Therapeutic Neuroscience Education
Teaching People About Pain

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Disclaimer

Author of various patient pain books
Pain is 100% from the brain...

Pain is a multiple system output, activated by an individual's specific pain neural signature.

The neural signature is activated whenever the brain perceives a threat.


Would this hurt?

Pain is a decision by the brain based on perception of... THREAT
Nociception vs. Pain


What’s wrong with Rene?

• Assumption: there is a direct link between the amount of tissue damage and the level of pain experienced. (Patients truly believe this)
• All pain is caused by injury and increased pain means more damage
• Pain is either physical or psychological (mental versus physical)
• In chronic pain tissues are not healing and damage is ongoing
• Nociception and pain is synonymous


Chronic pain has doubled in the last 15-20 years!

The dichotomy...

Pain is produced by the brain...

- Altering information the brain receives can potentially alter threat and thus the pain experience.
Traditionally...

What about a top-down approach?
**Top Down: Education**

- Pain is produced by the brain
- Altering information the brain receives can alter threat and the pain experience
- Education is one approach that could alter **threat**

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**Traditional Education Models...**

Very prevalent models...

- Prevailing biomedical models focus on tissues and tissue injury.
- Orthopedic-based professions commonly use anatomy and patho-anatomy based models to explain pain to their patients.


The problem with these models: 1

- Not only have these models shown limited efficacy in decreasing pain and disability, but they may increase fear in patients, which in turn, may increase their pain.

The problem with these models: 2

- People in pain want to know more about pain…NOT anatomy, biomechanics or patho-anatomy
- It cannot explain complex pain states


Teaching people about pain: the therapeutic origin

Since then...

Interest in pain science and manual therapy
- Gifford
- Butler

Secondary studies of TNE of other conditions: chronic whiplash, chronic fatigue syndrome, fibromyalgia, case studies on content, more CLBP, post-op lumbar surgery
- Meuws, Nij, Ryan, Louw and Puenteuda

Early 1990s-2002
- Various RCTs by Moseley to determine effectiveness of TNE on chronic LBP
  - Pain, Cognitions, Fear, Movement, Brain Activation, Catastrophization, Knowledge of Pain

2002-2005
- Two systematic reviews on TNE
  - Clark
  - Louw

2005-present

2011

Current
- Ongoing research into uses of TNE for chronic pain
- TNE as preemptive treatment to prevent chronicity (Louw)
  - Lumbar Surgery
  - Whiplash

First RCT

Each subject participated in a one-hour education session, once per week for four weeks. The education session was in a one-to-one seminar format, was conducted by an independent therapist, and focused on the neurophysiology of pain with no particular reference to the lumbar spine. In addition, the subjects completed a short workbook which consisted of one page of revision material and three comprehension exercises per day for 10 days.

Movement improves after pain education-only

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*

SLR (°)* ↑
Bending (cm from floor)* ↓

5.0° (4.0°–6.0°)
4 cm (0.0 cm–8.2 cm)

A brain that understands, is less threatened and has hope…


Evidence: Systematic Reviews & RCT’s

Therapeutic Neuroscience Education

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 differently about pain, push further into pain, etc.

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.


Therapeutic Neuroscience Education

Content and Education Delivery Methods

• Name: Therapeutic Neuroscience Education
• Who: Physical Therapists
• Duration: 15-30 minute sessions
• Best: One-on-one verbal
• Material: Images, examples, and metaphors
• Combine: Exercise/movement

• Neurophysiology of pain
• No reference to anatomical or patho-anatomical models
• No discussion of emotional or behavioral aspects to pain
• Nociception and nociceptive pathways
• Neurones
• Synapses
• Action potential
• Spinal inhibition and facilitation
• Peripheral sensitization
• Central sensitization
• Plasticity of the nervous system


Clinical Example

• Patient with 3 years of LBP
• High fear
• Limited motion/afraid to move
• Failed treatments
• Various explanations
• Stopped working
• Spreading & worsening pain

Clinical Example

Traditional

TNE

Nerves work like an alarm system

Normal electrical activity

Persistent pain

Electrical activity “waking up”

End-Result

Louw A & Puenteurda EJ: Therapeutic Neuroscience Education 2013 OPTP
Turning the alarm system down therapeutically

- Therapeutic Neuroscience Education
- Aerobic Exercise
- Manual Therapy
- Pacing
- Graded exposure
- Breathing, relaxation
- Modalities
- Etc.

After TNE reconceptualizing pain

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

Summary: Chronic


- Changes in regards to pain beliefs
- Changes in regards to attitudes
- Improved cognition
- Improved physical performance and function
- Increased pain thresholds
- Improved outcomes from exercise
- Decreased brain activation
- Patients able to take on complex pain issues

What about TNE for acute conditions?
Want more info on pain

Focus on anatomy

Not helpful unless pain education

1. Experiences of lumbar surgery patients
2. Surgeon’s preoperative education
3. Pre-op education for pain in orthopedics

Development of a Preoperative Neuroscience Education Program for Lumbar Radiculopathy

4. Public perception of lumbar surgery
5. Viewing surgery images prior to lumbar surgery
6. Neuroscience Education for Pain and Disability

Afraid and expect poor outcome
Induces fear
Effective in reducing pain and disability


Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy: Case Series

Submitted for Publication Louw, Diener and Puenteledura 2014
Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy: Case Series

Submitted for Publication Louw, Diener and Puentedura 2014

- Physical Measurements (after education only):
  - Passive SLR increased 9 degrees
  - Active trunk flexion increased 5cm

- Positive shift in surgical expectations

![Graph showing changes in pain levels and physical measurements over time after preoperative neuroscience education](image)
Preoperative Neuroscience Education: Single fMRI case

MRI: marked herniated L5/S1 disc; central and left towards the nerve root

Submitted for Publication Louw, Diener, Peoples and Puentedura 2014

Painful spine movements prior to TNE fMRI scan

Same spine movements after TNE fMRI scan
Preoperative Neuroscience Education for Lumbar Radiculopathy: A Multicenter RCT

- 64 Patients scheduled for L-Surgery
- Randomized
- 32 Surgeon Education
- 32 Surgeon Education + Neuroscience Ed
- Low Back Pain
- Leg Pain
- Oswestry
- Fear Avoidance
- Pain Catastrophization
- Pain Knowledge
- Surgery Experiences
- Cost Analyses

Preoperatively 1, 3, 6 and 12 months postop

• One year follow-up
• Superior results (no statistical significance):
  – Back Pain
  – Leg Pain
  – Catastrophization
  – Fear Avoidance
  – Pain Knowledge

But…
Satisfaction with LS


Healthcare Cost 1 year out...

45% less on medical tests and treatments...

Why is TNE effective?

- Redefine pain and thus change cognitions regarding pain
- Pain and Tissue injury are two different things
- Reduces threat
- Pain is NORMAL

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