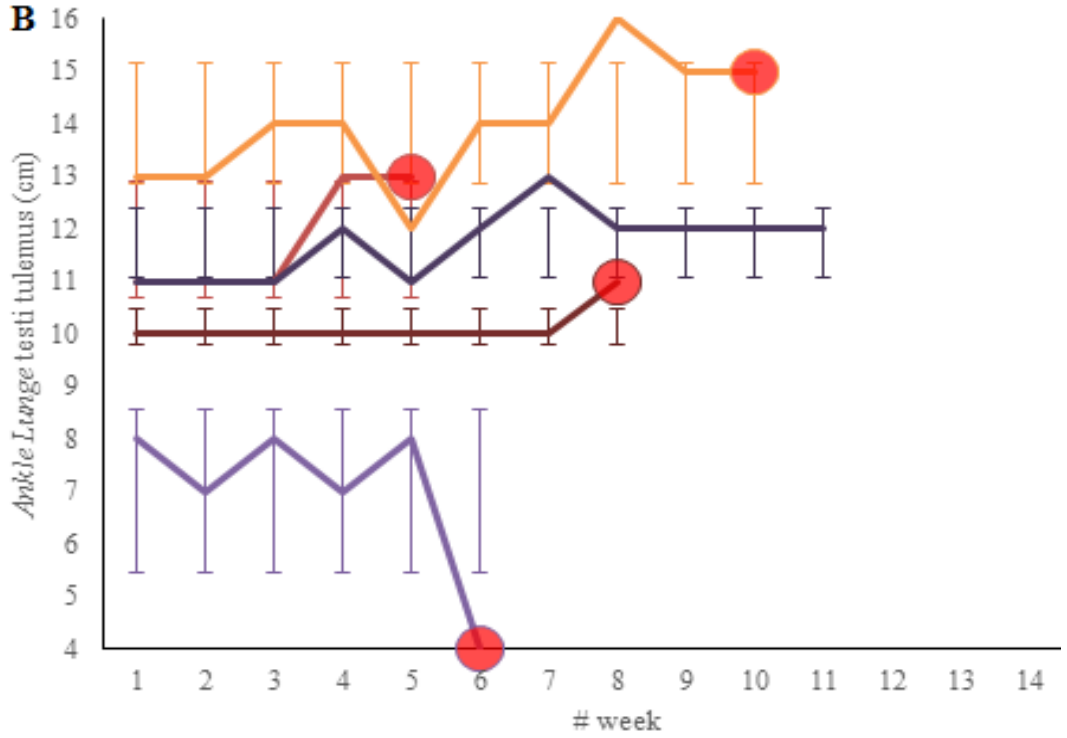



**Figure 7.** Description of the scoring criteria used for the rotary stability component of the FMS.

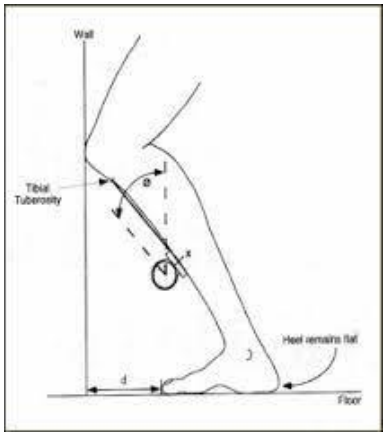
# Kehaliste võimete testimine

FYSIOKESKUS
Prehab, prevention & performance

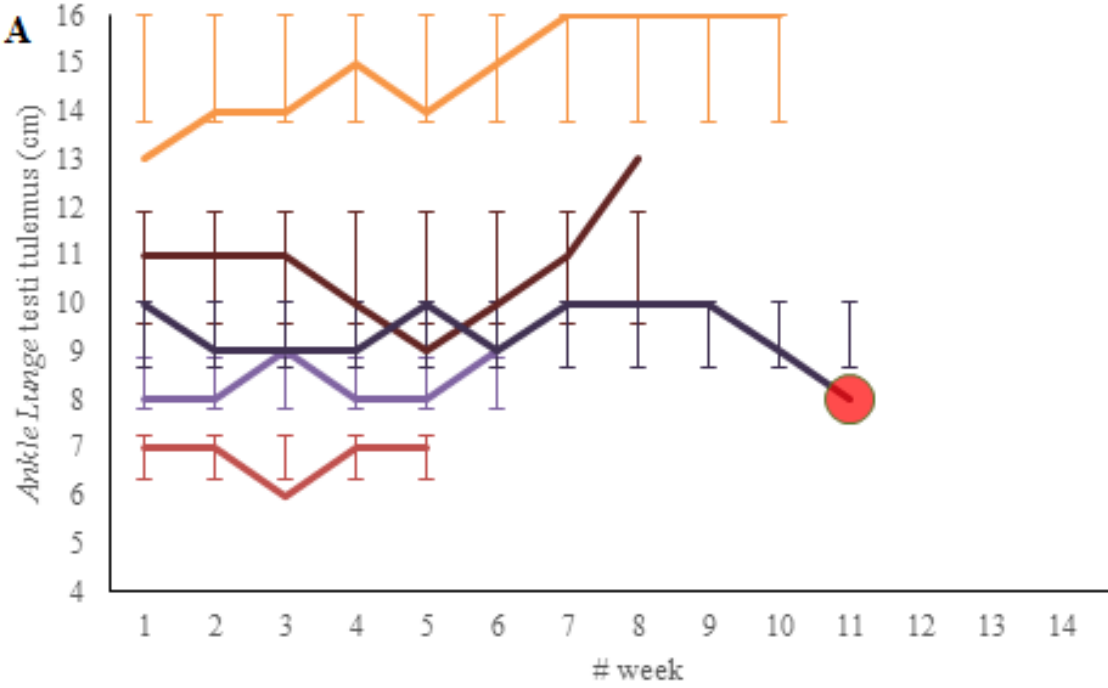
# Ankle injuries in track and field athletes



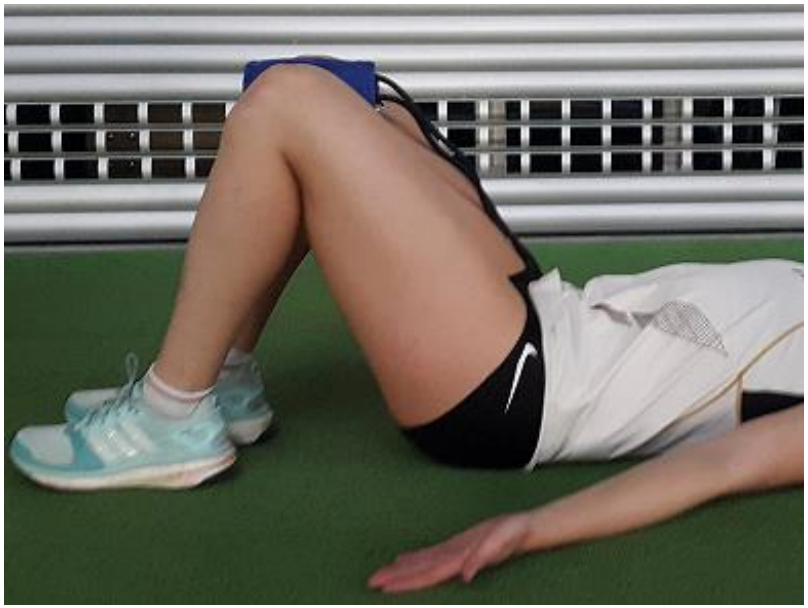

Kalev et al., 2015




Hüppeliigese liikuvuse regulaarne mõõtmine



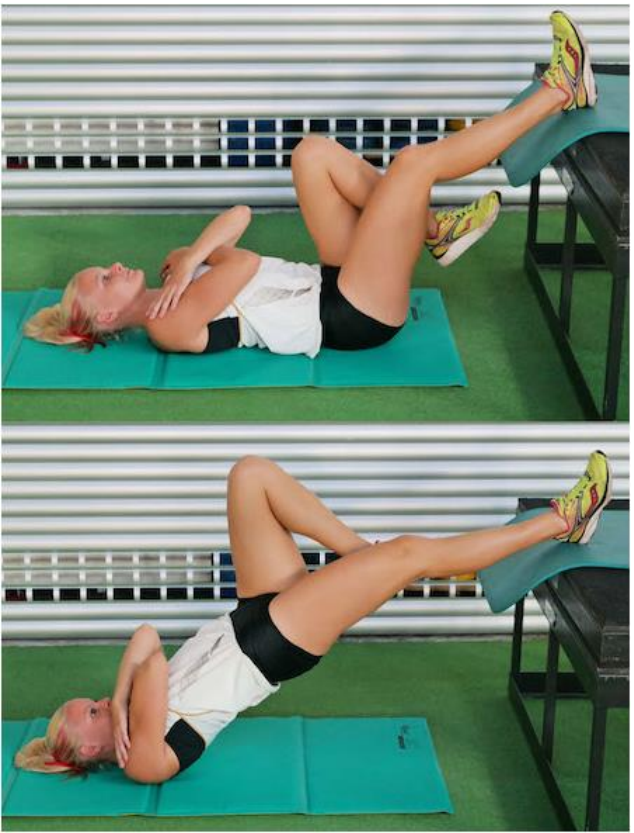
# Reie lähendajalihaste isomeetriline kontraktsioonijõud



- Kubeme piirkonna vigastused = isom.jõud ↓ 185 mmHg

# Puusa sirutajate conc/ecc vastupidavuse testimine

## (Tempo: 1 sek/ 1sek)



- Norm = > 30x
- Tulemused <20x = **4x suurem** alajäseme vigastuste tekkimise risk

# Säärelihaste conc/ecc vastup.testimine

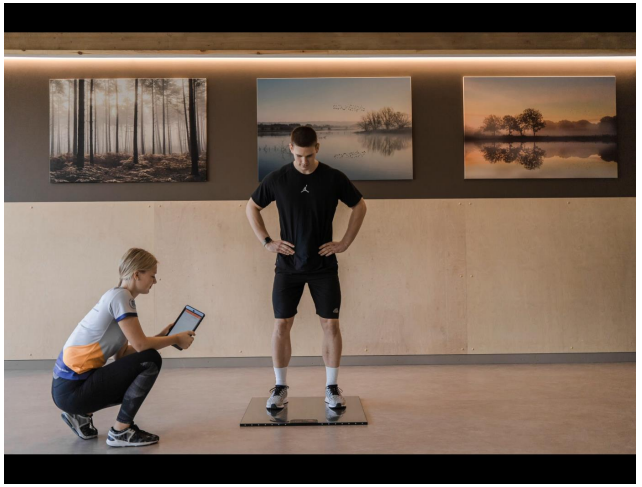
(Tempo: 1 sek/ 1sek)

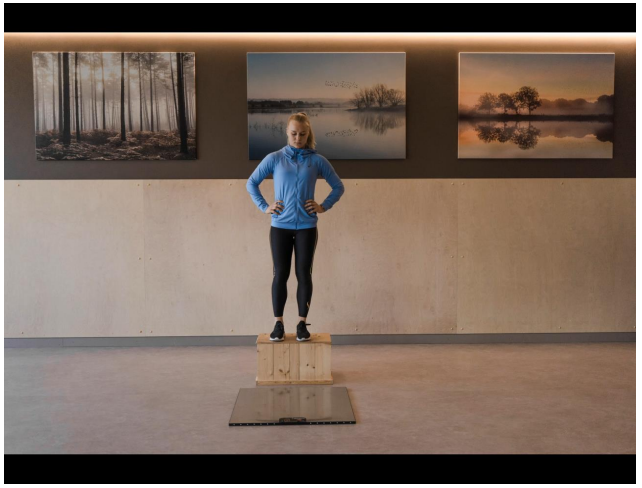
Norm = >30x

- Tulemused <20x = **4x suurem** alajäseme vigastuste tekkimise risk

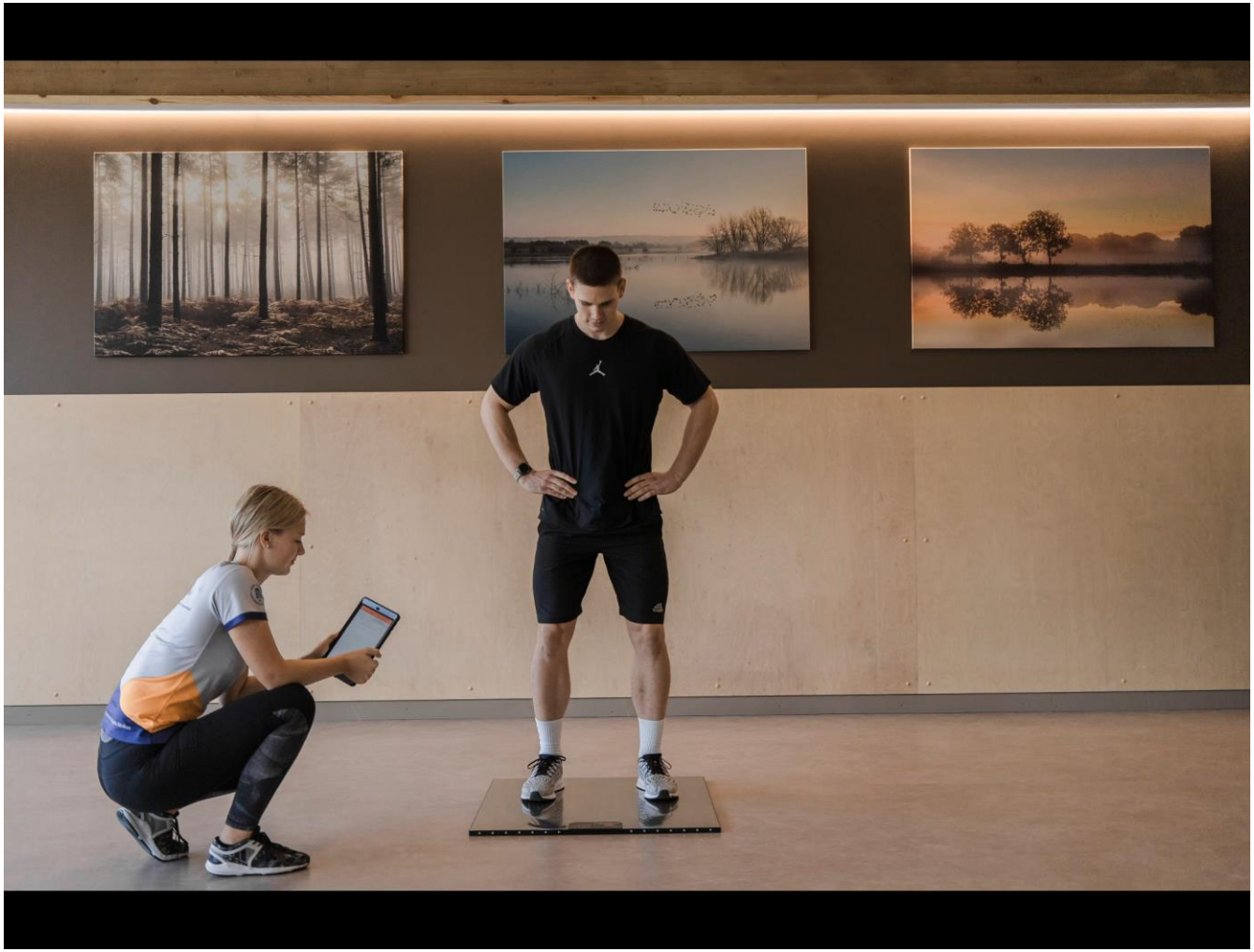
# Sügavushüpe *VS* kükist üleshüpe

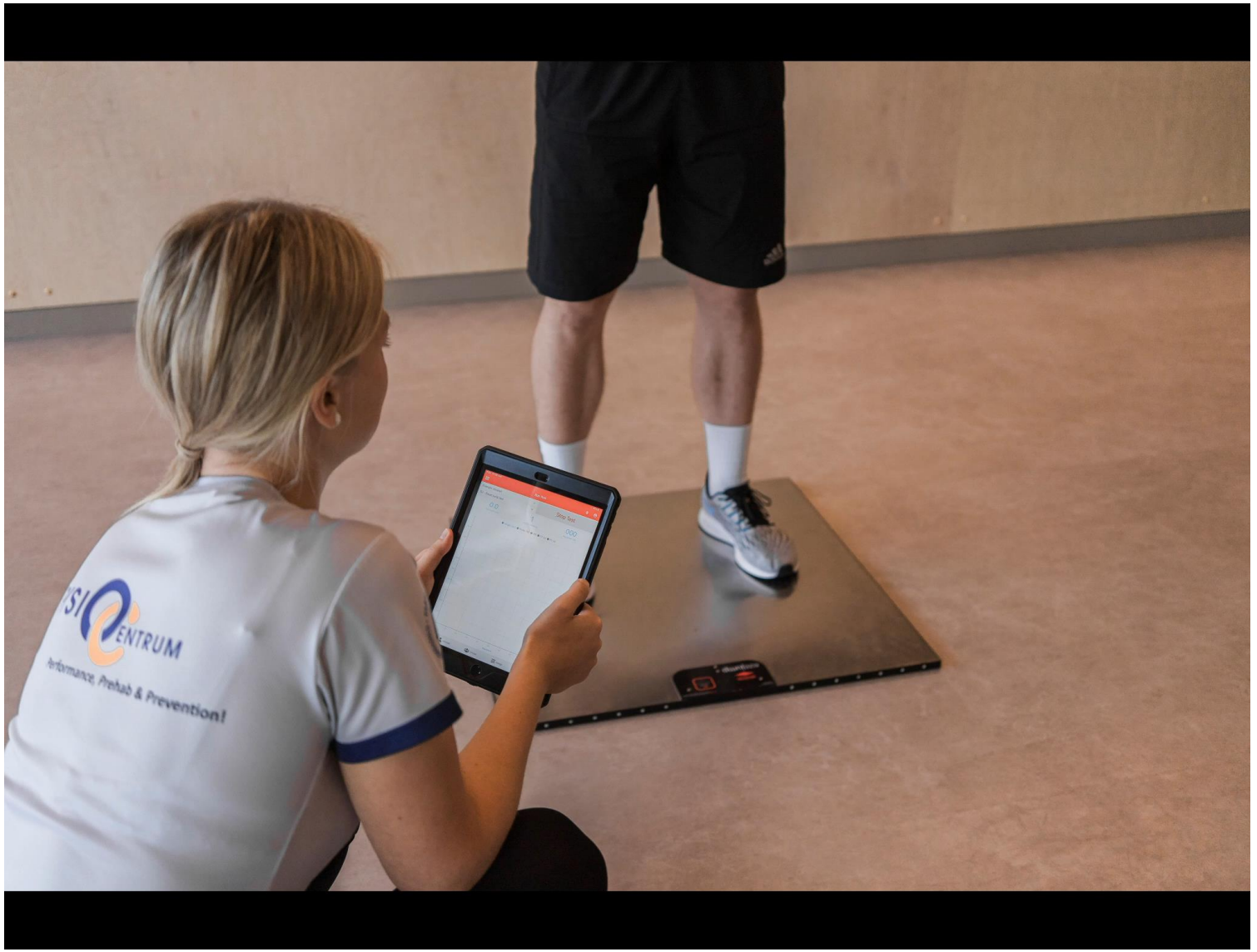
- Kiirus *vs* jõud (ja vastavalt ühe puudus)
- Treeningtsükli sisene testimine!





# CMJ

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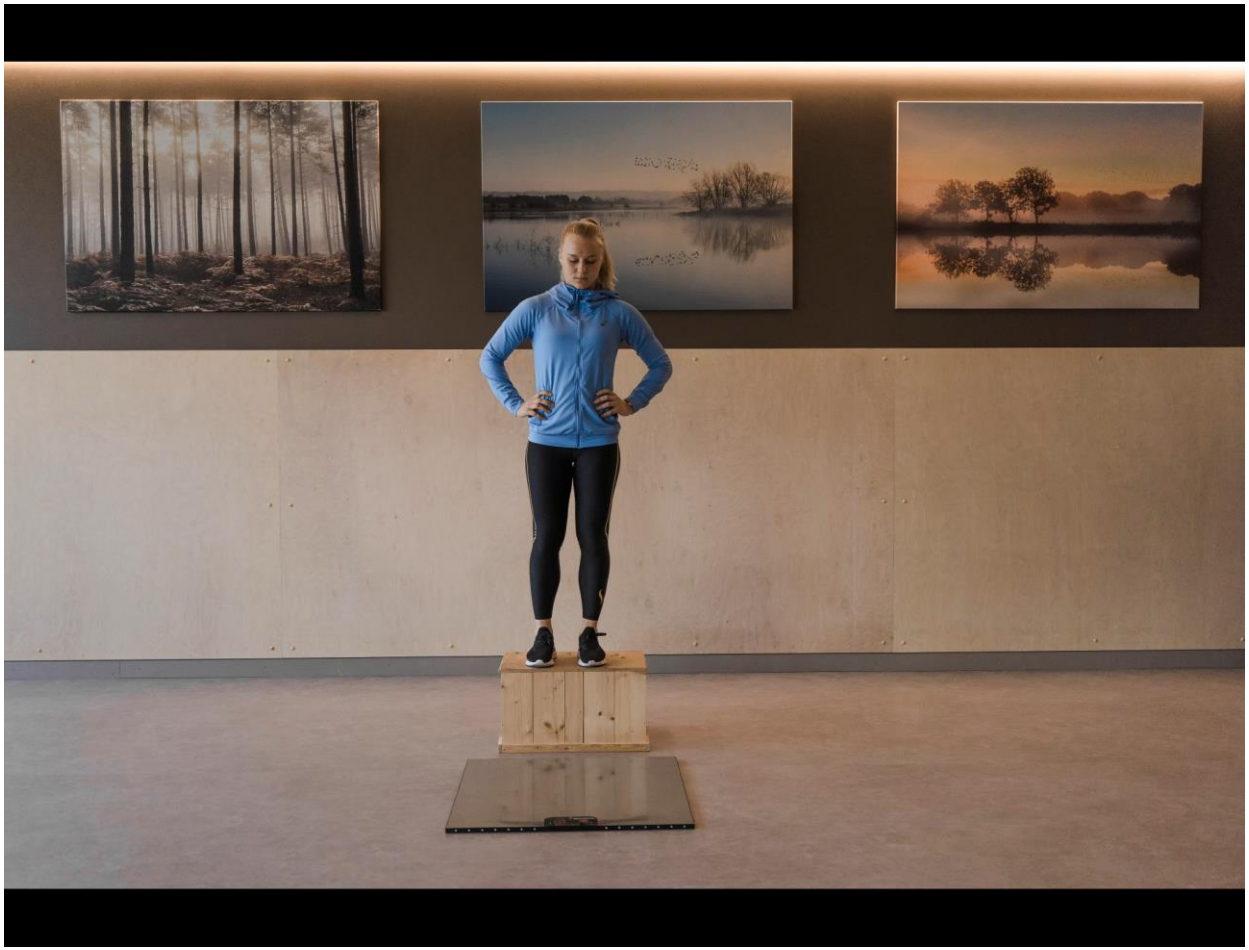
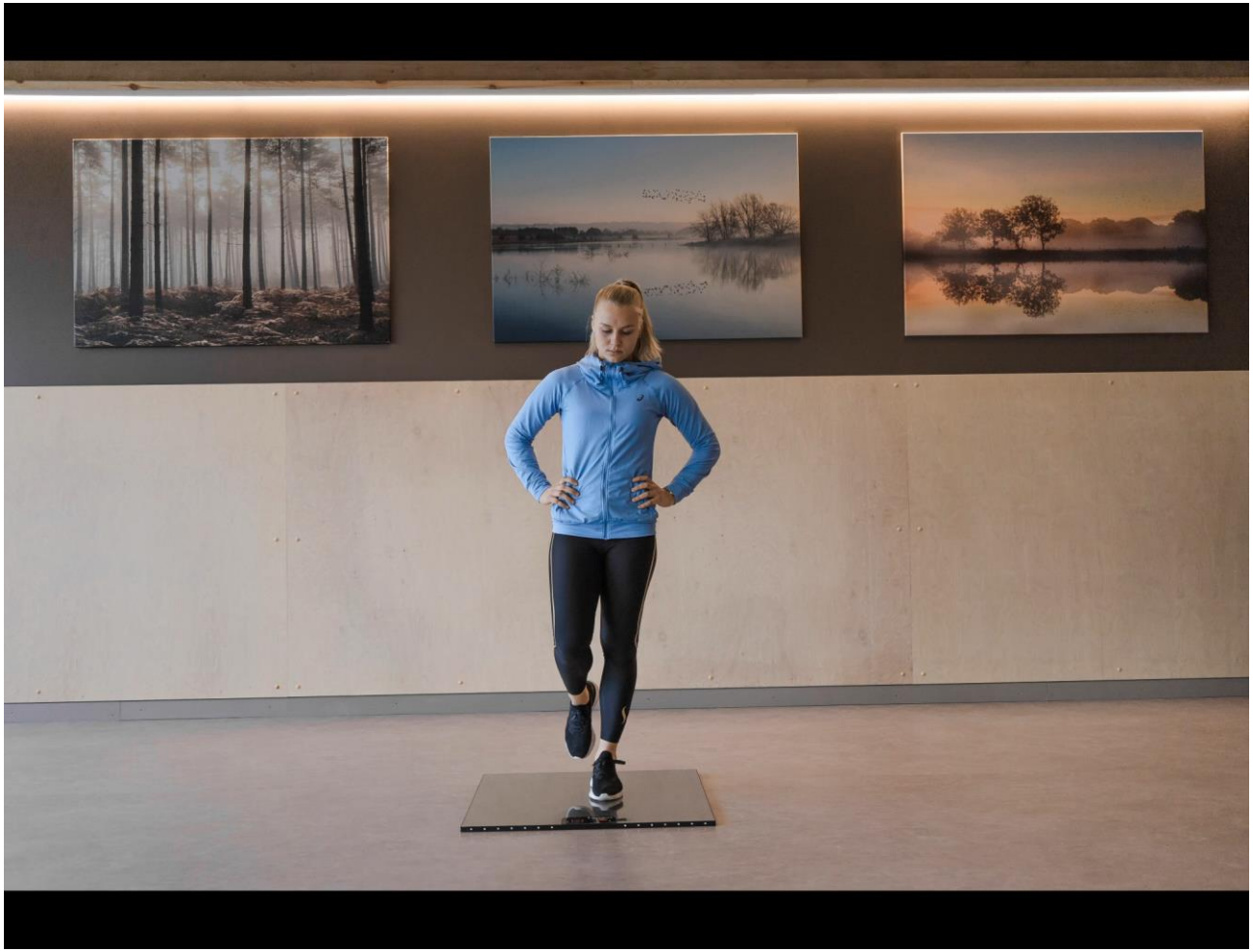
# Sügavushüpe (Drop jump, 30cm kast)



# CMJ, ühe jala kaupa



# Nordic hamstring (ecc.jõud)

**Reie tagakülg on põhiline vigastuse piirkond – kas parem = vasak jõu osas?**

# Nordic *hamstring* harjutus

**The Original Nordic Program**

| Week | Training Frequency (Sessions/Week) | Sets | Reps |
|---|---|---|---|
| 1 | 1 | 2 | 5 |
| 2 | 2 | 2 | 6 |
| 3 | 3 | 3 | 6-8 |
| 4 | 3 | 3 | 8-10 |
| 5-10 | 3 | 3 | 12,10,8 |

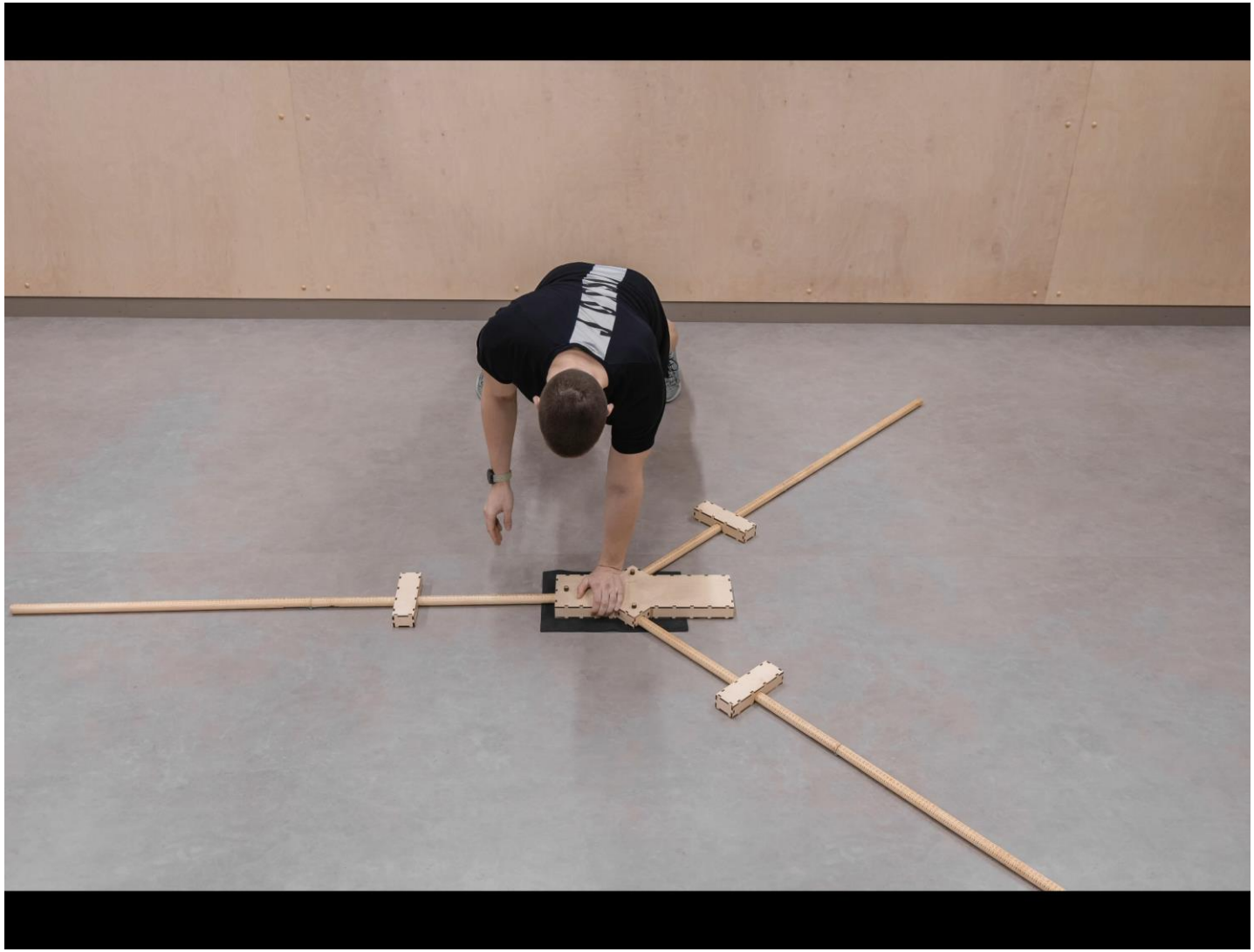
# Reie lähendajate (adduktorite) jõud

**Nö kubemelihased – enamasti põhjuseks lihaste omavaheline düsbalanss ehk parem nõrgem vasakust**

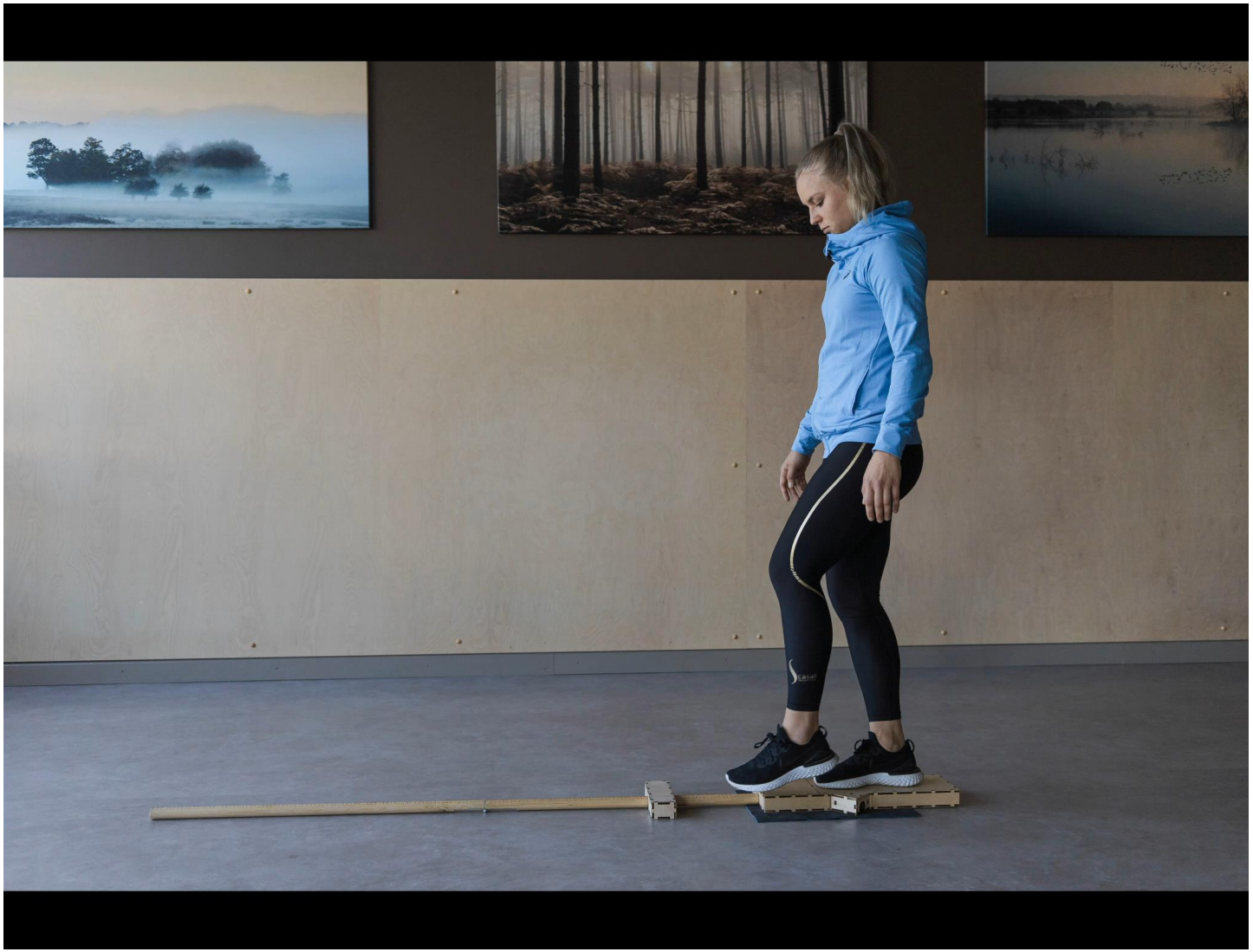
# Külgmiste tuharalihaste jõud


**Külgmiste tuharalihaste jõud – vajalik põlve stabiliseerimiseks!**

# Kerelihaste võimekus



# Tasakaal



# Õla soojendusprogramm

# SOOJENDUSPROGRAMM ENNETAMAKS ÕLAVIGASTUSI

1. Tõsta kehatemperatuuri
2. Valmistada õlaliigesed ja rotaatormanseti lihased ette liigutusteks ujumises
3. Parandada sooritusvõimet (vaimne ja füüsiline valmisolek)

**ALGASEND** **2x10-15** **LÕPPASEND**

**ALGASEND**

**LÕPPASEND**

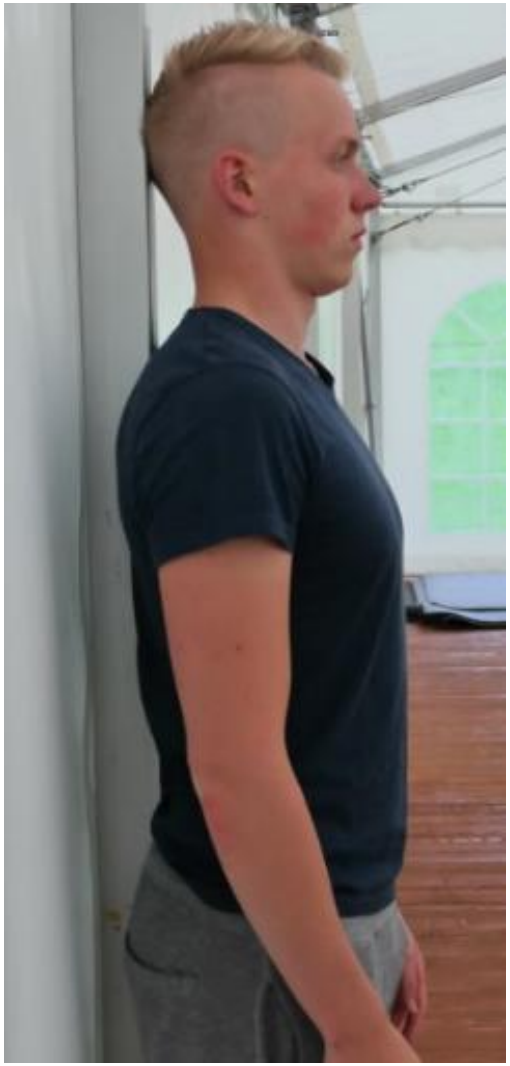
**2x10-15**

# 2x10-15

## ALGASEND

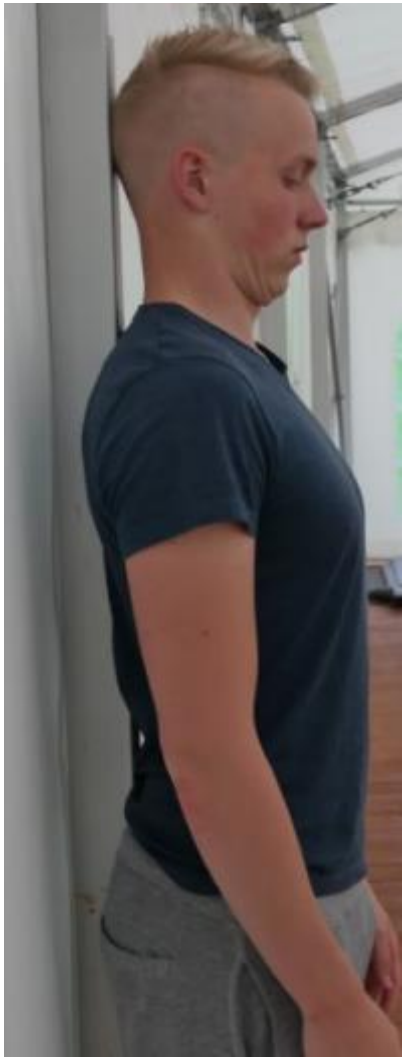
## LÕPPASEND

**ALGASEND**



**2x10-15**

**LÕPPASEND**



# 2x10-15

## ALGASEND

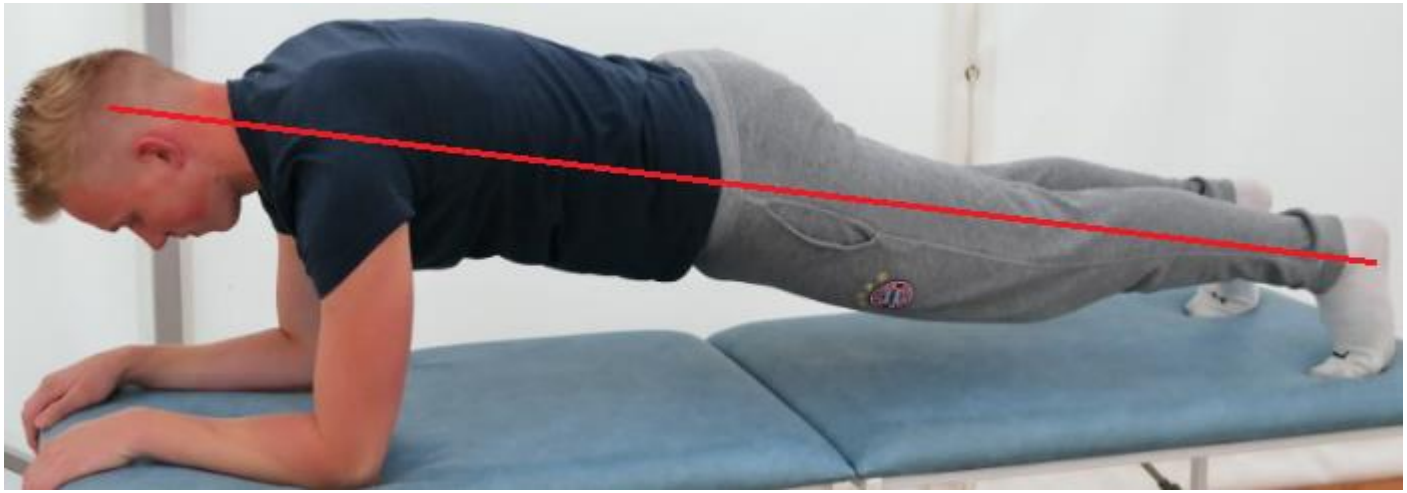
## LÕPPASEND

# Isomeetriline välisrotaatorite surumine 2x15sek 50% KM

Ekstsentriline + kontsentriline
ehk lased paarilisel võita (3sek töö),
ca 50% KM

**1x10-15**

# Küünartoenglamang 2x15sek



# Küünartoeng külili 2x15sek

# Kokkuvõte

- Kas jälgime terviseprobleeme süstemaatiliselt?
- Kas testime oma sportlaste kehalist võimekust ja vigastuste riskifaktoreid regulaarselt?
- Kas planeerime ja monitoorime treeningkoormuseid?

# NIMETAGA 10 UUT ASJA, MIDA TE TÄNA TEADA SAITE?

# Tänan kuulamast ja jõudu tööle!

mati@fysiocentrum.ee
mati.arend@ut.ee

www.fysiocentrum.ee

Kääriku SPORDIKESKUS

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