Achilles tendons
Pain, rehabilitation and neuroplasticity

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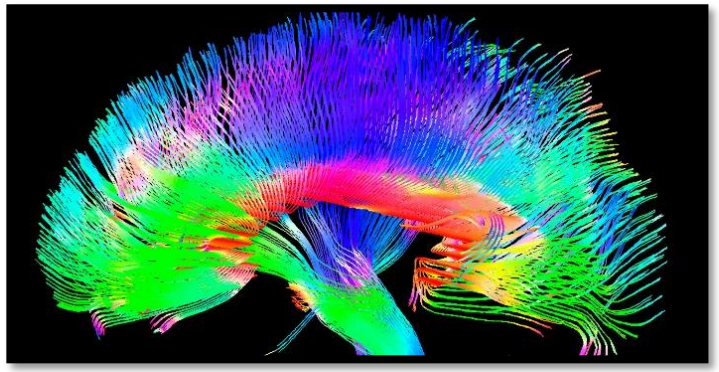
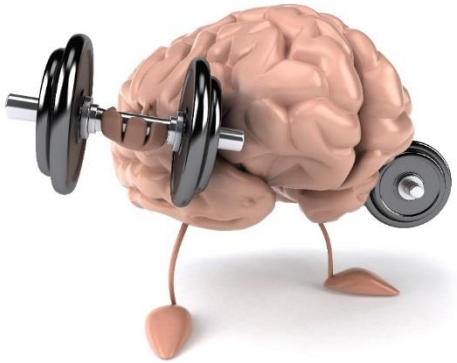




Rehabilitation meets neuroscience

- But first – differential diagnosis / clinical reasoning
  - Understand load

- Rehabilitate doughnuts, kinetic chains and brains (whole humans)

Understanding load

Must understand loads -
for clinical presentation & to prescribe loads

- **Compressive**
  - Squashed against a bone
- **Tensile**
  - Spring (energy storage)
- **Shear/friction**
  - Irritates structures outside the tendon

- **Combination**
  - Squashed & springy loads

(Cook & Purdam 2012; Lian 2005; Visnes 2013)

What is challenging?
Anything fast

Load (overload) usually what got them into trouble but loading is critical for recovery.

Anything slow – you wont get into trouble!

Achilles loads

Clinical tips

- Think like a tendon – what load can I see?
- May be several loads in the Achilles and in different spots

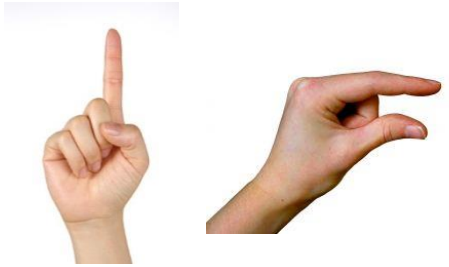
- This also clues you in to removing the provocative load (but not complete rest) more on this…
- Consider differential diagnosis – cycling, running….

Tendon pain – two key clinical questions

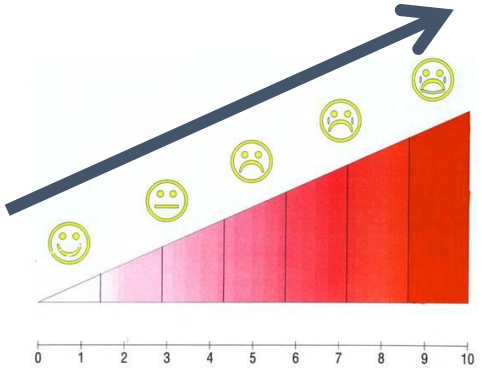
- Where is the pain?
- What aggravates the pain?
  - What loads?

Clinical presentation…Achilles tendon

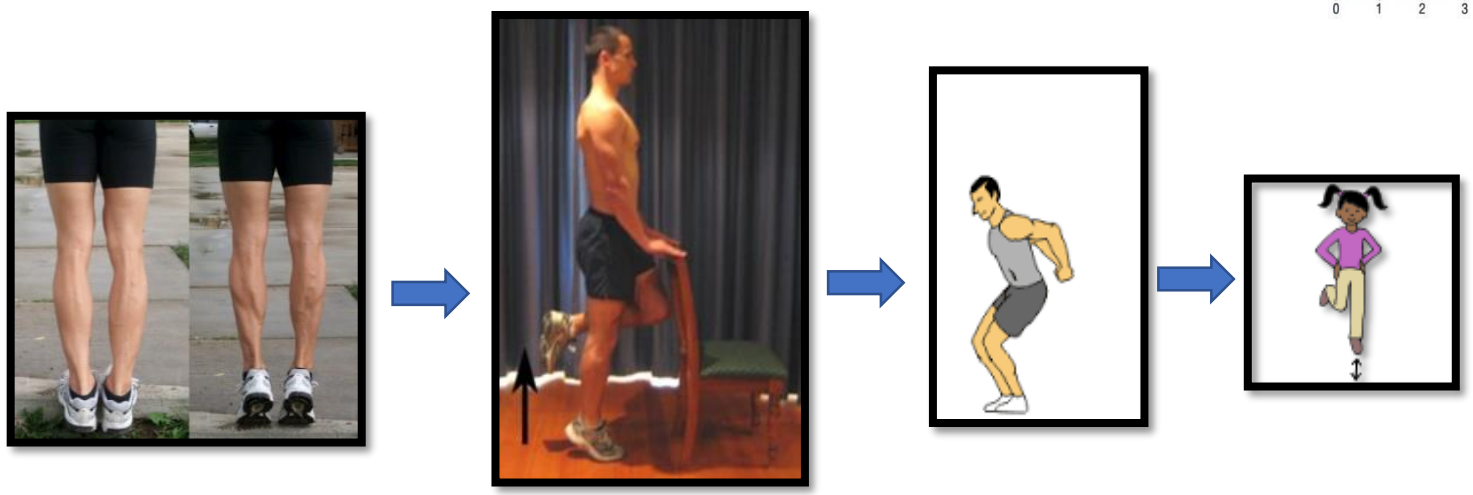
- Pain remains localised to the tendon
  - Insertion or mid-substance
  - Not pain to poke



- Aggravated by dose dependent tendon load



Differentials?
Prac



Moving up from the tendon to attached human….

Rest is detrimental to capacity…

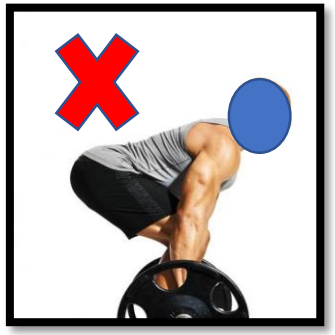
Provocative loads

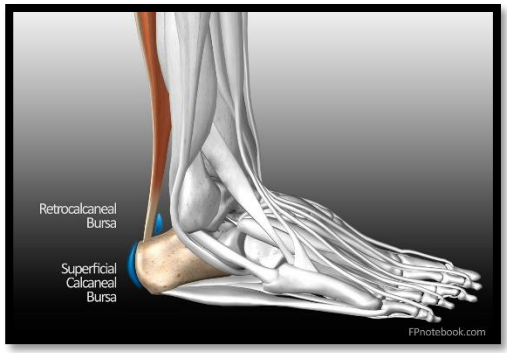
(but not all loads)

Analgesic loads?

Clinical considerations – what is the provocative load?

- **Compressive** → Remove: no stretching, no eccentrics off a step, add heel raise (outside of the shoe), **modify** exercises and attention to detail
- **Tensile** → Manage or remove speed
- **Shear/friction** → Example – paratendinitis: changes your clinical management
- **Combination** → Most provocative & likely where we need to get back to!





Analgesic loads: isometric **clinical** tips

Heavy

- 70% MVC
- Consider position – no compression

Long duration

- 5 x 45 seconds
- Sufficient time under tension

Clinical presentation

- Focal, load related pain
- Not pain to poke
- In-season or start point for rehab

Why?

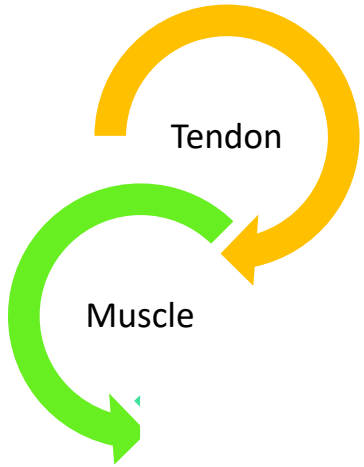
- Immediate effect (or not)
- In-season,inexpensive noninvasive, fires up the brain!
- Pain reduction – self efficacy & adherence (only a start point but a way in)

Clinical tip – not painful (remember load types)

Cool – but I knew all that

Let’s load

Why?
Current tendon rehabilitation

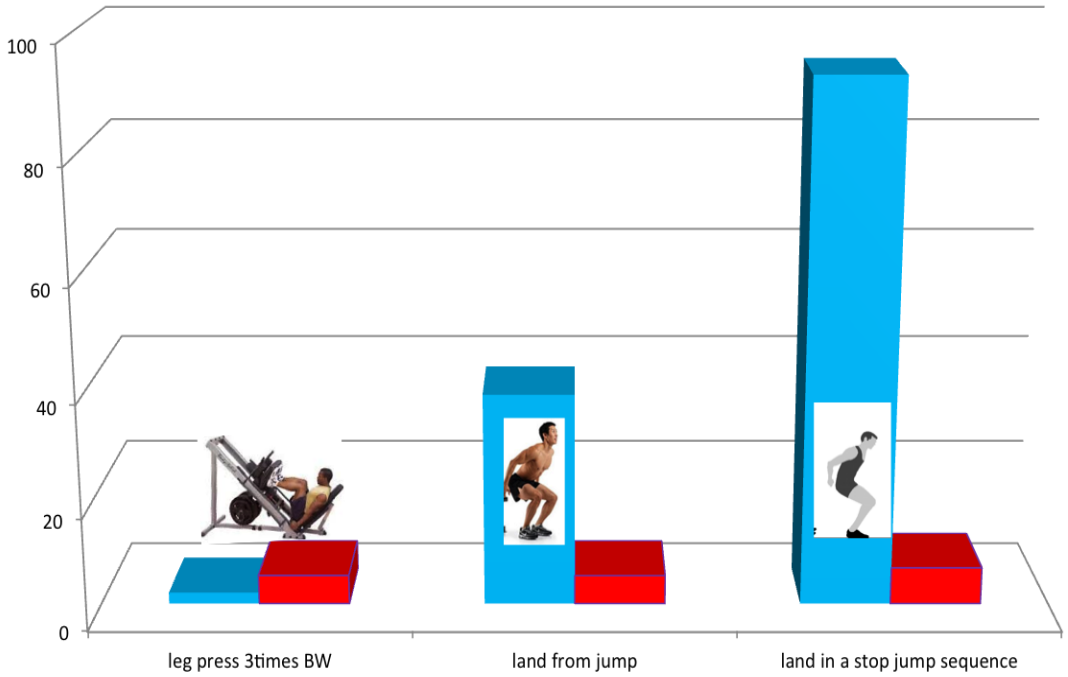


- There is much we don't understand…
- The best evidence is for load
- Tendinopathy is recalcitrant to treatment, persistent and often recurs
- So – is a strength training program enough?

Do we adequately address function?

How can we incorporate neuroscience?

Do we address athletic demands?
Loading rate for the patellar tendon



Reeves 2003, Janssen 2013, Edwards 2012

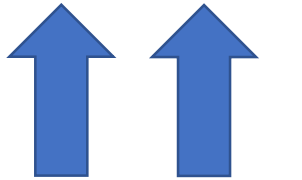
Sincere thanks to Adjunct Prof Craig Purdam for this slide

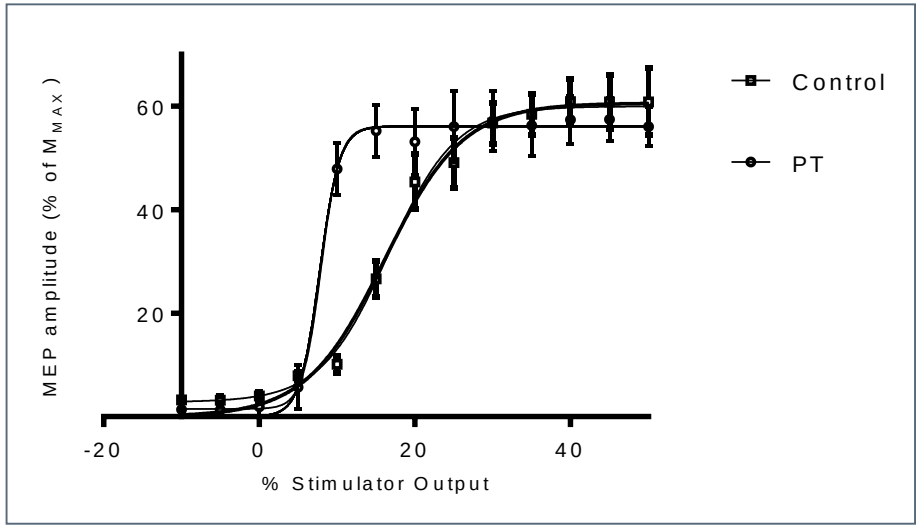
Clinical implications – can we enhance current rehabilitation?

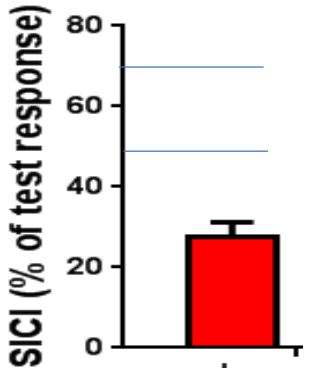
- Rationale for objective measures for athletes for progression & need for kinetic chain to distribute loads
- Don’t add speed & additional load
- Rehabilitation cannot stop at strength - function

Tendon pain and the brain

- Tendon pain has features of a nociceptive driver (focal, load related pain)
- Tendon pain is persistent – don't think the brain and spinal cord don't know about it
- Evidence for motor and sensory changes in LE (Burns 2016, Heales 2014) and RC (Ngomo 2015)

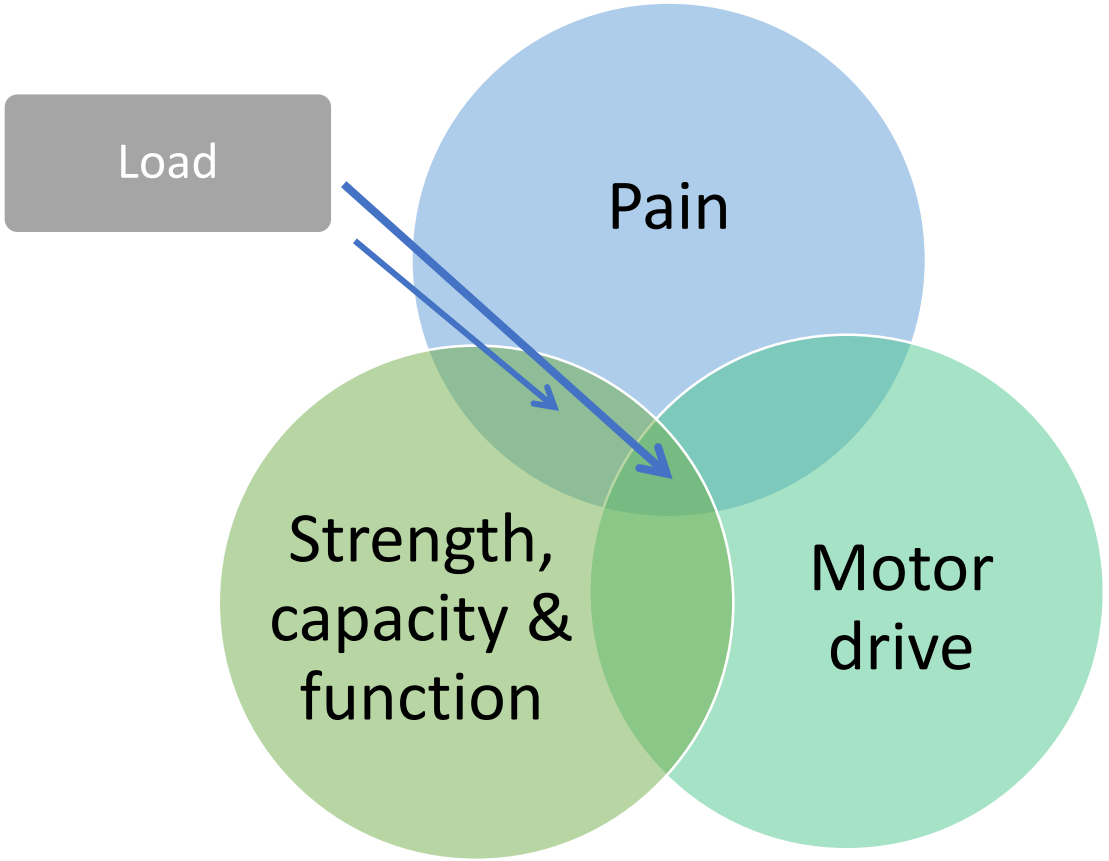






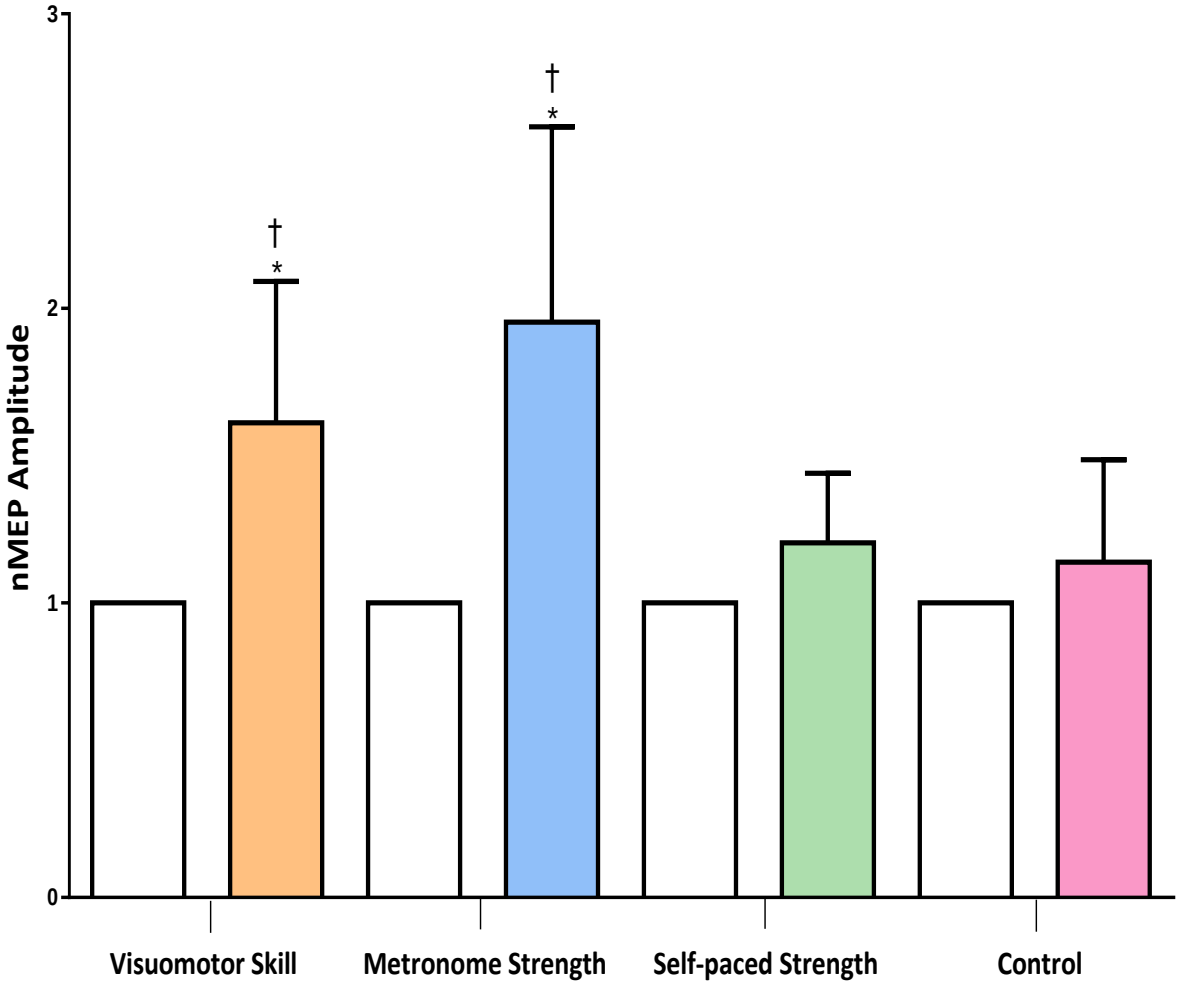
Rio 2015 SJSM
Schabrun 2015 MSSE
Coombes 2011 BJSM

Load is able to address pain, strength but how can it alter motor drive?



See also
Coombes 2011 LE

MOTOR CORTEX PLASTICITY



† Indicates significant difference ($p \leq 0.05$) from pre-training values

* Indicates significant difference ($p \leq 0.005$) from control

Repetitive, unskilled movements do not result in changes to motor cortex
(Bayona 2005)

Slide courtesy of Mike Leung & Dr. Dawson Kidgell

Leung 2015 Neuroscience

Passive tendon interventions?

No strength

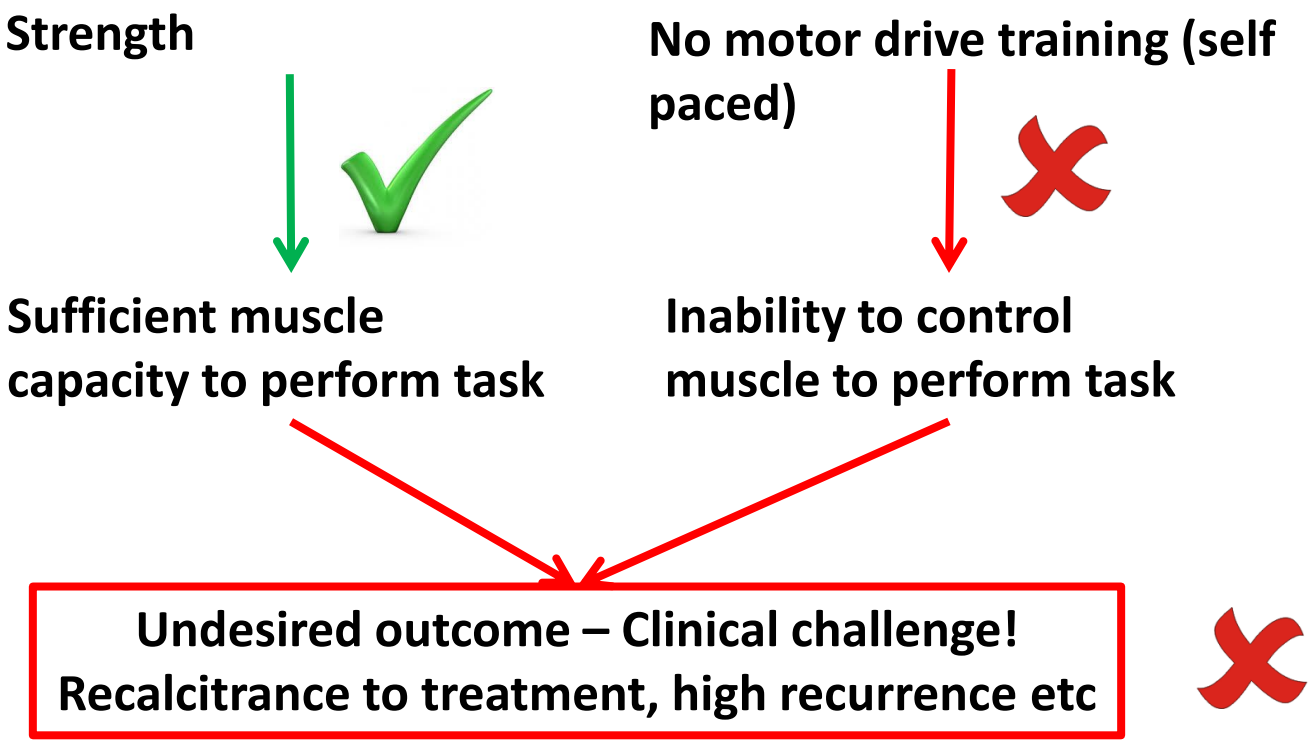
No motor drive training

Insufficient muscle capacity to perform task

Inability to control muscle to perform task

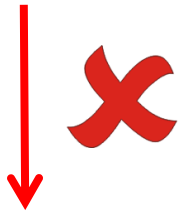
Undesired outcome (pain, reduced performance, recalcitrance, frustration etc)

Loading?


Strength
No motor drive training (self paced)
Sufficient muscle capacity to perform task
Inability to control muscle to perform task
Undesired outcome – Clinical challenge!
Recalcitrance to treatment, high recurrence etc

Focus on motor cortex and ignore the periphery?

No strength

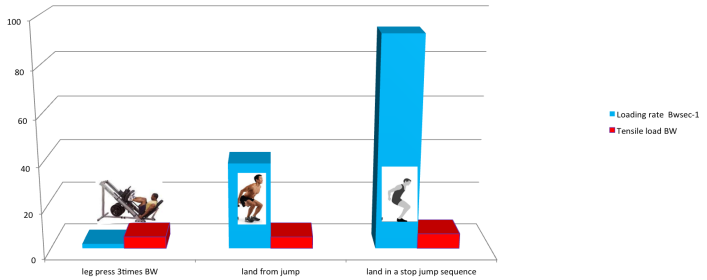


Insufficient muscle capacity to perform task

Motor drive training only

Ability to control muscle to perform task

Inability to perform task



TNT

Strength and function

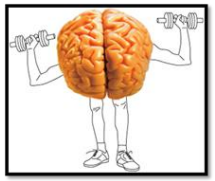
With motor drive training (external pacing`

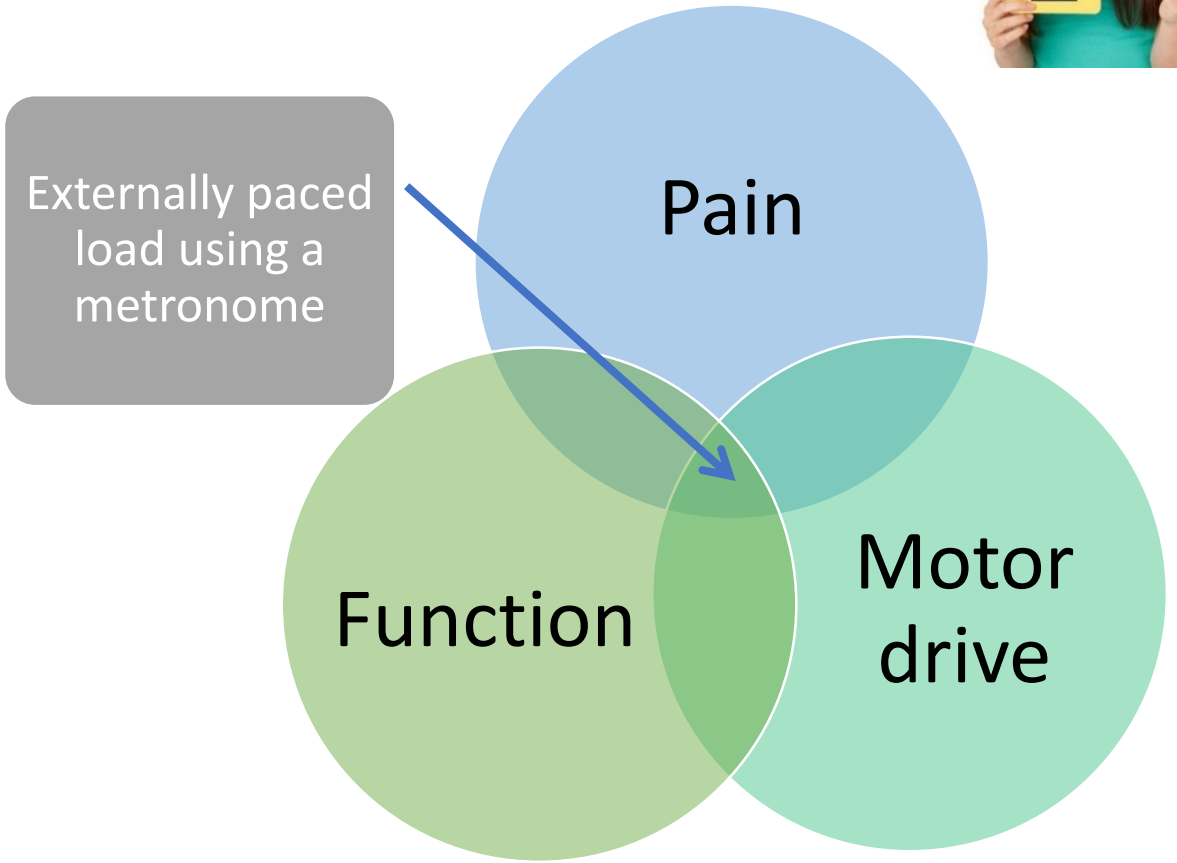
Sufficient muscle capacity to perform task

Ability to control muscle to perform task

Optimising outcome at all levels of dysfunction – tendon, muscle, kinetic chain & brain (in a happy human)

Load is able to change pain, strength and motor drive





Rio 2015a BJSM
Rio 2015b BJSM
Kidgell 2015
Leung 2015

What does the research tell us about loading?

Eccentric only

- Eccentrics (ie Alfredson protocol) may be helpful in a select population
    - Male, middle-age recreational runners (Alfredson 1998)
    - Painful to do, barrier for athletes
    - Less efficacious or ineffective in women, high BMI, in-season….
- Limited evidence

Heavy slow resistance

- 12 weeks, greater patient compliance 92% V 78%
- Beyer 2015

Pain monitoring

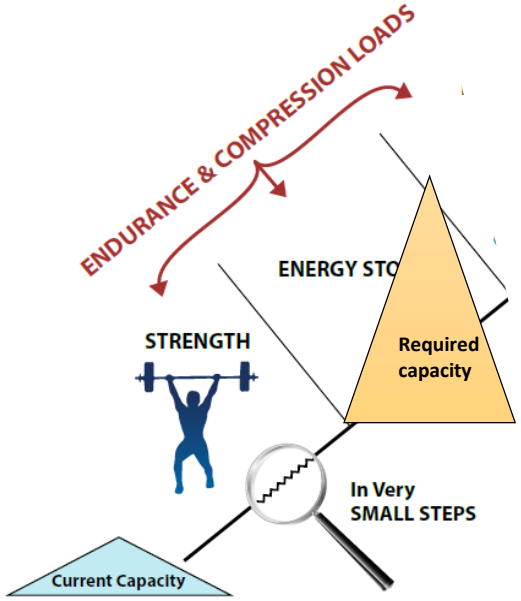
- Continued sports activity, modified with pain-monitoring, effective during rehabilitation
- Progressive loading
    - Silbernagel et al 2007

Research translation…

- What are your goals?
  - Required capacity
  - Is that like the person in front of me?

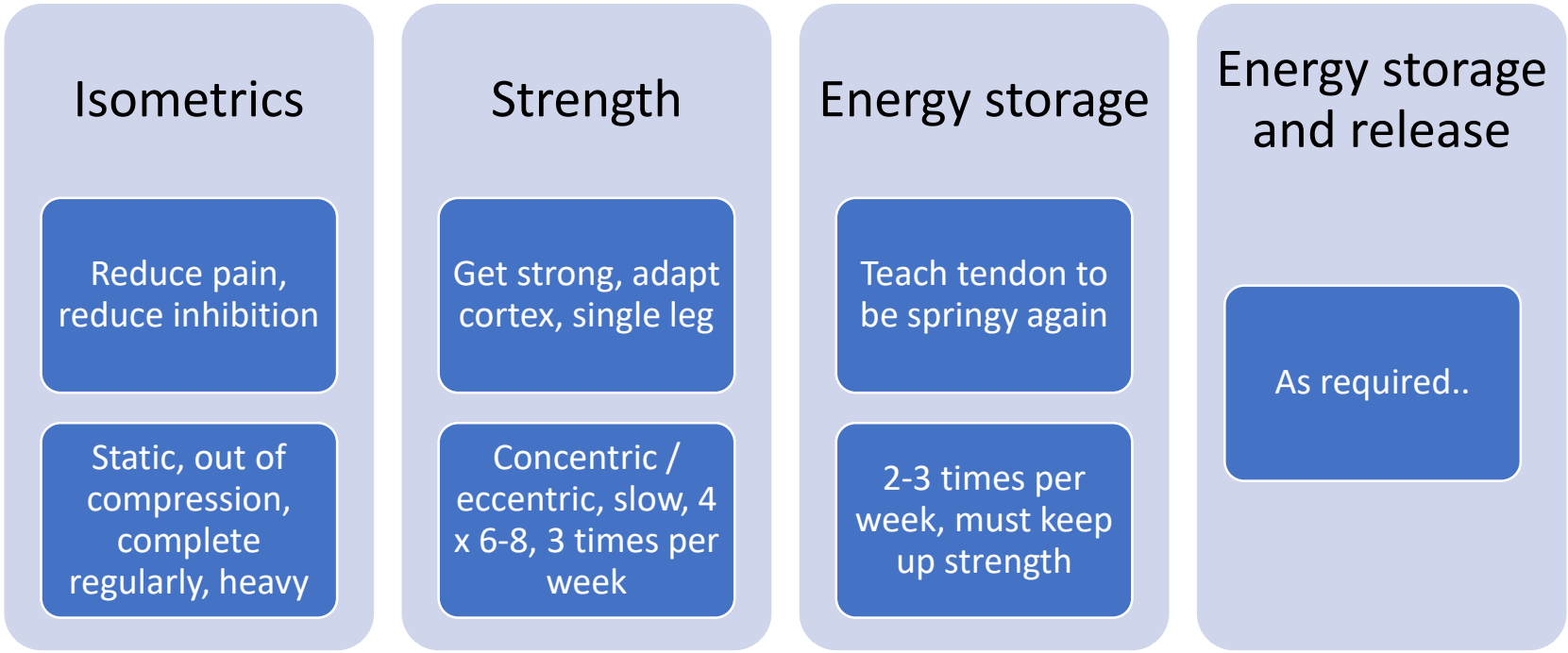
- How far away are you?
  - Current capacity (subjective & objective) is highly patient specific
  - Helps establish timeline for individual

  - Education:
    - tendons hate change
    - how to listen to your tendon - 24 hour response
    - what will change your capacity?
    - cannot stop at strength…



Cook and Docking 2015 BJSM

Stages 1-4 **individualised** progressive loading

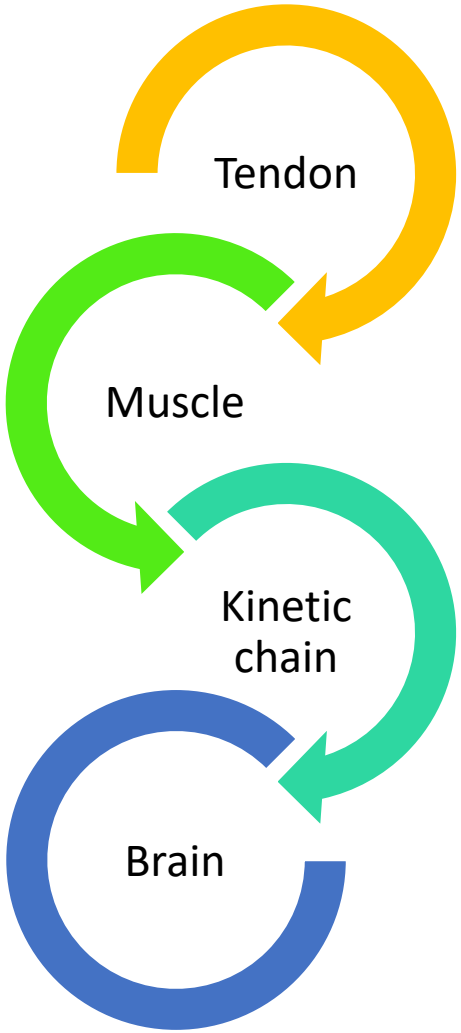


Not high tendon load

This is where we have used the metronome

These are high tendon load (spring)

Do we need strategies here – different for different people?



Optimal (evidence based) loading draws on many areas

- Single leg
- Sufficient strength & load distribution
- Understand required capacity – e.g speed / function

Cross-education

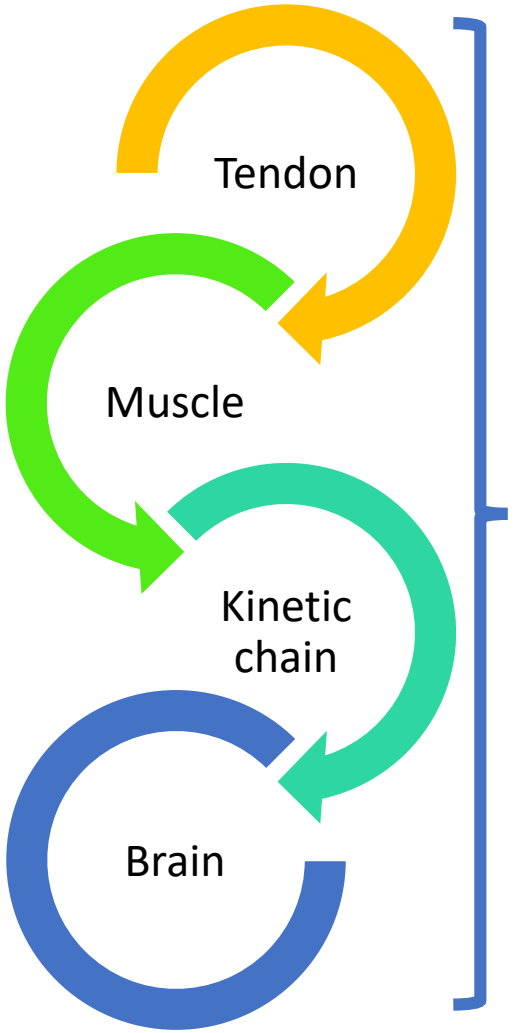
External pacing during loading

- Time under tension, load & changes to brake & accelerator

Education

Rio 2015; Lee 2017; Goom 2017; Malliarus 2015; Leung 2015; Cook & Purdam 2012; Kongsgaard 2010; Revak 2017; Alfredson 1998; Abate 2017; Beyer 2015; Pellitier 2015

TNT: Tailoring evidence based loading for the person in front of you



Changing the way we **think** about rehabilitation

- Use analgesic loads, cross education & external pacing / visuomotor training during loading
- Progressive loading
  - isometric, concentric, eccentric, energy storage & release
- Education & expectations

- Thank you so much for the invitation

- Sincere thanks to Professor Jill Cook, Adjunct Prof Craig Purdam, Professor Lorimer Moseley, Dr. Dawson Kidgell, Mick Girdwood and Dr. Sean Docking
- La Trobe University, ACRISP