


Evidence for efficacy of interventions: Can we change motor control? Does it help if we do?

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**Spinal Pain,
Injury & Health**
NIHRI Q Landmark centre



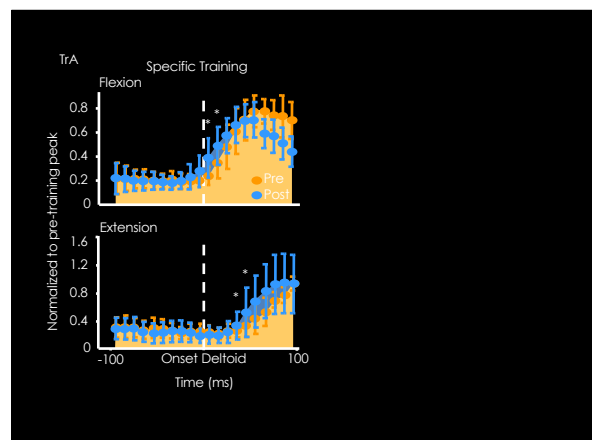
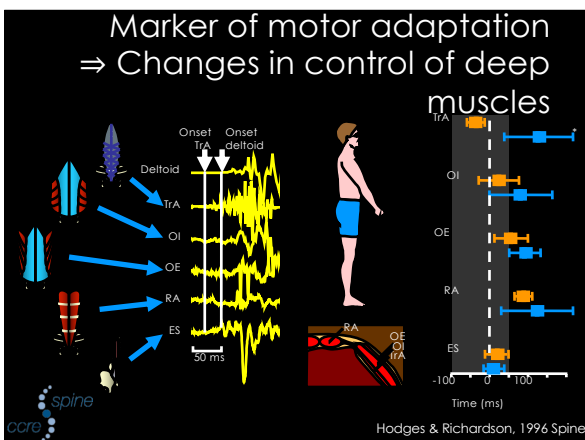
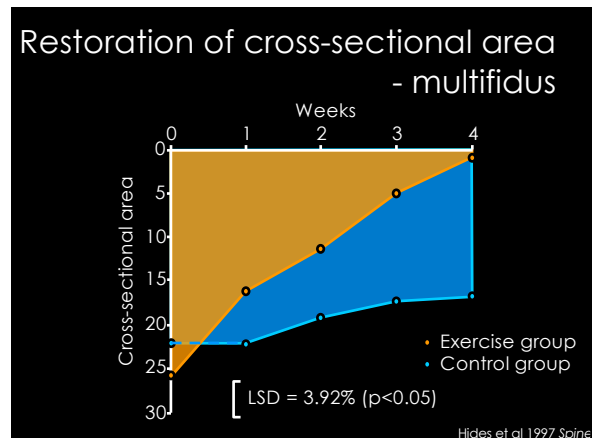
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Questions

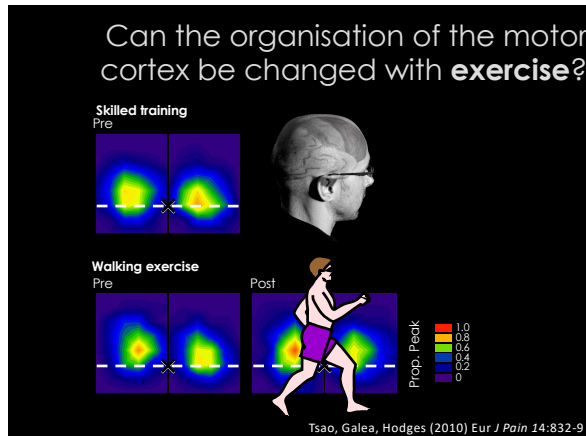
- Can training change motor behaviour in people with pain?
- Can training change motor system reorganisation?
- Can training change pain?

Outcomes of treatment

- Improved structure & behaviour of deep trunk muscles
(Hides et al. 2001; Tsao et al. 2008)
- Reduced activity of superficial trunk muscles
(Tsao, Druit & Hodges, 2010)
- Improved proprioception
(Falla, Jull & Hodges, 2007)
- Improved spine posture
(Falla, Jull & Hodges, 2007)
- Improved movement
(Scholtes et al. 2010)



Can training change motor system reorganisation?



Can training change pain?

- ### Systematic reviews
- **Saragiotto BT, Maher CG, Yamato TP, Costa LO, Costa LC, Ostelo RW, Macedo LG.** Motor Control Exercise for Nonspecific Low Back Pain. *Spine*. 41(16):1284-1295, 2016 .
 - **Ferreira PH, Ferreira ML, Maher CG, Herbert RD, and Refshauge K.** Specific stabilisation exercise for spinal and pelvic pain: a systematic review. *Aust J Physiother* 52: 79-88, 2006.
 - **Macedo LG, Maher CG, Latimer J, and McAuley JH.** Motor control exercise for persistent, nonspecific low back pain: a systematic review. *Phys Ther* 89: 9-25, 2009.

Effect of treatment

Pregnancy-related pelvic pain ↓ pain & disability <small>Stuge et al 2003</small>
Acute unilateral LBP ↓ LBP recurrence <small>Hides et al, 2001</small>
Spondylolisthesis pain & disability <small>O'Sullivan et al 1997</small>

Effect of treatment

More effective for specific LBP phenotypes

Pregnancy-related pelvic pain ↓ pain & disability <small>Stuge et al 2003</small>	Chronic non-specific LBP ↓ pain & disability & better early vs. graded exercise <small>Ferreira et al, 2007</small>
Acute unilateral LBP ↓ LBP recurrence <small>Hides et al, 2001</small>	Chronic non-specific LBP no additional benefit <small>Cairns et al, 2006</small>
Spondylolisthesis pain & disability <small>O'Sullivan et al 1997</small>	Chronic non-specific LBP no additional benefit <small>Koumantakis et al, 2005</small>

Response to motor control training depends on **motor** presentation

Baseline measures as a predictor of outcome

- TrA thickening (US imaging) during leg loading task - **baseline**
- N=34
- Worse Baseline TrA thickening related to greater change in pain
- Interaction effect for pain -18.2 (1.4-35.0), p= 0.035

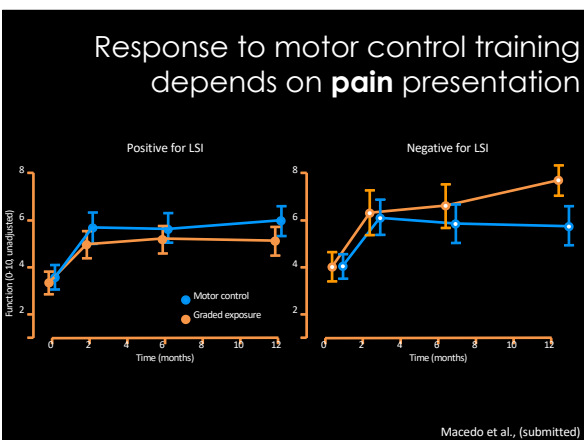
Ferreira et al. (2010) Br J Sports Med

Baseline measures as a predictor of outcome

- TrA slide (US imaging) during voluntary activation of TrA – **before & after treatment**
- N=87
- Pain - before & 1 year after treatment
- Baseline TrA slide associated with likelihood for improved pain level (OR 0.75, 0.57-0.98)

Unsgaard-Tøndel et al. (2011) Br J Sports Med

Response to motor control training depends on **pain** presentation



Lumbar Spine Instability Questionnaire Cook et al. Man Ther. 2006;11(1):11-21

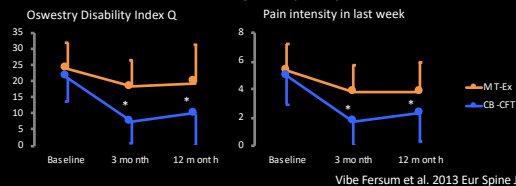
	YES	NO
I feel like my back is going to "give way" or "give out" on me		
I feel the need to frequently pop my back to reduce the pain		
I have frequent times when my pain occurs throughout the day		
I have a past history where my back catches or locks when I twist or bend my spine		
I have pain when I sit to stand or stand to sit		
I have a lot of pain when I sit up from lying down if I don't raise up the right way		
My pain is sometimes increased with quick, unexpected, or mild movements		
I have difficulty sitting without a back support like a chair and feel better with a supportive backrest		
I cannot tolerate prolonged positions when I can't move		
It seems like my condition is getting worse over time		
I have had this problem a long time		
I sometimes get temporary relief with back brace or corset		
I have many occasions when I get muscle spasms		
I sometimes am fearful to move because of my pain		
I have had a back injury from trauma in the past		

Lumbar Spine Instability Questionnaire

- A measure of nociceptive pain?

Subgrouping: Evidence

- Subgroup
 - Non-specific chronic LBP (>3 months)
 - Provoked with postures, movement and activities
- Intervention
 - Classification-based cognitive functional therapy (n=62) or manual therapy & exercise group (n=59)



Who benefits from motor control training

- Motor control training is effective for specific **subgroups** (better for those with **nociceptive** features with **deficits** in motor control), and when **individualised** to the patient
- Requires consideration of multiple domains to guide treatment
 - **STEP 1:** Is the patient appropriate for motor control training (pain type)
 - **STEP 2:** What features of motor control require modification

How can we make clinical decisions to guide optimal care

- **Right** treatment to **right** patient at **right** time
- Hybrid method of treatment targeting

Pain mechanism based classification

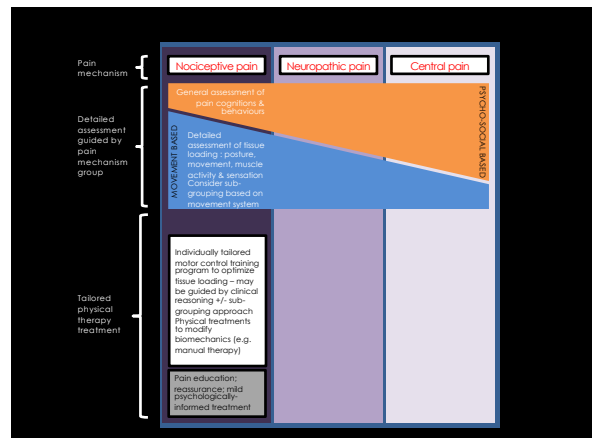
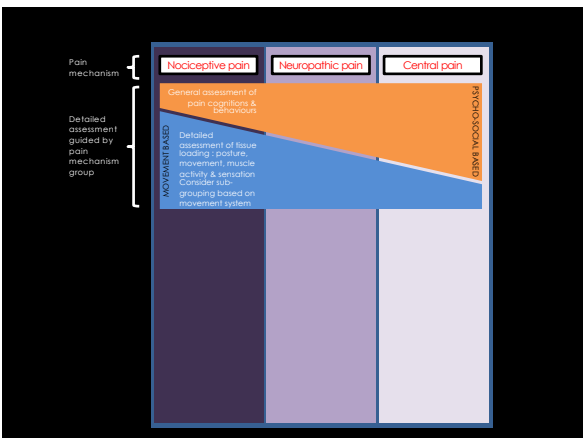
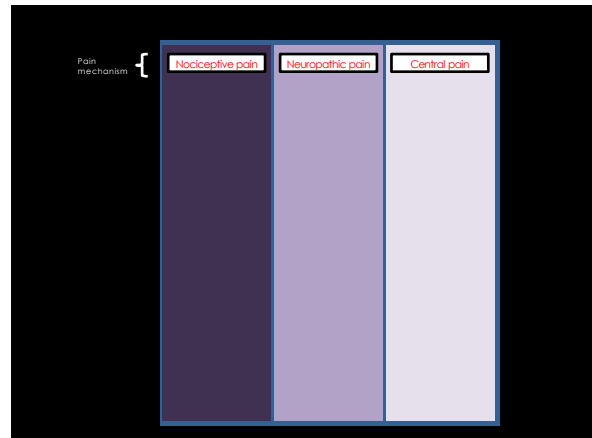
- Identify mechanism of pain to guide treatment allocation

Pain neurobiology

- Not all pain is the same
 - **Nociceptive/movement-related**
 - Assumed to be predominantly driven by activation of peripheral nociceptive fibres Scholz & Woolf, 2002
 - **Central/central sensitization**
 - Amplification of neural signaling within the central nervous system that elicits pain hypersensitivity – from cellular to widespread network Woolf 2011
 - **Neuropathic**
 - Pain attributable to a lesion or dysfunction in the peripheral or central nervous system Woolf, 2004

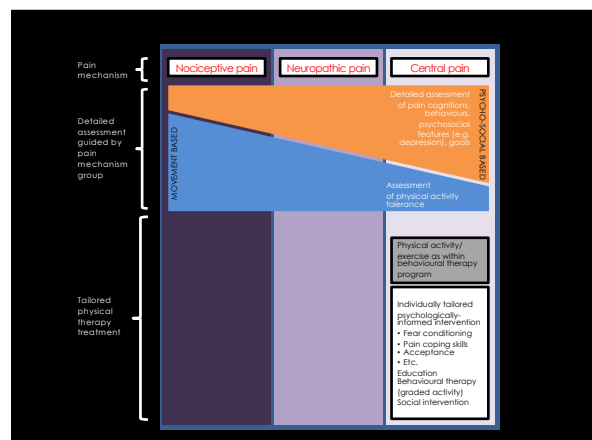
NOCICEPTIVE PAIN: Modification of tissue loading

- Detailed assessment of tissue loading: posture, movement, muscle activity & sensation
- Consider sub-grouping based on movement system
- Some consideration of psychosocial



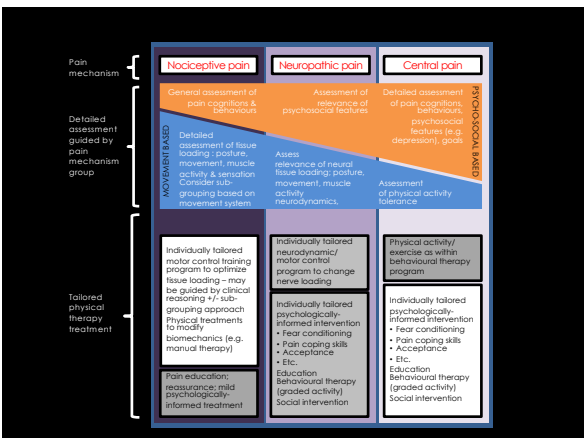
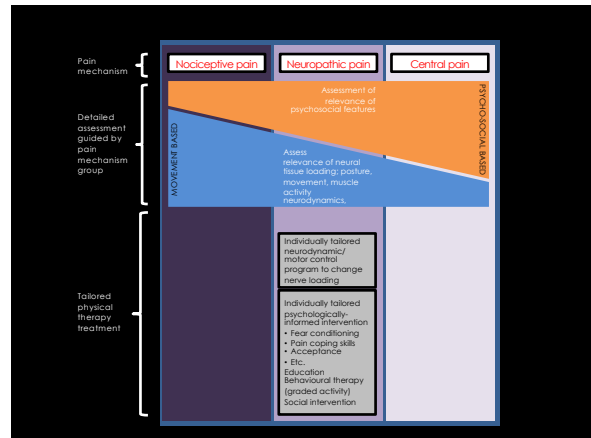
CENTRAL PAIN: Individually Tailored psychosocial intervention

- Detailed assessment of pain cognitions, behaviours, psychosocial features (e.g. depression), goals
- Some consideration of movement



NEUROPATHIC PAIN: Combined loading and psychosocial intervention

- Assessment of relevance of psychosocial features
- Assess relevance of neural tissue loading; posture, movement, muscle activity neurodynamics,



Clinical studies: Outcome

- Motor control training reduces pain, disability and recurrence (Ferreira et al, 2006; Macedo et al, 2008)
- Better when targeted to specific groups and individualised
- Only exercise intervention better than placebo (Costa et al, 2010)

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Physiological studies: Outcome

- Motor control can be changed
- Depends on what you do - better with cognitive attention
- Motor control improvements can be maintained
- Motor control improvement are related to plasticity of the motor cortex (and most likely many other regions of nervous system)

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