

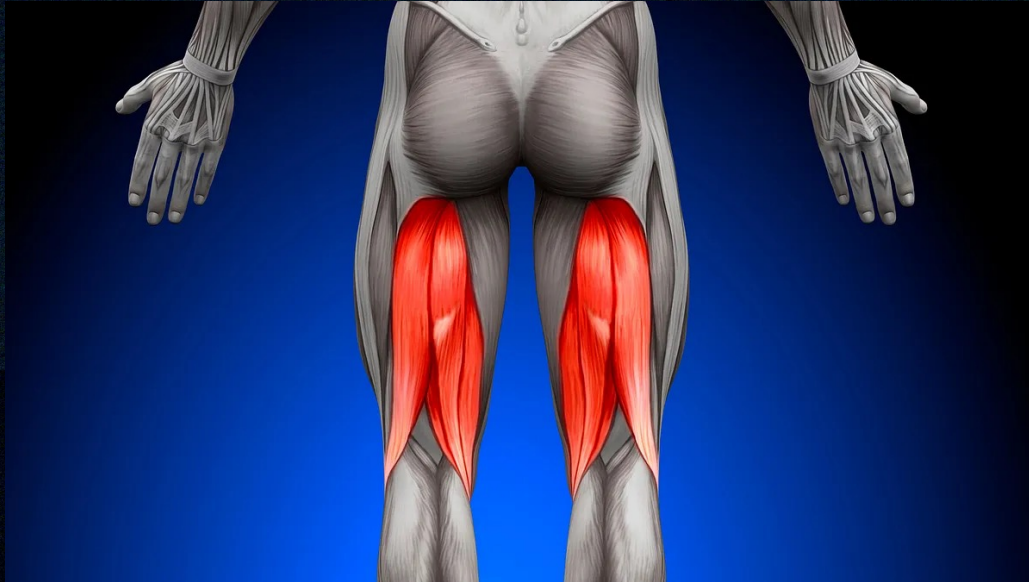
Muscle injuries: what do we need to know more?



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Academic Centre of Evidence Based Sports Medicine
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Muscle injury research: disclaimer



Challenges in muscle injury management to discuss today

How long will this injury take?

What is the best treatment?

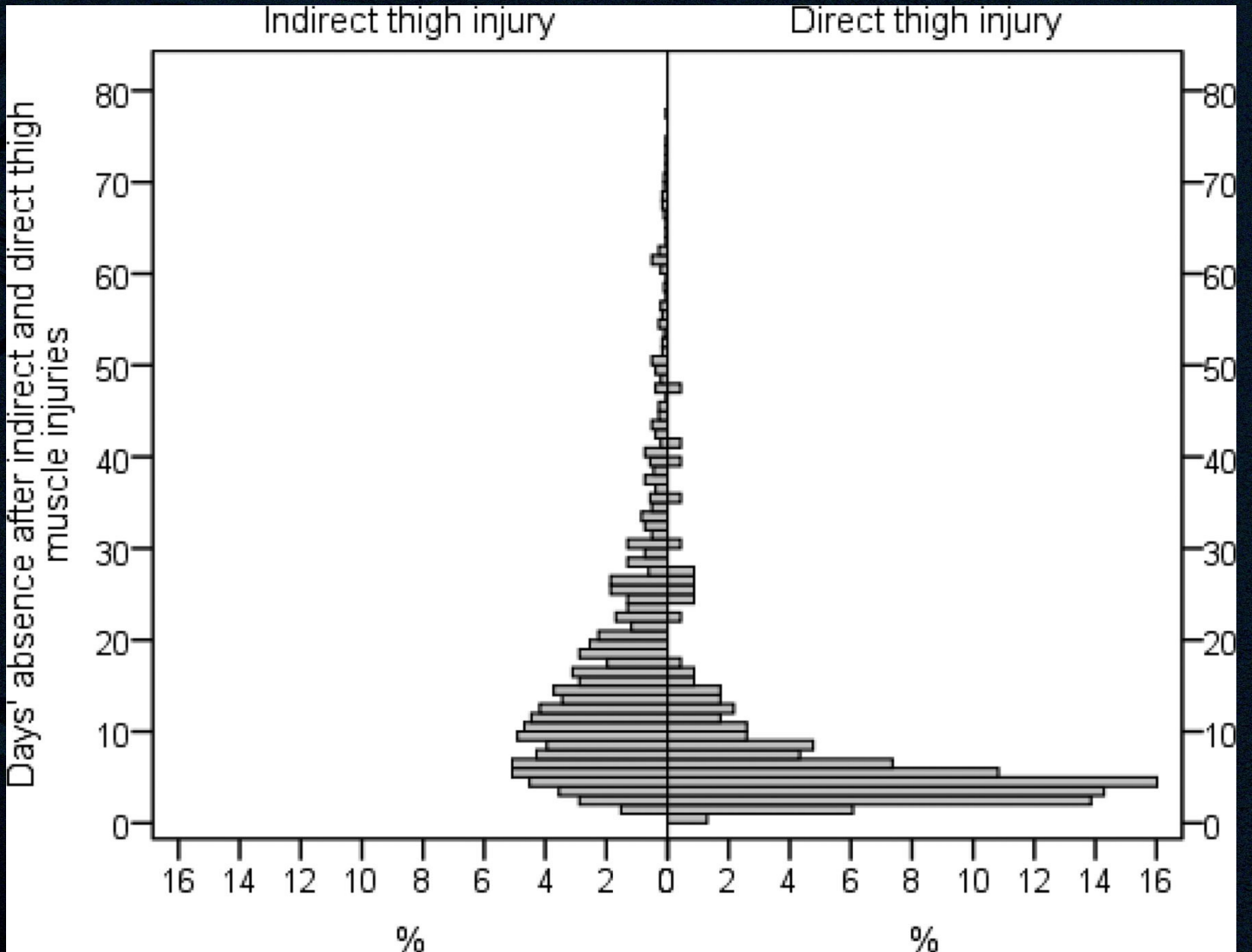


Can we predict injury duration?

How long will this injury take?



The challenge: large variation



“Quick – get an MRI so we know when he will be back ready to compete”



MRI grading

UEFA study, Ekstrand et al. 2012:

	MRI findings	Days to return to play
Grade 0	No abnormalities	6 (± 7)
Grade I	Oedema without rupture	17 (± 10)
Grade II	Partial rupture	22 (± 11)
Grade III	Totale rupture	73 (± 60)

Statistical significant $p < 0.05$

.....but useful in clinical practice?

Real world: large variance in time to RTP, even within MRI grades

“Coach, based on the MRI scan.....
I am quite sure he will play
in **0** to **44** days”



Grade II: Partial rupture



Other MRI variables?

MRI variables:

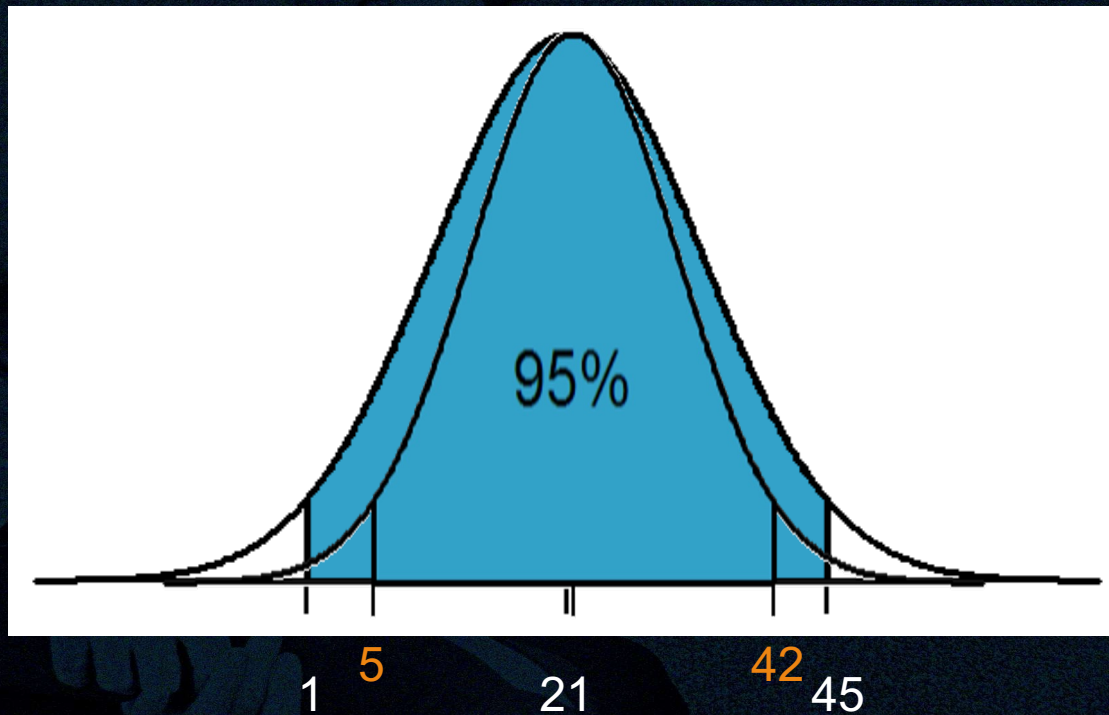
Grade

Volume of oedema

Volume of rupture

Location

Free tendon injury



“Quick – get an MRI so we know when he will be back ready to play”



A combination of initial and follow-up physiotherapist examination predicts physician-determined time to return to play after hamstring injury, with no added value of MRI

Phil Jacobsen,¹ Erik Witvrouw,^{1,2} Patrice Muxart,¹ Johannes L Tol,^{1,3} Rod Whiteley¹



Injury

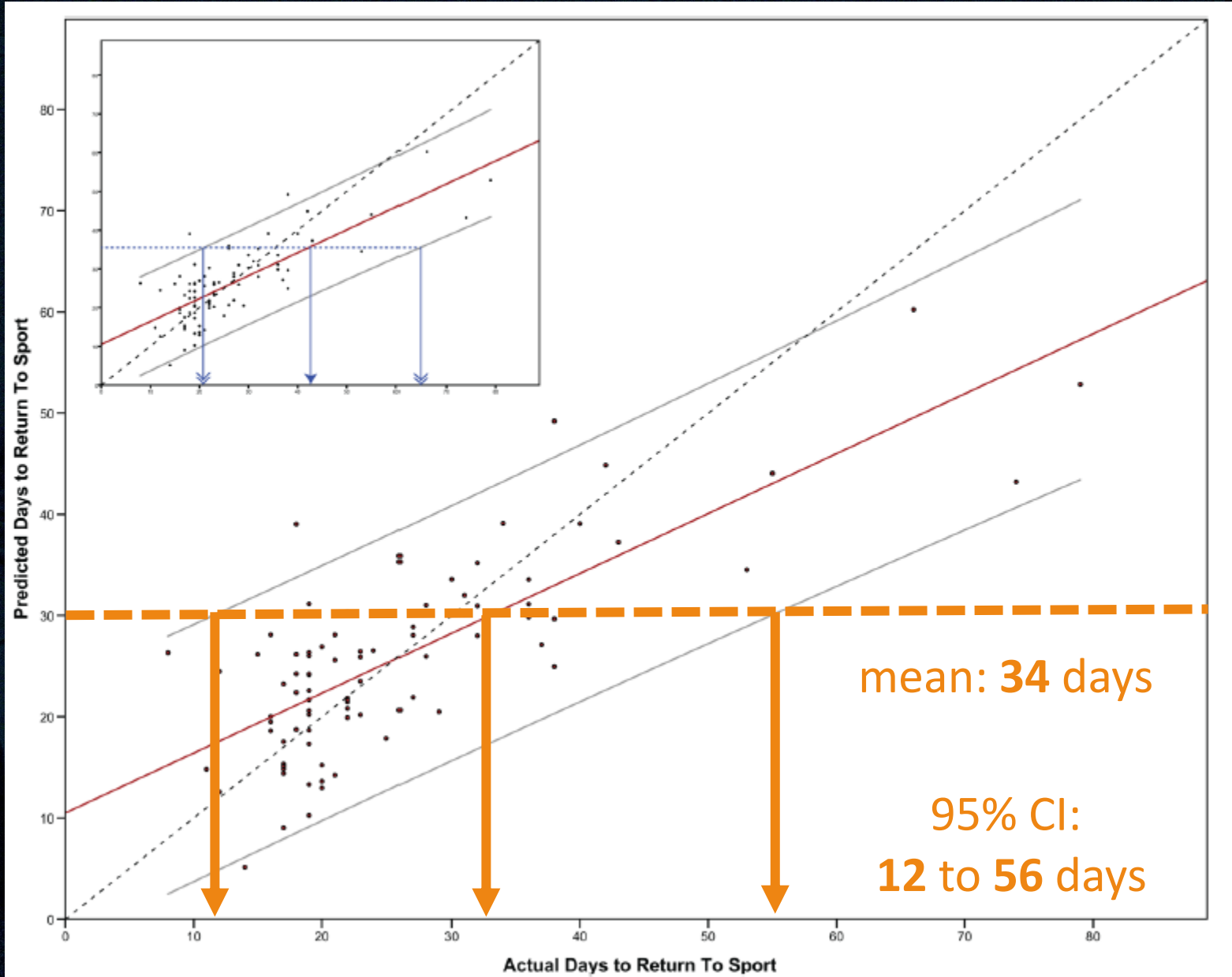
Return to play

50%

History
Physical examination
MRI

Association ?

Prediction just after injury



A combination of initial and follow-up physiotherapist examination predicts physician-determined time to return to play after hamstring injury, with no added value of MRI

Phil Jacobsen,¹ Erik Witvrouw,^{1,2} Patrice Muxart,¹ Johannes L Tol,^{1,3} Rod Whiteley¹



Injury

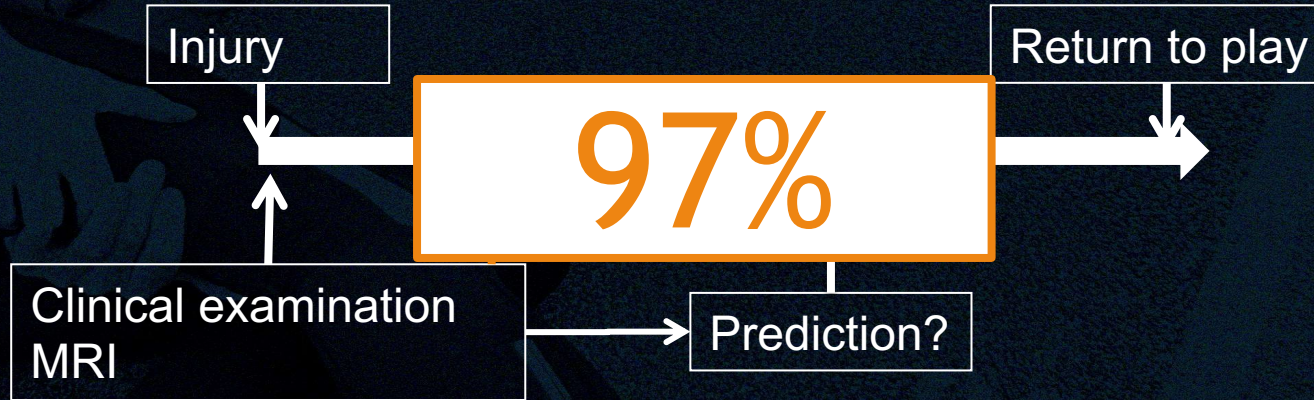


Return to play

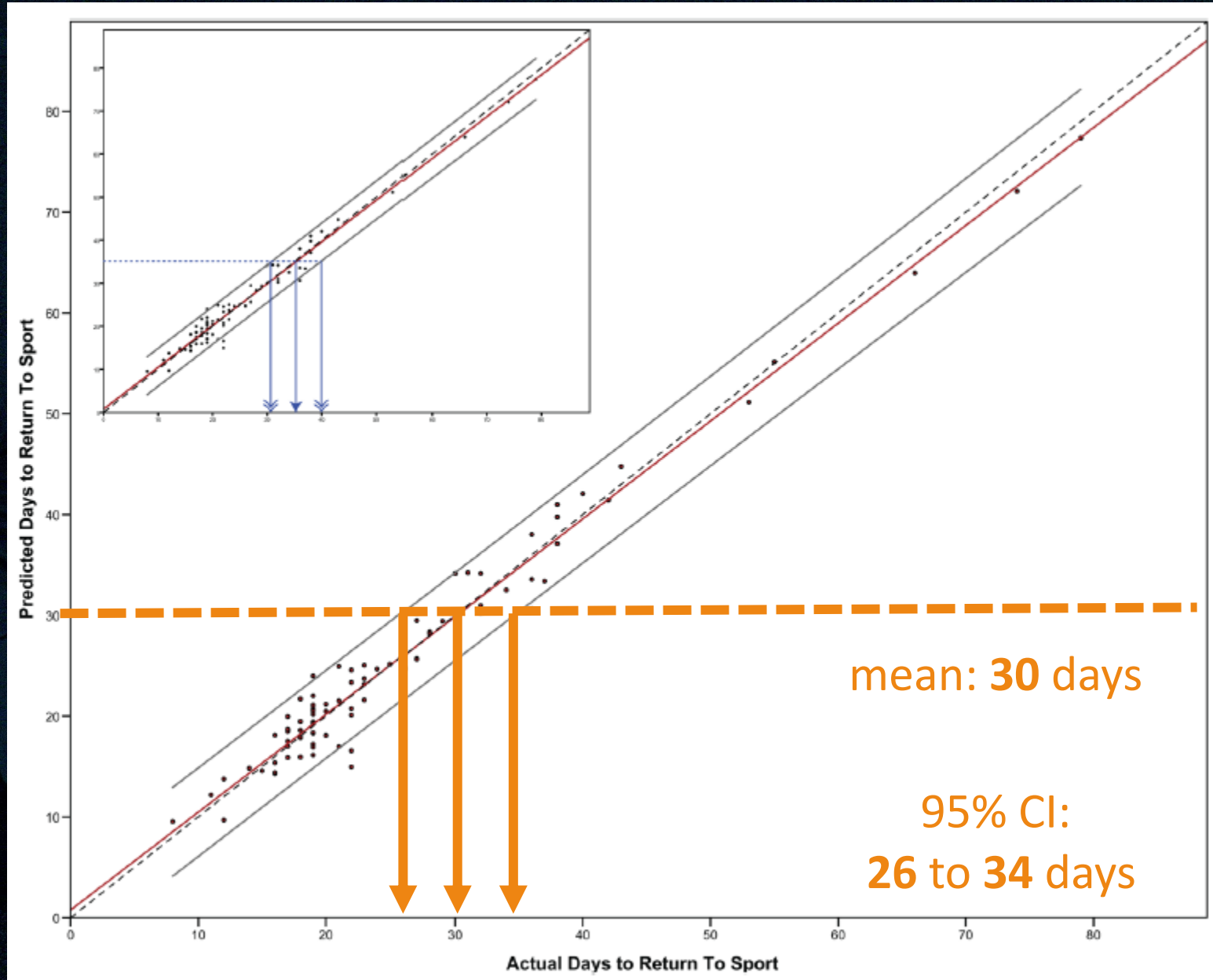
Clinical examination
MRI

97%

Prediction?

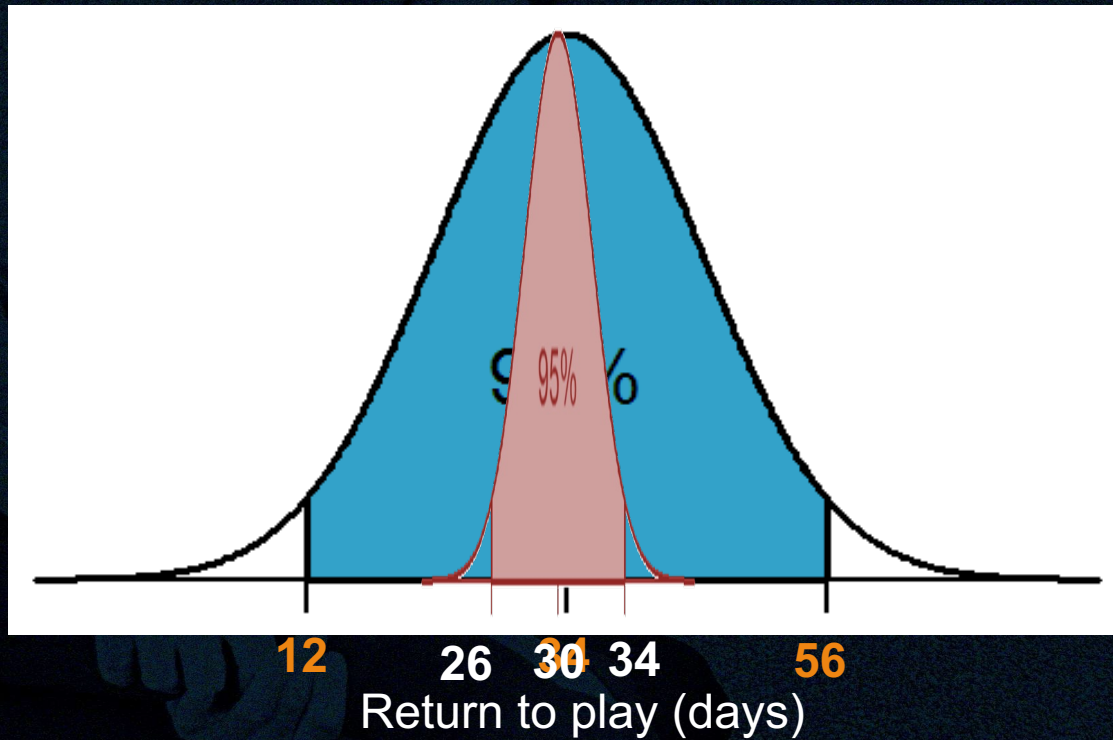


Prediction +1 week after injury



Delayed clinical evaluation

NO MRI variable of predictive value



Examination at injury + 7 days

Strength
&
Pain

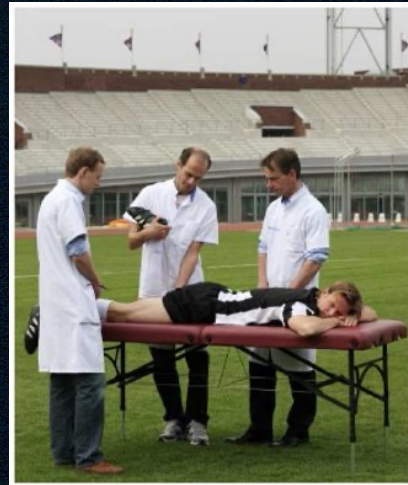
week

Real world prediction...



“Coach, it’s a hammie, we will monitor the player closely the coming week...than we know more accurate how long the injury will take...”

1 week



Coach, I expect the player is fit to play in **20** to **27** days”



Part 2: Treatment

What is the best treatment?



Medical treatment modalities

- NSAIDs
- Corticosteroids
- Platelet-rich plasma
- Actovegin
- Traumeel
- Losartan
- Relaxin
- Deferiprone
- Interferon- α
- Stem cells
- Anabolic steroids
- Hyperbaric oxygen
- Horse placenta extract
- Dental treatments
- Enzymatic preparations
- Mesotherapy
- Hirudoid
- Autologous blood
-

Insufficient evidence to support its use

Medical treatment modalities

- NSAIDs
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- Platelet-rich plasma
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-

Insufficient evidence to support its use

NSAIDs

Aim: Reduce inflammatory response

- Clinical studies
 - Placebo controlled RCTs show no effect on pain or strength
- Animal models
 - Delayed muscle regeneration
 - Increased fibrosis (increase TGF β -1 expression)²
 - Prostaglandin depletion and prostaglandin depletion \rightarrow impaired muscle regeneration³
 - Intra-articular injection = locally myotoxic⁴

Probably detrimental

Corticosteroids

- Aim: Reduce inflammatory response
- Clinical studies
 - Two case series
 - 1. 58 NFL hamstring injuries¹
 - 2. 100 MLB pitchers²
- Animal models^{3,4}
 - Delayed inflammatory response
 - Increased fibrous tissue
 - Less regeneration/atrophy at 2-4 weeks

Probably detrimental

Impact of Inflammation and Anti-inflammatory Modalities on Skeletal Muscle Healing: From Fundamental Research to the Clinic

Elise Duchesne, Sébastien S. Dufresne, Nicolas A. Dumont

- The **inflammatory process plays a critical role** in orchestrating muscle regeneration following injury
- There is accumulating evidence that **pharmacological inhibition** of the inflammatory process actually **impairs acute muscle healing**

Platelet-rich plasma (PRP)

Animal models with muscle injury:

- Growth factors released by platelets⁽¹⁻³⁾
 - Myoblast proliferation ↑
 - Myofiber regeneration ↑



RCT's on PRP in muscle injury

- Reurink et al. 2014
- Hamilton et al. 2015
- Martinez-Zapata et al. 2016
- Hamid et al. 2014
- Rossi et al. 2016

RCT's on PRP in muscle injury

Time to recover:

NO EFFECT PRP

- Reurink et al. 2014
- Hamilton et al. 2015
- Martinez-Zapata et al. 2016

POSITIVE EFFECT PRP

- Hamid et al. 2014
- Rossi et al. 2016

→ What can explain this difference?

RCT's on PRP in muscle injury

Time to recover:

NO EFFECT PRP

- Reurink et al. 2014
- Hamilton et al. 2015
- Martinez-Zapata et al. 2016

EFFECT PRP

- Hamid et al. 2014
- Rossi et al. 2016

PLACEBO-RICH PRODUCT

CONTROLLED

NO PLACEBO

PRP in muscle injury

5 RCTs < 2years → great job!

The current available evidence:

- Placebo effect
- No effect found on re-injury

→ BUT IT WAS EFFECTIVE IN ANIMALS??

Postinjury Exercise and Platelet-Rich Plasma Therapies Improve Skeletal Muscle Healing in Rats But Are Not Synergistic When Combined

Paola Contreras-Muñoz,^{*†} PhD, Joan Ramon Torrella,[‡] PhD, Xavier Serres,[§] MD, PhD, David Rizo-Roca,[‡] PhD, Meritxell De la Varga,^{*} PhD, Ginés Viscor,[‡] PhD, Vicente Martínez-Ibáñez,[†] MD, PhD, José Luis Peiró,^{†||} MD, PhD, Tero A. H. Järvinen,[¶] MD, PhD, Gil Rodas,^{*#} MD, PhD, and Mario Marotta,^{*†**} PhD

5 groups of rats with muscle injuries

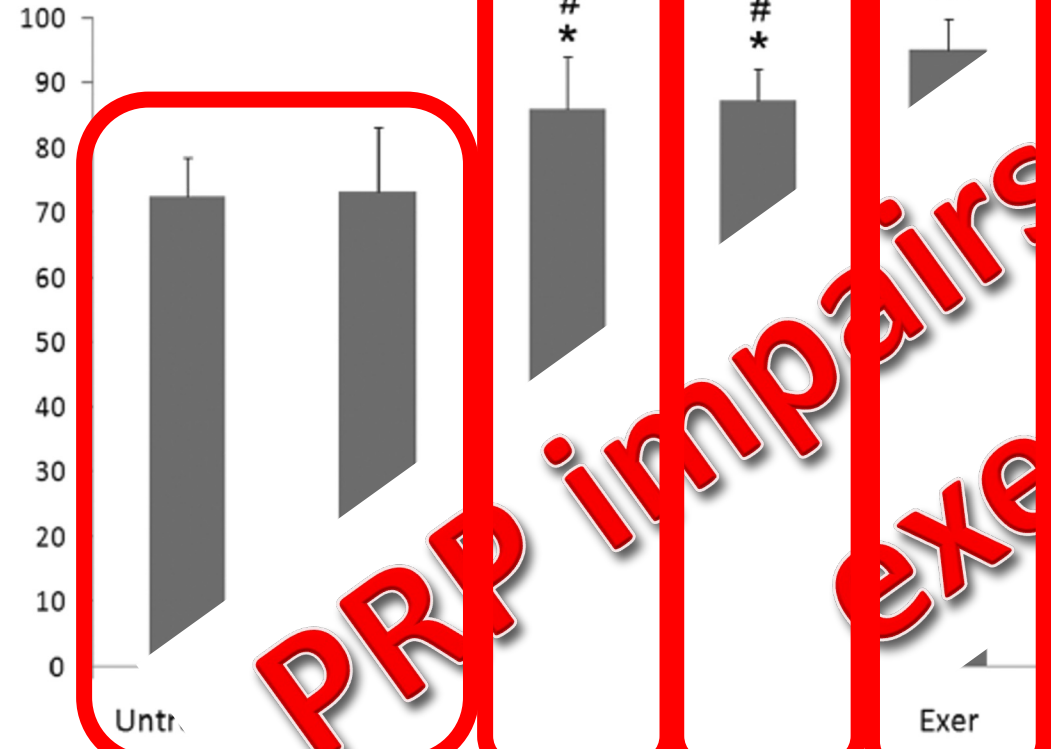
- Untreated
- Saline (placebo)
- PRP
- PRP + exercise
- Exercise



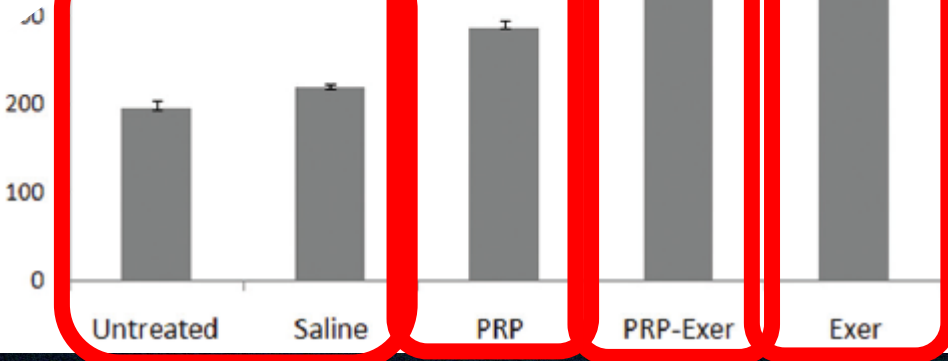
effect of

PRP impairs exercise

TetF injured vs control muscle (%)



Myofib.



Medical treatment modalities

- NSAIDs
- Corticosteroids
- Surgery
- Cryotherapy

- Insufficient evidence to support its use
- Possible detrimental

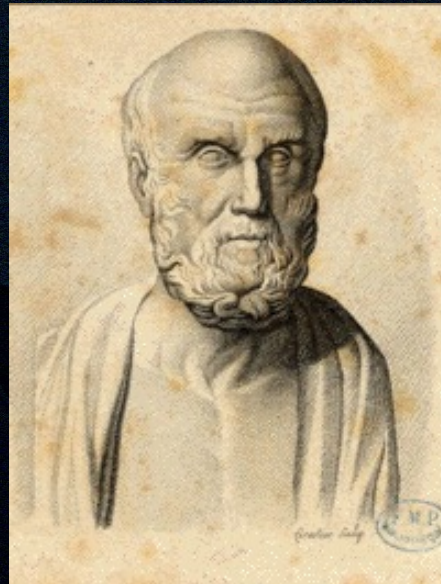
- Relaxin
- Decorin
- Suramin
- Gamma-interferon
- Dental treatments
- Enzymatic preparations
- Mesotherapy
- Hirudoid
- Autologous blood
-

Key message

THINK TWICE

before you intervene in the healing process of muscle injury

... you can do harm



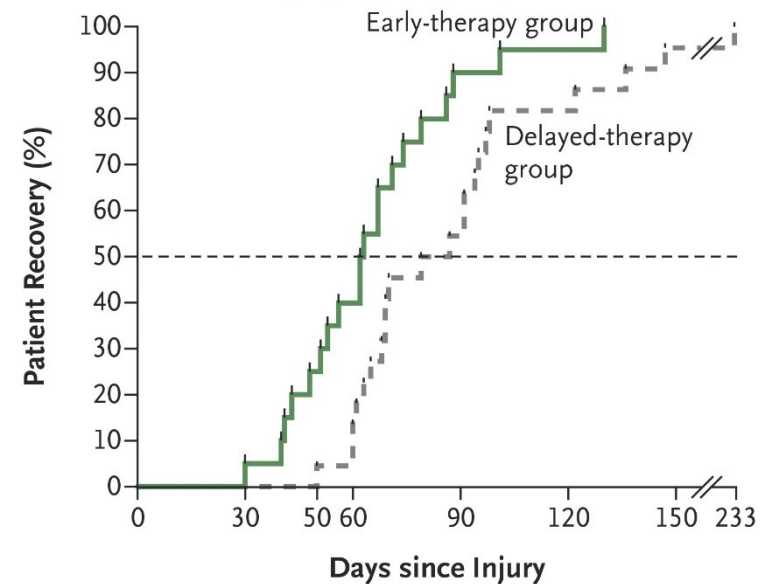
Muscle rehab that works!



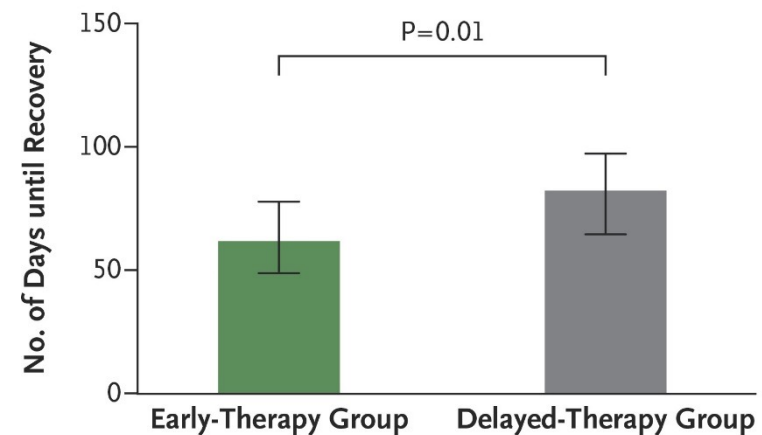
Muscle injury: Rehabilitation clinical pearls

- Start early

A Interval between Injury and Recovery

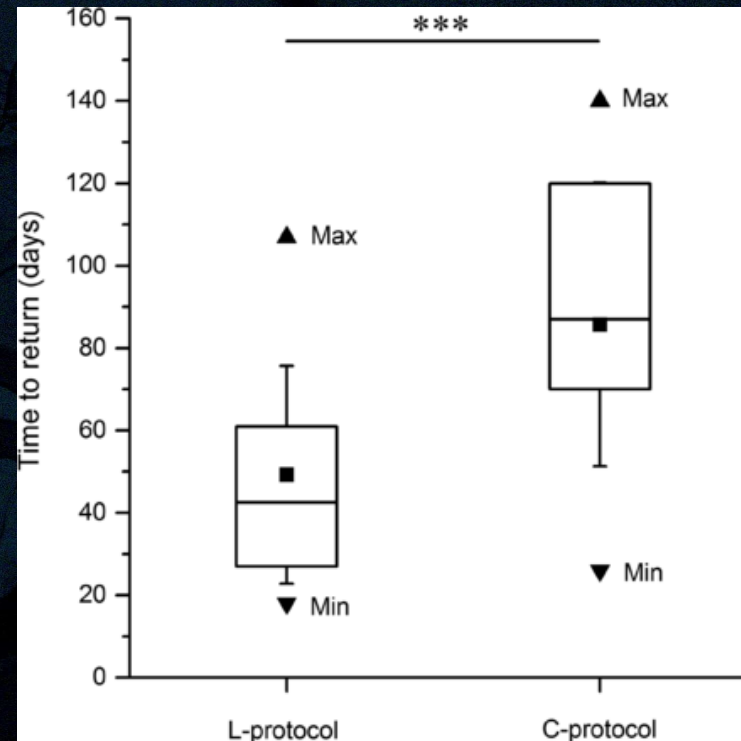


B Median No. of Days until Recovery



Rehabilitation clinical pearls

- Start early
- Exercises at functional muscle length



Rehabilitation clinical pearls

- Start early
- Exercises at functional muscle length
- Emphasise bi-articular control
 - Hamstring: hip and knee
 - Calf: knee and ankle

REGIONAL MUSCLE USE DURING HAMSTRING STRENGTHENING EXERCISES

Reference: by Mendez-Villanueva, Suarez-Arrones et al. PLoS ONE 2016



PROXIMAL



Flywheel leg-curl



Nordic hamstring



Russian belt



Hip-extension conic-pulley



		Flywheel leg-curl	Nordic Hamstring	Russian belt	Hip-extension conic-pulley
Biceps Femoris (long head)	Proximal	+		+	++
	Medial	++		+	
	Distal	++	+	+	
Biceps Femoris (short head)	Proximal	++	++	+	
	Medial	++	++		
	Distal	++	++	+	
Semitendinosus	Proximal	++	++	++	+
	Medial	++	++	++	++
	Distal	++	++	+	
Semimembranosus	Proximal			++	
	Medial	++		+	
	Distal			+	

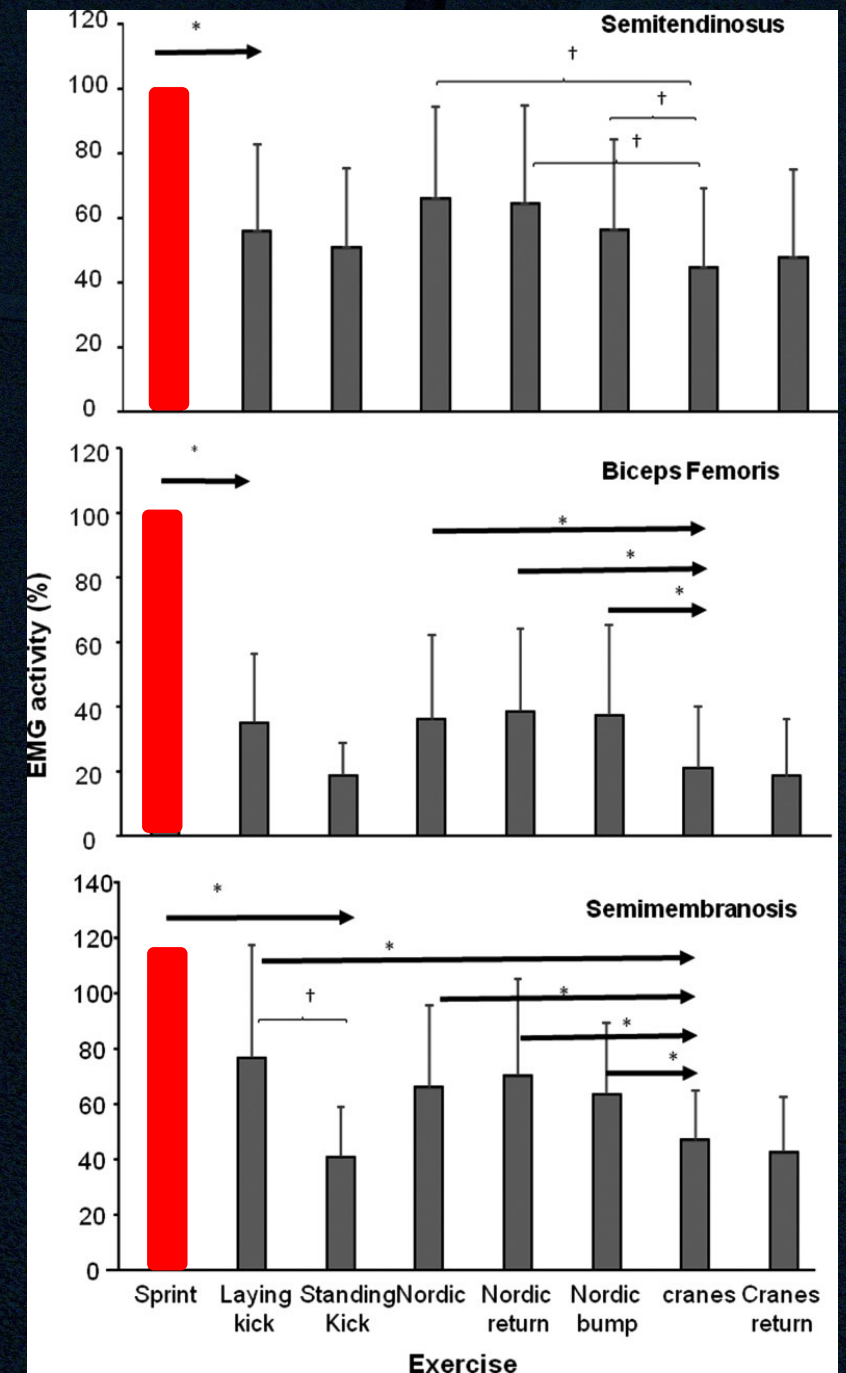


Designed by ©YLMSSportScience

Rehabilitation clinical pearls

- Start early
- Exercises at functional muscle length
- Emphasise bi-articular control
 - Hamstring: hip and knee
 - Calf: knee and ankle
- Incorporate speed and sprinting

Van den Tillaar et al. *IJSPT* 2017



Rehabilitation clinical pearls

- Start early
- Exercises at functional muscle length
- Emphasise (bi-)articular control
 - Hamstring: hip and knee
 - Calf: knee and ankle
- Incorporate speed and sprinting
- Final rehab phase that mimics sport-specific demands

Take home messages

How long will this injury take?

- Follow-up clinical examination is most valuable, not imaging

What is the best treatment?

- Don't do harm with medical stuff
- Rehab is key

