

The Efficacy of Cognitive Therapy on Lumbar Pain

Adriaan Louw, PT, PhD (c), M.App.Sc (physio), CSMT



The Ultimate Goal of LBP Treatment

- Decreased and/or loss of pain
- Increased function
- Increased ROM



Verbeek J, Sengers MJ, Riemens L, Haafkens J. Patient expectations of treatment for back pain: a systematic review of qualitative and quantitative studies. *Spine*. Oct 15 2004;29(20):2309-2318.



If the main reason for pain is joint or soft tissue related...



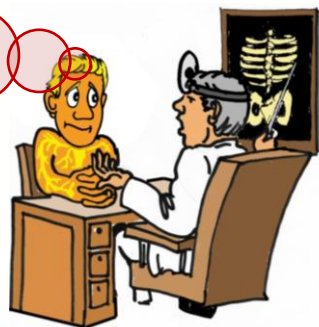
Flynn T, Fritz J, Whitman J, et al. A clinical prediction rule for classifying patients with low back pain who demonstrate short-term improvement with spinal manipulation. *Spine*. Dec 15 2002;27(24):2835-2843.



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But what if the pain and disability is due to faulty cognitions?

- My pain is due to the bulging disc
- Movement will damage tissue and increase pain
- Pain means something is wrong
- I am not doing anything until all pain is gone
- I am afraid my pain will get worse
- I have a very rare case of LBP



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It is well established that cognitions are correlated to LBP

- Fear
- Catastrophization
- Knowledge
- Anticipation and consequence of pain
 1. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioural performance. *Pain*. 1995;62:363-372.
 2. Kovacs FM, Seco J, Royuela A, Pena A, Muriel A. The correlation between pain, catastrophizing, and disability in subacute and chronic low back pain: a study in the routine clinical practice of the Spanish National Health Service. *Spine*. Feb 15 2011;36(4):339-345.
 3. Moseley GL, Hodges PW, Nicholas MK. A randomized controlled trial of intensive neurophysiology education in chronic low back pain. *Clinical Journal of Pain*. 2004;20:324-330. Moseley GL. A pain neuromatrix approach to patients with chronic pain. *Man Ther*. Aug 2003;8(3):130-140.



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Cognitive Processing

- Afraid; poorly understood; movement = pain due to tissues being damaged



High Threat

PAIN to defend



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Re-examining our Paradigms in Lumbar Manual Therapy



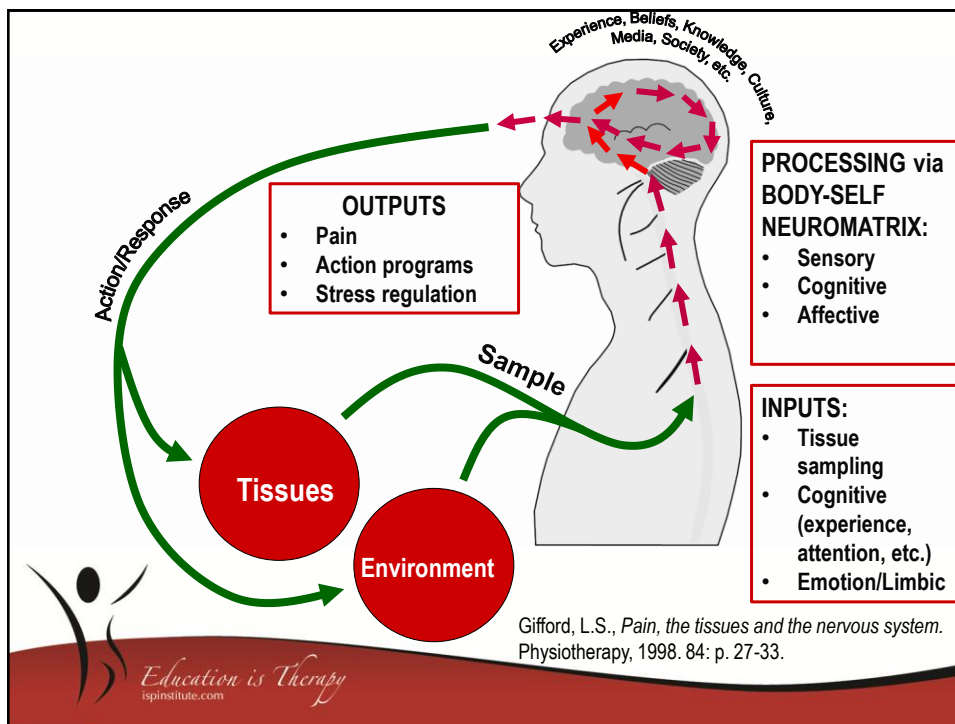
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Wade, D., *Why physical medicine, physical disability and physical rehabilitation? We should abandon Cartesian dualism.* Clin Rehab, 2006. 20: p. 85-90.



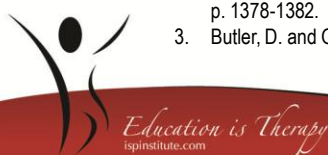
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Modern definition of LBP


LBP is a multiple system output, activated by an individual's pain neuromatrix in response to perceived threat

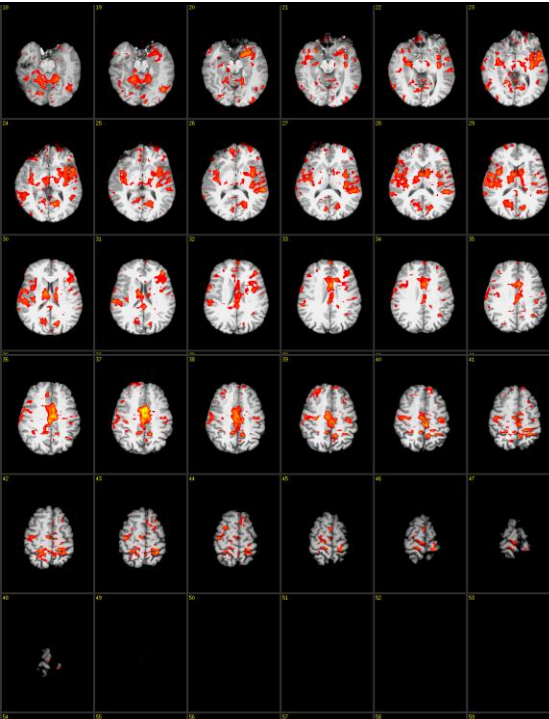
1. Moseley, G.L., *A pain neuromatrix approach to patients with chronic pain.* Man Ther, 2003. 8(3): p. 130-40.
2. Melzack, R., *Pain and the neuromatrix in the brain* Journal of Dental Education, 2001. 65: p. 1378-1382.
3. Butler, D. and G. Moseley, *Explain Pain.* 2003, Adelaide: Noigroup.



Courtesy Dr.
Lorimer Moseley

Moseley, G.L., *Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain.* Aust J Physiother, 2005. 51(1): p. 49-52.






Representation of Pain in the Brain

- **Common areas are frequently “ignited”**
- **Via connections, backfiring neurons, and neurotransmitters, pain is perceived – the pain neural signature**

1. Flor, H. *The image of pain.* in *Annual scientific meeting of The Pain Society (Britain)*. 2003. Glasgow, Scotland.
2. Flor, H., *The functional organization of the brain in chronic pain*, in *Progress in Brain Research*, Vol 129, J. Sandkühler, B. Bromm, and G.F. Gebhart, Editors. 2000, Elsevier: Amsterdam.
3. Casey, K.L. and M.C. Bushnell, *Pain imaging.* Pain: Clinical Updates, 2000. 8: p. 1-4.
4. Petrovic, P. and M. Ingvar, *Imaging cognitive modulation of pain processing.* Pain, 2002. 95(1-2): p. 1-5.
5. Moseley, G.L., *Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain.* Aust J Physiother, 2005. 51(1): p. 49-52.



A TYPICAL PAIN NEUROTAG

1. PREMOTOR/ MOTOR CORTEX
organize and prepare movements
2. CINGULATE CORTEX
concentration, focusing
3. PREFRONTAL CORTEX
problem solving, memory
4. AMYGDALA
fear, fear conditioning, addiction
5. SENSORY CORTEX
sensory discrimination
6. HYPOTHALAMUS/ THALAMUS
stress responses, autonomic regulation, motivation
7. CEREBELLUM
movement and cognition
8. HIPPOCAMPUS
memory, spacial recognition, fear conditioning
9. SPINAL CORD
gating from the periphery

Image adapted from Explain Pain – Butler and Moseley 2003

Physical Therapy in Sport
Masterclass
A neuroscience approach to managing athletes with low back pain
Emilio J. Puentedura^{a,b,*}, Adriaan Louw^b

More Complexity

● Denotes synaptic modulation

Beliefs ———

Knowledge, logic ———

Social context ———

Anticipated consequences ———

Other sensory cues ———

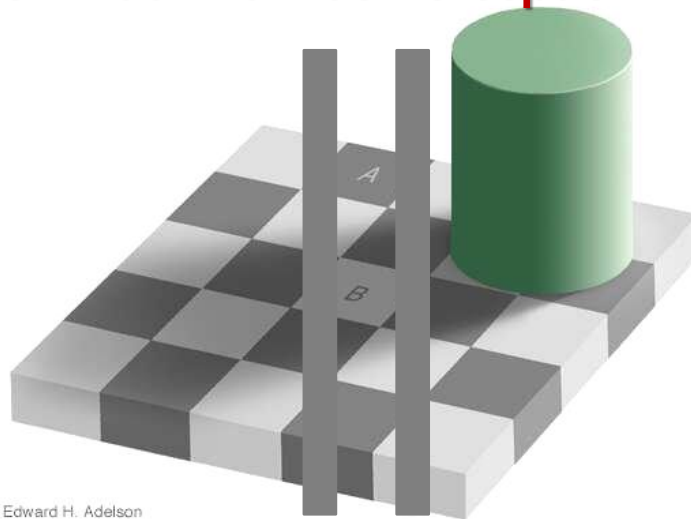
Physical Therapy in Sport
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LBP as an output...crossing the road



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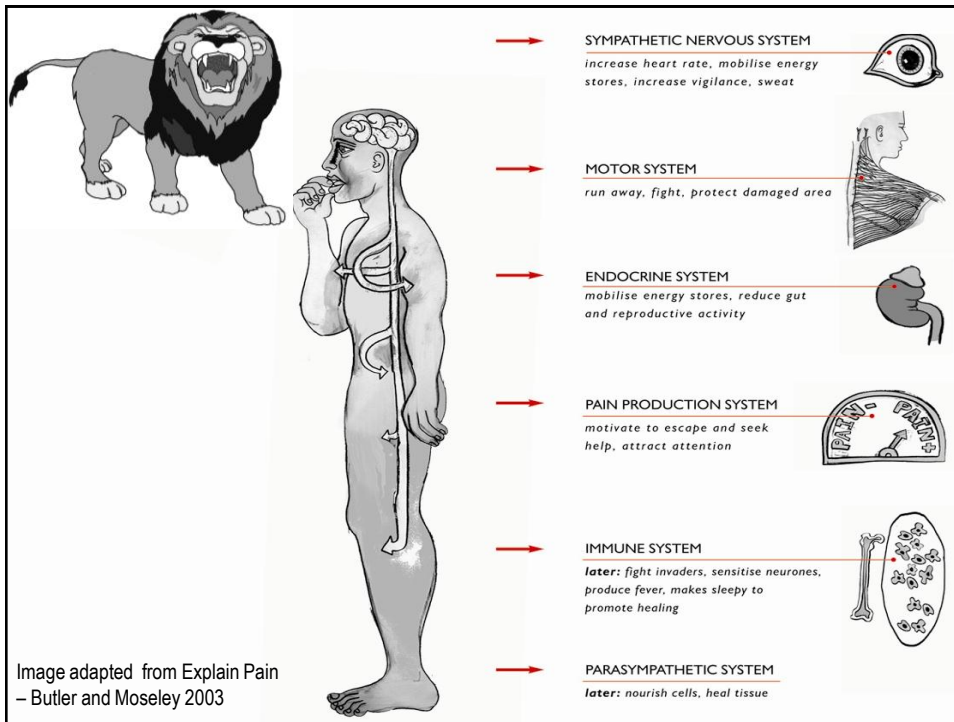
Low Back Pain as Perception



Edward H. Adelson



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LBP is a

- **multiple system**
- **output**
- **activated by an individual's pain**
- **neuromatrix**
- **in response to**
- **perceived**
- **threat**

The diagram includes several illustrative images:

- A diagram of the spine showing various levels and structures.
- A seesaw with a bus on one end, representing imbalance or threat.
- A brain with neural connections, representing the neuromatrix.
- A diagram of a herniated disc protruding, labeled "Herniated disc protruding".
- A chessboard with a green cylinder on it, representing a perceived threat.

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Research into anatomy, biomechanical and patho-anatomy models

Explanatory and Diagnostic Labels and Perceived Prognosis in Chronic Low Back Pain

SPINE Volume 35, Number 21, pp E1120-E1125
©2010, Lippincott Williams & Wilkins

Tim John Sloan, BMBS, BMedSci(Hons),* and David Andrew Walsh, FRCP, PhD*†

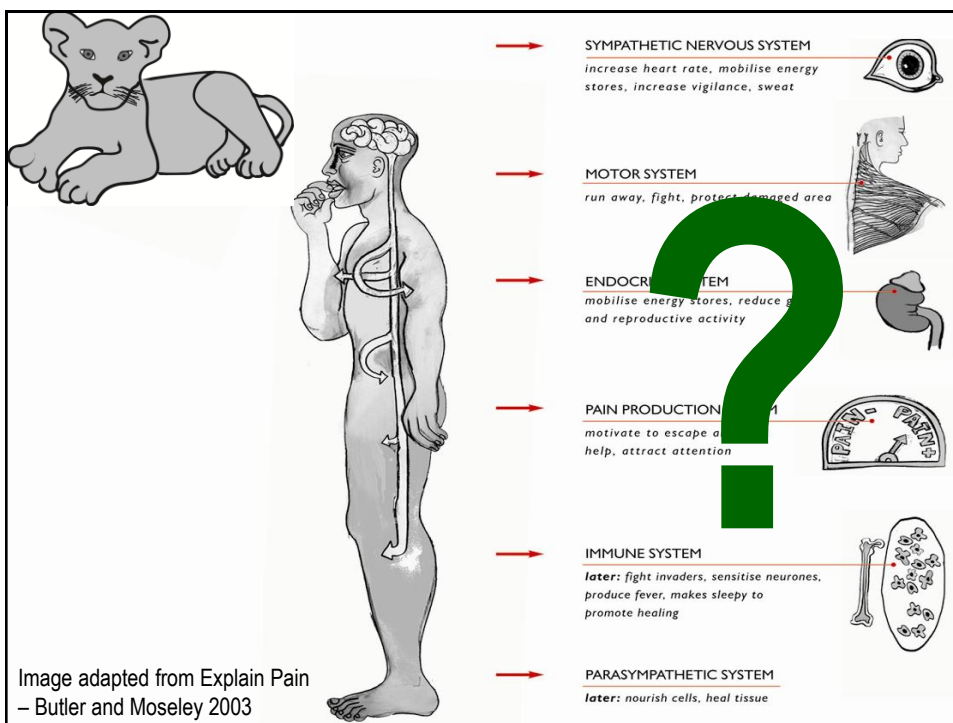
Results. Two major categories representing the predominant themes emerging from the content analysis were “Degeneration” and “Mechanical.” Degenerative terms such as “wear and tear” and “disc space loss” indicated a progressive loss of structural integrity. Examples of phrases used by patients included “deterioration [...] spine is crumbling” and “collapsing [...] discs wearing out.” The use of degenerative terms by patients was associated with a poor perceived prognosis ($P < 0.01$). Degenerative and mechanical terms were more commonly used by patients when they were documented in correspondence from secondary care specialists ($P = 0.03$ and 0.01 , respectively).

Conclusion. A common language is shared between professionals and patients that may encourage unhelpful beliefs. The use of degenerative terms such as wear and tear by patients is associated with a poor perceived prognosis. The explanation of radiological findings to patients

Degenerative terms

- “Wear and tear”
- “Deterioration”
- “Disc space loss”
- “Crumbling”
- “Collapsing”

presents an opportunity to challenge unhelpful beliefs, thus facilitating uptake of active treatment strategies.



Making lions become lion cubs

Emerging research shows that explaining to patients their **pain experience from a biological and physiological perspective** of how the **nervous system/ brain's processes pain** allow patients to move better, exercise better, think different about pain, push further into pain, etc.

Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Archives of physical medicine and rehabilitation*. Dec 2011;92(12):2041-2056.



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Therapeutic Neuroscience Education

- **Decrease fear** and positively change a patient's **perception of their pain** (Moseley 2003)
- **Immediate effect** on improvements in patients' **attitudes** about pain (Moseley 2003)
- **Improvements in pain, cognition and physical performance** (Moseley 2004)
- **Increased pain thresholds during physical tasks** (Moseley, Hodges et al. 2004)
- **Improved outcomes of therapeutic exercises** (Moseley 2002)
- **Reduction in widespread brain activity** characteristic of a pain experience (Moseley 2005)



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SYSTEMATIC REVIEW

The Effect of Neuroscience Education on Pain, Disability, Anxiety, and Stress in Chronic Musculoskeletal Pain

Adriaan Louw, PT, MAppSc, Ina Diener, PT, PhD, David S. Butler, PT, EdD, Emilio J. Puentedura, PT, DPT

Arch Phys Med Rehabil Vol 92, December 2011






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Efficacy Neuroscience Education

Conclusions: For chronic MSK pain disorders, there is compelling evidence that an educational strategy addressing neurophysiology and neurobiology of pain can have a positive effect on pain, disability, catastrophization, and physical performance.


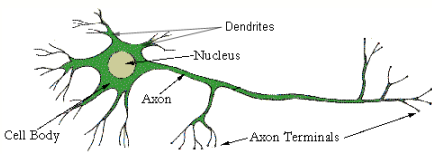
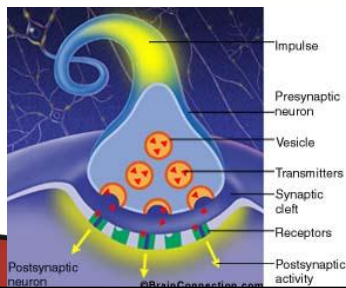
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Content: Louw, et al 2011

1. Neurophysiology of pain
2. No reference to anatomical or patho-anatomical models
3. No discussion of emotional or behavioural aspects to pain
4. Nociception and nociceptive pathways
5. Neurones
6. Synapses

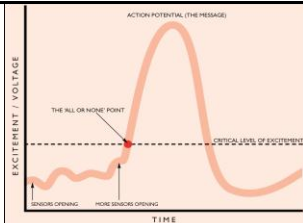
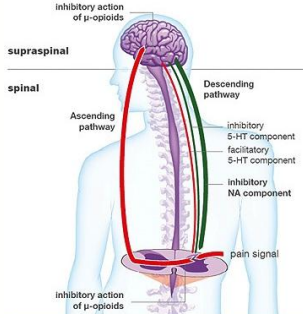
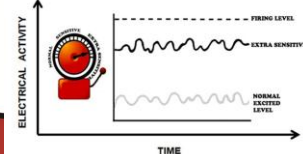





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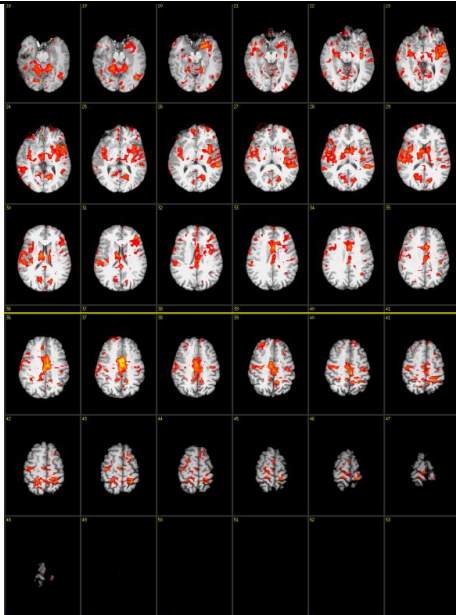


Content: Louw, et al 2011

- Action potential
- Spinal inhibition and facilitation
- Peripheral sensitization
- Central sensitization
- Plasticity of the nervous system







- 36 year-old female
- 4.5 years of pain
- Started as LBP, then spread to her buttocks and now into both legs
- Pain would flare up with stress at work
- First child 2.5 years ago – “horrible” labor, delivery and pain
- Now constant LBP
- Not able to return to work
- Now severe spasms in both legs
- CT, MRI and X-Ray WNL
- Meds: High doses of pain killers and narcotics


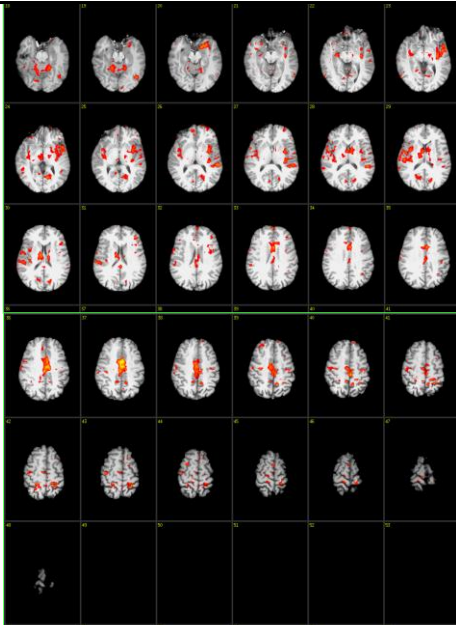


Moseley, G.L., *Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain.* Aust J Physiother, 2005. **51**(1): p. 49-52.

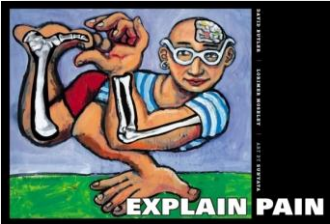
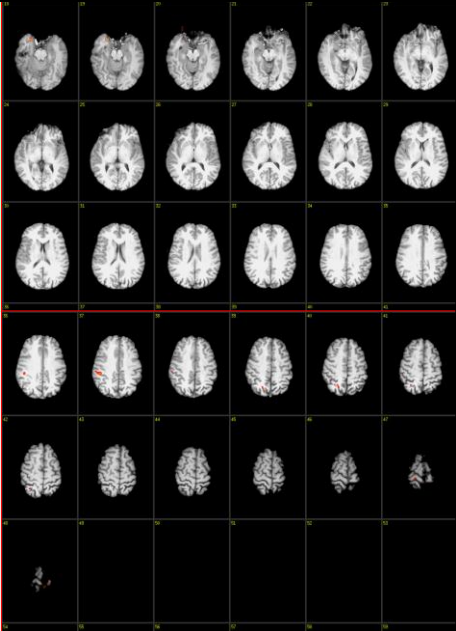

- **Segmental Spinal Stabilization Exercises***
 - 1 week practice
 - 5 minutes each waking hour



*** Myth**

• **1 – to – 1 pain physiology education**

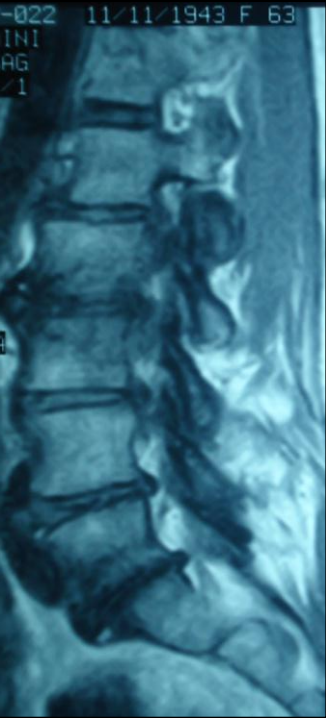

Use of an abbreviated neuroscience education approach in the treatment of chronic low back pain: A case report

Adriaan Louw, PT, M.AppSc (Physio), CSMT,¹ Emilio “Louie” Puentedura, PT, DPT, OCS, GDMT, FAAOMPT,² and Paul Mintken, PT, DPT, OCS, FAAOMPT³

Physiotherapy Theory and Practice, 2011, Early Online, 1–13

What about my recent patient?

- Years of “chronic LBP”
- Numerous different treatments
 - Latest = ESI, RF, PT
- ODI = 3675940.1
- Docs mentioned FM
- “Surgeons won’t touch her”
- MRI – severe DDD

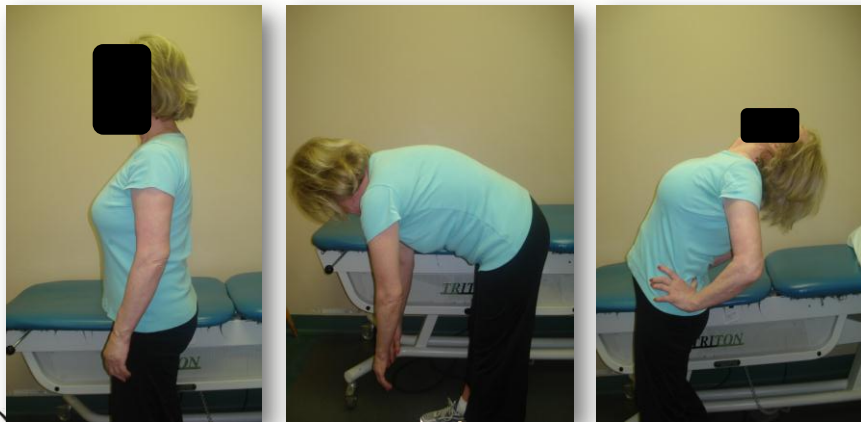


1st Session (75 minutes)

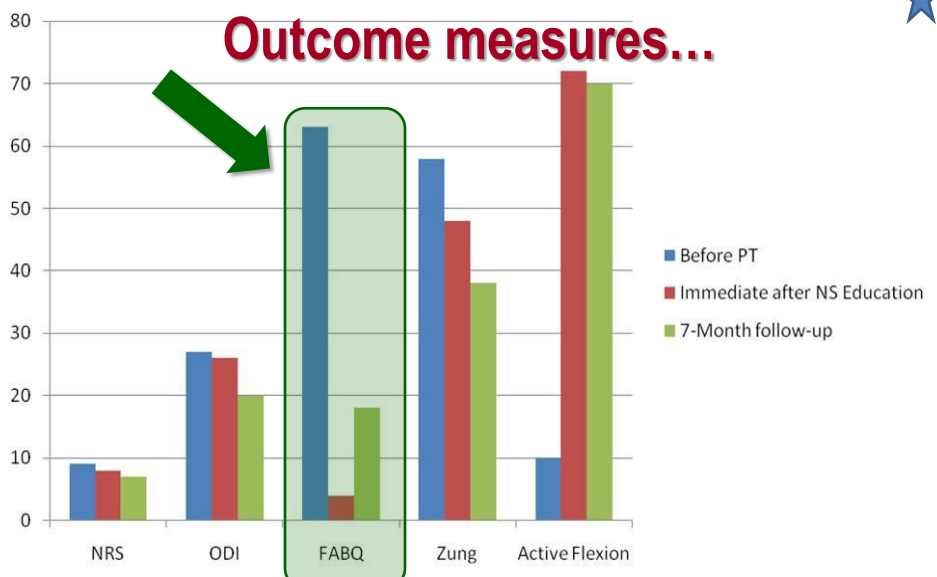
- Thorough subjective examination
- Thorough physical examination
- Therapeutic neuroscience education



After the 1st session (75 minutes later) No physical treatment



Outcome measures... ★



A Randomized Controlled Trial of Intensive Neurophysiology Education in Chronic Low Back Pain

G. Lorimer Moseley, PhD, *†‡ Michael K. Nicholas, PhD,‡ and Paul W. Hodges, PhD*

Clin J Pain • Volume 20, Number 5, September/October 2004

Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain

G Lorimer Moseley

Department of Physiotherapy, Royal Brisbane and Women's Hospital & The University of Queensland, Brisbane

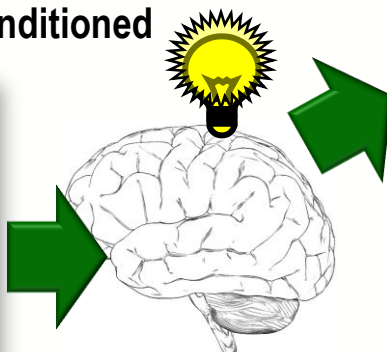
- **Redefine pain and thus change cognitions regarding pain**
- **Pain and Tissue injury are two different things**
- **Reduce threat**

Evidence for a direct relationship between cognitive and physical change during an education intervention in people with chronic low back pain

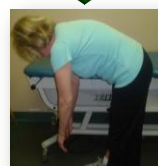
G. Lorimer Moseley * *European Journal of Pain* 8 (2004) 39–45

The Neuromatrix, Brain & Processing

- **After: Tissues heal; tissues sensitive; sore and deconditioned**



Threat smaller
Won't hurt tissues



To date...

- **Chronic LBP** (Moseley 2002; Moseley 2003; Moseley 2004; Moseley, Hodges et al. 2004; Moseley 2005; Ryan, Gray et al. 2010; Louw, Puentedura et al. 2012)
- **Chronic Whiplash** (Van Oosterwijck, Nijs et al. 2011)
- **Chronic Fatigue Syndrome** (Meeus, Nijs et al. 2010)
- **Fibromyalgia** (Meeus, et al – in preparation)

**What about acute conditions?
Prevention?**



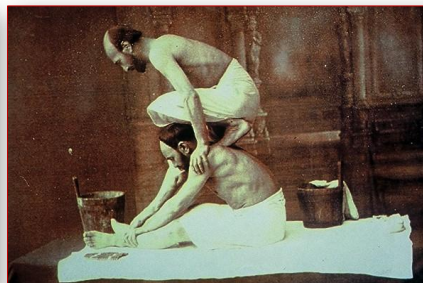
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Development and Implementation of a Preoperative Neuroscience Education Program for Lumbar Radiculopathy

Adriaan Louw, PT, PhD (c), M.App.Sc (physio)
Ina Diener, PT, PhD
David Butler, PT, M.App.Sc (physio), EdD
Louie Puentedura, PT, DPT, PhD, OCS, FAAOMPT



Current Landscape of US Spine Surgery



1. Spinal surgery is prevalent and increasing
2. At least 1 in 3 people will have persistent pain and disability following lumbar surgery
3. Postoperative rehabilitation has not shown significant ability to decrease postoperative pain and disability
4. Surgeons do not readily send patients to rehabilitation following lumbar surgery

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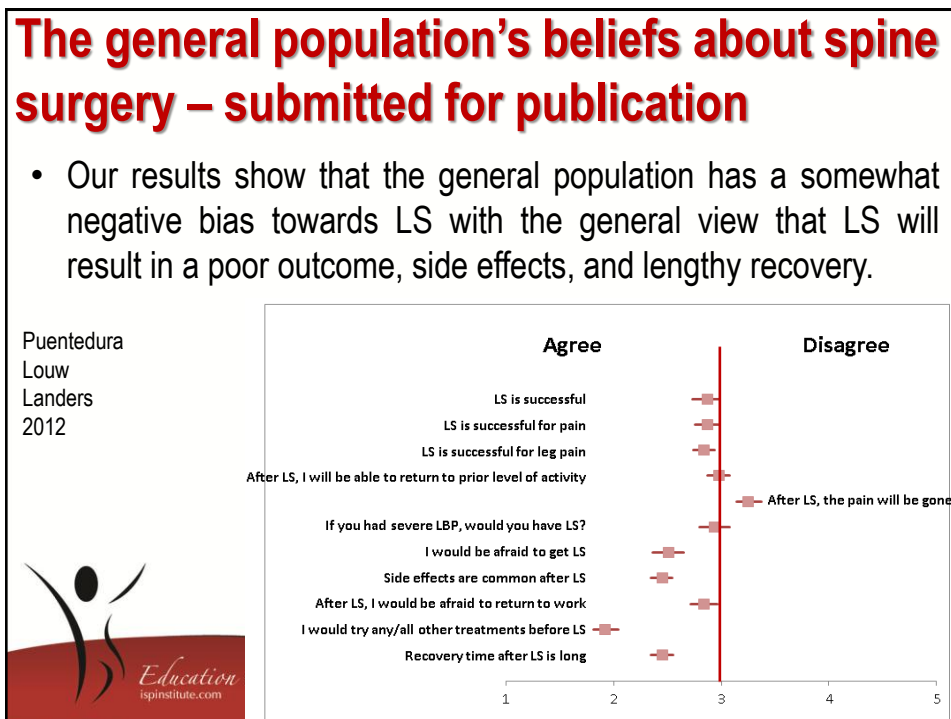
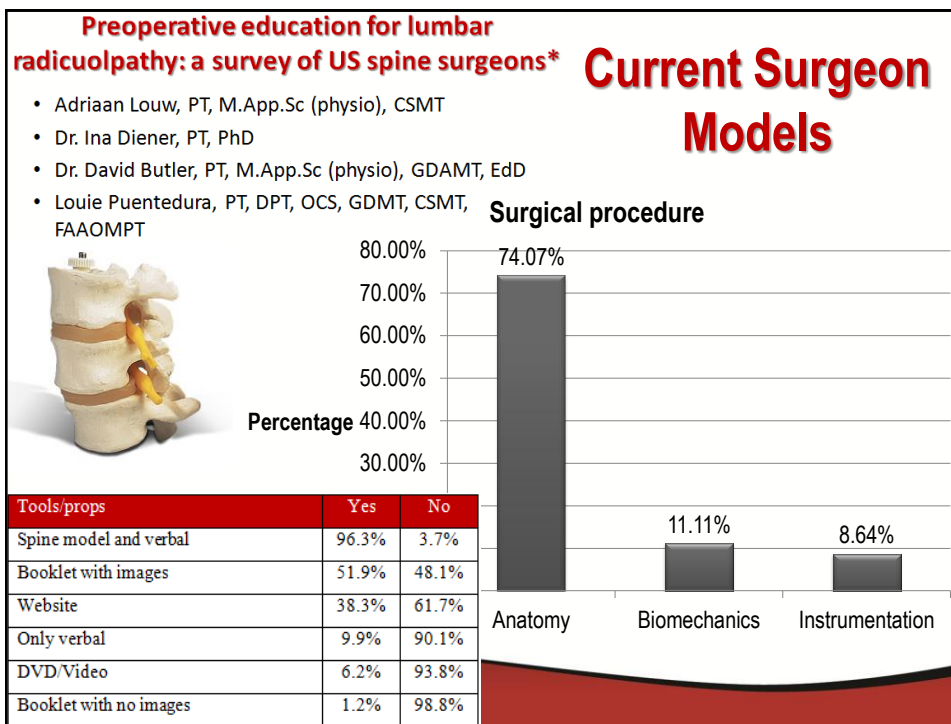
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Preoperative Education for Lumbar Surgery

- **Handful of studies: preoperative education for lumbar surgery.** (Douglas, Mann et al. 1998; Krupp, Spanehl et al. 2000; LaMontagne, Hepworth et al. 2003; Johansson, Nuutila et al. 2005; Walters and Coad 2006)
- **Focus:**
 - Procedural information
 - Informed consent
- **Little added benefit regarding post-surgical outcomes**


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Development of a Preoperative Neuroscience Education Program...

Your Nerves Are Having Back Surgery

Neuroscience Education For Patients Having Back Surgery

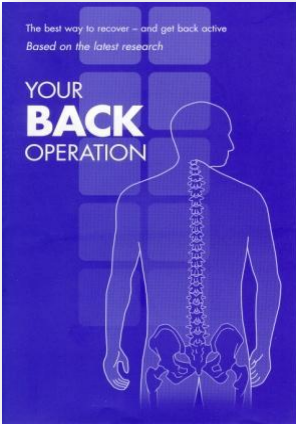




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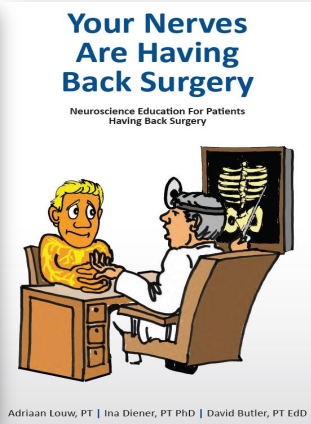
Adriaan Louw, PT | Ina Diener, PT PhD | David Butler, PT EdD

By the way...



The best way to recover – and get back active
Based on the latest research

YOUR
BACK
OPERATION



Adriaan Louw, PT | Ina Diener, PT PhD | David Butler, PT EdD

- 70% fewer provocative terms
- Expert panel review
- Submitted for publication

ISSLS Prize Winner: Function After Spinal Treatment, Exercise, and Rehabilitation (FASTER)

A Factorial Randomized Trial to Determine Whether the Functional Outcome of Spinal Surgery Can Be Improved

Alison H. McGregor, PhD,* Caroline J. Doré, BSc,† Tim P. Morris, Konrad Jamrozik, PhD,§ on behalf of the FASTER team

SPINE Volume 36, Number 21, pp 1711–1720

Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy (submitted for publication)

- **Case series of 10 Patients scheduled for Surgery for L-Radiculopathy**
 - Ave. age 47 years
 - Ave. duration of leg pain 7 months
 - Ave. LBP rating 5/10
 - Ave. leg pain 4.5/10
 - Ave. Oswestry 43% (severe disability)
 - Fear Avoidance Beliefs – High risk for CLBP



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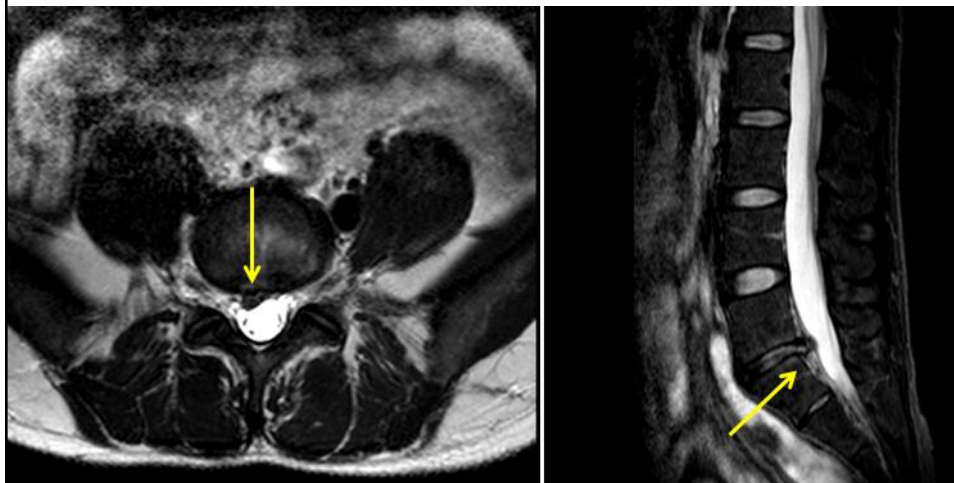
Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy (submitted for publication)

- **Immediate post-education session measurements: Statistically significant change in:**
 - Straight Leg Raise (Ave. 9 degree increase)
 - Forward Flexion (5 cm)
 - Fear Avoidance Scores decrease (especially work)
 - Pain Catastrophization
 - Knowledge of pain
 - Positive changes in regard to beliefs and a expectations of lumbar surgery

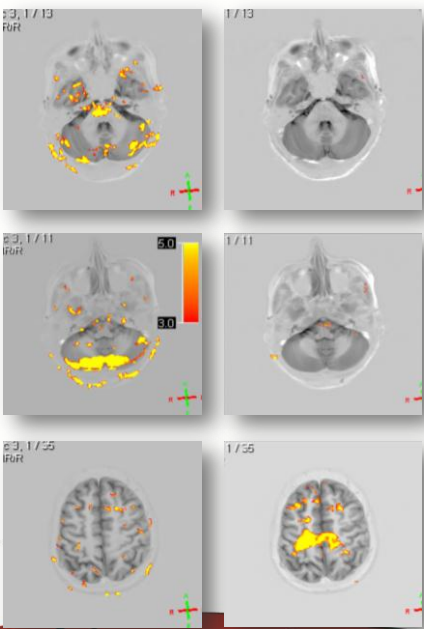


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Preoperative Neuroscience Education: Single fMRI case



Preoperative Neuroscience Education for Lumbar Radiculopathy

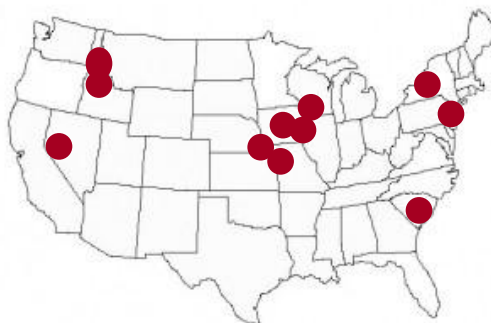


Louw, A et al 2012

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Next step – in progress...

- Multi-center
- Multi-clinician
- NS Education vs. usual care
- 40% patients enrolled



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Some preliminary data (NE vs. usual care) – 1 month post-op data

- NE program superior to UC
 - LBP ratings after surgery
 - Fear Avoidance
 - Oswestry
 - Pain Knowledge
 - Catastrophization
- Same decrease in leg pain NE vs. UC



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Physical Therapists are Ideal to Treat Pain

- **Biology**
- **Hands-on**
- **Psychology**
- **Numbers**
- **Cheap**
- **Fitness-Wellness**
- **Movement**
- **Pain Science**

Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Archives of physical medicine and rehabilitation*. Dec 2011;92(12):2041-2056.

