Teaching People About Pain – Live 2019 Update

Adriaan Louw, PT, PhD
Teaching People About Pain
Chapter One

Chronic Pain, Cognitions, and Education
Battling Pain Everyday
Chronic Pain Has Doubled In the Last Fifteen Years!

- Epidemiological data suggest that chronic, widespread, nonspecific musculoskeletal pain is on the rise, especially in the area of chronic low back pain (CLBP), adding to the ever increasing costs of health care.  
- The prevalence of chronic pain was 35.5%.

1. Magni et al, 1993; McMahon and Koltzenburg, 2005
2. RaGery, Sarma et al. 2011 UK Data

Friday Afternoon: 5 P.M.
Only a “Few” Issues

Patient Profile

- Pain for three years
- Diagnosed with Fibromyalgia
- Numerous healthcare providers
- Currently: ESI; RF and spinal stabilization
- Has good and bad days
- Spreading pain
- Pain comes and goes; has “a mind of its own”
- Stress increases her pain considerably
- She does not sleep well

Only a “Few” Issues (cont.)

- She has had to stop cooking
- Standing < 20 minutes; pain lasts 1–2 days
- Sit < 60 minutes
- ODI = 34756595
- FABQ = State record
- General health good
- Works out: Pilates and Yoga
- No joint problems
- Family history of LBP
- Unable to work (part-time office manager)

Physical Examination

- **Flexion:** 10 degrees = pain
- **Extension:** 10 degrees = pain
- **SLR:** sensitive at 45 degrees (L = R)
- **Slump:** leg pain with neck flexion
- **Palpation:** tender C0–L91
- **Stabilization:** Unable to perform a coordinated deep corset contraction

Patients Want to Know

1. What is wrong with me?
2. How long will it take?
3. What can I (the patient) do for it?
4. What can you (the clinician) do for it?
5. How much will it cost?
Patients Want to Know (cont.)

1. What is wrong with me?
2. How long will it take?
3. What can I (the patient) do for it?
4. What can you (the clinician) do for it?
5. How much will it cost?
Change

• To treat patients with more complex issues, we need to change
  – Cognitions
  – Beliefs
  – Fear
• Before movement therapy
Cognitions and Pain

It is well established that cognitions and pain are inter-related

- Fear
- Catastrophization

2. Waddell, Newton et al. 1993; Cleland, Fritz et al. 2008; George, Valencia et al. 2009; Mintken, Cleland et al. 2010
Fear

• **Definition:** a distressing negative sensation induced by a perceived threat
• FABQ
• Clinical
Could Also Be Emotional Overload

Catastrophization

- Inability to foresee anything other than the worst possible outcome, however unlikely, or experiencing a situation as unbearable or impossible when it is just uncomfortable
- PCS
- Clinical
Impaired Beliefs

• Pain is always bad
• All pain must be gone before engaging in normal activity and movement (and therapy)
• Passive treatment is the answer
• Pain will increase with any/all activity
• Work is potentially harmful
Impaired Beliefs (cont.)

Yellow Flags

Emotions

- Fear of increased pain
- Depression
- Irritability
- Anxiety
- Stress

Yellow Flags (cont.)

Behaviors

- Extended rest
- Poor compliance
- Extreme pain ratings
- Excessive reliance on aids/devices
- Sleep disturbance
- High intake of alcohol or medication
- Smokers

Yellow Flags (cont.)

Family
- Overprotective
- Punitive responses

Work
- Manual work
- Work history
- Belief that work is harmful
- Unhappy at work
- Low educational background
- Working shifts
- Negative previous experiences at work with LBP

Yellow Flags (cont.)

Compensation

– Lack of financial incentive to return to work
– Extended time off work
– Number of claims
– Previous history of LBP

Yellow Flags (cont.)

Diagnosis and Rx

– Sanctioning disability
– Conflicting diagnosis
– Language
– Passive treatments
– Number of health care providers
– “Techno-fix”
– Lack of satisfaction
– “If it hurts–don’t do it”
– Selling treatment in numbers
Cognitive Processing

Afraid; poorly understood; movement equals pain due to tissues being damaged
Modern Definition of Pain

Simplified start

– Pain is a multiple system output, activated by the brain based on perceived threat

“Hold on…”

“But I’m a physical therapist, not a psychologist”
If the Main Reason for Pain is a Stiff Joint

If the Main Reason for Pain is a Tight Muscle

If the Main Reason for Pain is Altered Muscle Recruitment

But What if the Pain and Disability is Due to Faulty Cognitions?

- My pain is due to the bulging disc
- I hurt because I have arthritis
- Movement will damage tissue and increase pain
- I am no doing anything until all the pain is gone
- I am afraid my pain will get worse
- I have a very rare case of...
Chapter Two

The Evolution of Therapeutic Neuroscience Education
To Change Cognitions

- Video
- TV Advertising
- E-mail
- Education
- Booklets/Pamphlets
- Joint models
- Verbal one-on-one
- Back school
- Internet
Education
Education (cont.)
Education: Internet Medical Images Used for Educating the Patient

- Often patients will turn to online resources
- These resources aren’t always reliable
- If the patient does not understand medically what they are viewing, it can be alarming, and confusing
Patients who are not used to seeing medical illustrations may not understand them fully and might find them alarming.
Research into Anatomy, Biomechanical and Pathoanatomy Models

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.

Greene, Appel et al. 2005; Morr, Shanti et al. 2010
Research into Anatomy, Biomechanical and Pathoanatomy Models

Be very careful with your choice of language around a patient: Degenerative terms can generate fear

- Examples of these terms are
  - “Wear and tear”
  - “Deterioration”
  - “Disc space loss”
  - “Crumbling”
  - “Collapsing”
Education: Current Models

- Does it work?
- Why not?
Education

• Why educate patients in pain about anatomy and biomechanics?
• Why not just teach them more about…pain?
Biomedical Education

- Does not explain pain
- Induces fear
- Does not include the nervous system, brain or pain processing
- **Patients want to know more about: pain**

Suggested Reading One

Origins of Neuroscience Education Pain, the Tissues and the Nervous System” A conceptual model

- Louis Gifford
Suggested Reading One (cont.)

Origins of Neuroscience Education Pain, the Tissues and the Nervous System” A conceptual model

• Louis Gifford
Suggested Reading Two

Combined Physiotherapy and Education is Efficacious for Chronic Low Back Pain

Evolution of Therapeutic Neuroscience

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
- Meeuws, Nijs, Ryan, Louw and Puentedura

Early 1990’s – 2002

2002 – 2005
Various RCT’s by Moseley to determine effectiveness of TNE on chronic LBP
- Pain
- Cognitions
- Fear
- Movement
- Brain activation
- Catastrophization
- Knowledge of pain

2005– present
Two systematic reviews of TNE
- Clark
- Louw

2011
Ongoing research into uses of TNE for chronic pain
- Lumbar surgery
- Whiplash

Current

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.

- **Conclusion**: 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.

# TNE: Education Delivery Methods

<table>
<thead>
<tr>
<th>Professionals</th>
<th>Education format</th>
<th>Educational tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical therapists</td>
<td>• One-on-one verbal communication</td>
<td>• Prepared pictures</td>
</tr>
<tr>
<td><strong>Duration and frequency</strong></td>
<td>• Two studies utilized</td>
<td>• Metaphors</td>
</tr>
<tr>
<td>• High: eight hours</td>
<td></td>
<td>• Hand drawings</td>
</tr>
<tr>
<td>• Low: 30–40 minutes</td>
<td></td>
<td>Workbook with reading/Q&amp;A</td>
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<tr>
<td></td>
<td></td>
<td>• Neurophysiology questionnaire</td>
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</tbody>
</table>


TNE: Content

- 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

TNE: Content (cont.)

[Diagram showing normal, sensitive, extra-sensitive, and firing levels]
Too Many Numbers?

• Increased knowledge of pain
• Healthcare providers underestimated patient’s ability to take on these “complex” neuroscience ideas

• Suggested reading
  – 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

Patient Study One

Profile

– 34-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
– Medication: high doses of pain killers and narcotics

Segmental Spinal Stabilization Exercises

- One week practice
- Five minutes each waking hour

Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy

Physical measurements (after education only)

- Passive SLR increased nine degrees
- Active trunk flexion increased five centimeters

Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy: Case Series
Louw, Diener, Puenterdura 2014–submitted for publication
### Immediate Effect of Preoperative Neuroscience Education for Lumbar Radiculopathy (cont.)

<table>
<thead>
<tr>
<th>SLR (°)* ↑</th>
<th>5.0° (4.0°–6.0°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bending (cm from floor) * ↓</td>
<td>4 cm (0.0 cm–8.2 cm)</td>
</tr>
</tbody>
</table>
Neuroscience Education

• Increased knowledge of pain
• Healthcare providers underestimated patient’s ability to take on these “complex” neuroscience ideas
Pain Neurophysiology Questionnaire

Adriaan Louw, PT, PhD

<table>
<thead>
<tr>
<th>Questions</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When part of your body is injured, special pain receptors convey the pain message to your brain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Pain only occurs when you are injured.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The timing and intensity of pain matches the timing and number of signals in danger messages.</td>
<td></td>
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<tr>
<td>4. Nerves have to connect a body part to the brain in order for that part to be in pain.</td>
<td></td>
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<tr>
<td>5. In chronic pain, the central nervous system becomes more sensitive to danger messages from tissues.</td>
<td></td>
<td></td>
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<tr>
<td>6. The body tells the brain when it is in pain.</td>
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<tr>
<td>7. The brain can send messages down your spinal cord that can increase the danger messages going up the spinal cord.</td>
<td></td>
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<tr>
<td>8. Nerves can adapt by increasing their resting level of excitement.</td>
<td></td>
<td></td>
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<tr>
<td>9. Chronic pain means an injury hasn’t healed properly.</td>
<td></td>
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<tr>
<td>10. Receptors on nerves work by opening ion channels (sensors) in the wall of the nerve.</td>
<td></td>
<td></td>
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<tr>
<td>11. The brain decides when you will experience pain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Worse injuries always result in worse pain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. When you are injured, the environment that you are in will not have an effect on the amount of pain that you experience.</td>
<td></td>
<td></td>
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<tr>
<td>14. It is possible to have pain and not know about it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Nerves can adapt by making more ion channels (sensors).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Second order messenger nerves post-synaptic membrane potential (excitement) is dependent on descending modulation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Nerves adapt by making ion channels (sensors) stay open longer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. When you are injured, chemicals in your tissue can make nerves more sensitive.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. In chronic pain, chemicals associated with stress can directly activate danger messenger nerves.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Handout available for download

Moseley GL. Unravelling the barriers to reconceptualisation of the problem in chronic pain: the actual and perceived ability of patients and health professionals to understand the neurophysiology. J Pain. 2003;4(4):184--189.
Neuroscience Education

- Redefine pain and thus change cognitions regarding pain
- Pain and tissue injury are two different things
- Reduce threat
We Do Not Manage Pain!


The Neuroscience of Pain

We need to retrain YOU first

Information used in educating the patient

What you need to know
Our View of Pain is Old

A: Avoid the Fire

B: Putting Out Fires

- Injections
- Medication
- 629% increase in Medicare expenditures for epidural steroid injections
- 423% increase in expenditures for opioids for back pain in Medicare patients

B: Putting Out Fires (cont.)

Opioid Analgesic Prescription for Spine Problem

Millions of Prescriptions

- 9.42
- 19.56


Lumbosacral Injections Rates, Medicare

Injections per 100,000

- Epidural steroids: 553.4, 79.7, 2055.2
- Facet injections: 79.7, 263.9

B: Putting Out Fires (cont.)

- Ice
- Manual therapy
- Education
- TENS
- Electrical stimulation
- Ultrasound
- Exercise
B: Putting Out Fires (cont.)

Small Nerve Fibers

Inhibitory Neuron

Large Nerve Fibers

Projection Cells

SMALL FIBER INPUT = GATE OPEN
C: Cutting Cords

- Surgery
- Nerve ablation/radio frequency
Persistent pain, disability and functional loss. It can easily be stated that at least one third of lumbar surgery patients continue to have significant

C: Cutting Cords (cont.)

End Result?

- Epidemiological data suggest that chronic, widespread, nonspecific musculoskeletal pain is on the rise, especially in the area of chronic low back pain (CLBP), adding to the ever increasing costs of health care\(^1\)
- The prevalence of chronic pain was 35.5\%\(^2\)

1. Magni et al, 1993; McMahon and Koltzenburg, 2005
2. RaGery, Sarma et al. 2011 UK Data
What’s Wrong with Rene?

• Assumption that 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 vs. physical)
• In chronic pain tissues are not healing and damage is ongoing
• Nociception and pain is synonymous
• Pain is an input driven system
• Nervous system as a wire
The Big Picture

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27–33.
Chapter Three

Pain Neuroscience Update: Input Mechanisms
The Big Picture

Input Mechanisms

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27–33.
The Big Picture (cont.)

Input Mechanisms
1. Tissue issues

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27--33.
Tissues Do Get Injured, But…

Tissues heal!
Tissues and Pain

- 40% of people with no back pain have a bulging disc
- Disc bulges absorb


Discs respond and look different between static and movement MRI

Tissues and Pain (cont.)

No correlation between arthritis and pain

Tissues and Pain (cont.)

Lumbar Discectomy

– NBA: 75% returned to play again
– NFL: 78% return to play again

Tissues and Pain (cont.)

Demolition derby drivers

- 52 crashes per night
- 30 nights per career
- 24 miles per hour
- 2.5% chronic neck pain

Tissues and Pain (cont.)

After successful rotator cuff repairs and clinically sound examination

- 90% abnormal signaling
- 16% partial tears
- 20% complete tears
- 33% sub-acromial effusion
- 16% joint effusion
- 20% bone marrow edema

Tissues and Pain (cont.)

- The overall prevalence of tears of the rotator cuff in all age groups was 35%\(^1\)
- Over age 70
  - Two out of three have asymptomatic RC tear\(^2\)
- 40% of normal asymptomatic people have RC tears\(^3\)

1. Sher, Uribe et al. 1995
2. Milgrom, Schaffler et al. 1995
3. Reilly, Macleod et al. 2006
Tissues and Pain (cont.)

- 15% of MRIs show meniscus degeneration\(^1\)
- 50% correlation between knee pain and arthritis\(^2\)
- 35% of collegiate basketball players with no knee pain: significant abnormalities on MRI\(^3\)

1. Munk, Lundorf et al. 2004
2. Bedson and CroG 2008
3. Major and Helms 2002
Nerve Fibers

<table>
<thead>
<tr>
<th>Axon type</th>
<th>Diameter (μm)</th>
<th>Speed (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aα</td>
<td>13–20</td>
<td>80–20</td>
</tr>
<tr>
<td>Aβ</td>
<td>6–12</td>
<td>35–75</td>
</tr>
<tr>
<td>Aδ</td>
<td>1–5</td>
<td>5–35</td>
</tr>
<tr>
<td>C</td>
<td>.2–1.5</td>
<td>.5–2.0</td>
</tr>
</tbody>
</table>
C-Fibers
Nerve Fibers and Myelin
“Pain” Nerve Fibers
“Pain” Nerve Fibers (cont.)
"Pain" Nerve Fibers (cont.)

- **Eyes**: contain light receptors; not vision
- **Ears**: contain vibration receptors; not hearing
- **Tissues**: contain nociceptive receptors; not pain
- **Tissues**: contain danger receptors; not pain
  - Nociceptive or danger fibers
Pain and Tissues
Think for Yourself
The Big Picture

**Input Mechanisms**

2. Peripheral nervous system

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27–33.
Peripheral Nervous System

Firing Level

Normal Excited Level

**Action Potential**

![Diagram of Action Potential]

- **Voltage vs. Time**
  - **Threshold**
  - **Stimulus**
  - **Depolarization**
  - **Rearrangement**
  - **Refactory period**
Voltage
Various Kinds of Channels

TEMPERATURE
STRESS
MOVEMENT
IMMUNITY
BLOOD FLOW

Genetic Coding
DNA → mRNA → Proteins →
Distribution of Ion Channels

TEMPERATURE
STRESS
MOVEMENT
IMMUNE
BLOOD FLOW
Removing Myelin

- Mechanical
- Immune
- Chemical
Clinical Example

Key Point One: Ion Channels

Half-life or an ion channel is 48-hours
Key Point Two: Ion Channels

Key Point Two: Ion Channels (cont.)

Bidirectional Nerve Firing
Bidirectional Nerve Firing (cont.)

Retrograde/antidromic

- Substance P increase
- Histamine increase
- Enzymes increase
Bidirectional Nerve Firing (cont.)

Orthodromic

- Persistent C-fiber activity
- Firing into the dorsal horn
- Potential long-lasting changes
Bidirectional Nerve Firing (cont.)

So what?

– An unhealthy nervous system (physically and emotionally) has potential significant long term effects on
  • Tissue health
  • Central nervous system
  • Brain
Chapter Four

Pain Neuroscience Update: Processing and Output Mechanisms
The Big Picture

Processing Mechanisms
1. Spinal cord

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27--33.
Bidirectional Nerve Firing

Orthodromic

– Persistent C-fiber activity
– Firing into the dorsal horn
– Potential long-lasting changes
Bidirectional Nerve Firing (cont.)
Dorsal Horn
Central Sensitization
Central Sensitization (cont.)
Central Sensitization (cont.)

Spinal cord

- Gating
- Interneuron
Central Sensitization (cont.)
Central Sensitization: End Result

- Interneuronal death
- C-fibers pull back; A-beta grows in
- Decreased endogenous mechanisms
- Inappropriate synapsing
- Left/right discrimination
The Big Picture

Processing Mechanisms

2. The neuromatrix

Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1998. 84: p. 27--33.
How Does the Brain Work?

Grandma
The Brain’s Processing of Danger

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

The Brain’s Processing of Danger (cont.)

Louw A, Diener I, Puentedura E and Peoples, R; 2014 Preoperative Neuroscience Education for Lumbar Radiculopathy: A Single Case fMRI Study
A Typical Pain Neuromatrix

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

A Typical Pain Neuromatrix (cont.)

6. Hypothalamus/Thalamus
Stress responses, autonomic regulation, motivation

7. Cerebellum
Movement and cognition

8. Hippocampus
Memory, spatial recognition, fear conditioning

9. Spinal Cord
Gating from the periphery

Synaptic Modulation Neuromatrix

Denotes synaptic modulation

Synaptic Modulation Neuromatrix (cont.)

Denotes synaptic modulation
Beliefs

Synaptic Modulation Neuromatrix (cont.)

- **Denotes synaptic modulation**
  - Yellow: Beliefs
  - Green: Knowledge, logic
Synaptic Modulation Neuromatrix (cont.)

- Denotes synaptic modulation
- Yellow: Beliefs
- Green: Knowledge, logic
- Blue: Social context
Synaptic Modulation Neuromatrix (cont.)

○ Denotes synaptic modulation
- Beliefs
- Knowledge, logic
- Social context
- Anticipated consequences
Synaptic Modulation Neuromatrix (cont.)

- Beliefs
- Knowledge, logic
- Social context
- Anticipated consequences
- Other sensory cues

Denotes synaptic modulation
Synaptic Modulation Neuromatrix (cont.)

- Denotes synaptic modulation
  - Beliefs
  - Knowledge, logic
  - Social context
  - Anticipated consequences
  - Other sensory cues
Questions to Ask
Questions to Ask (cont.)
“Nerves That Fire Together Wire Together”
Living Your Pain

“Nerves that fire together wire together”
Living Your Pain (cont.)

“Nerves that fire together wire together”
Definition of Pain: Update

Pain is produced by the brain when a person’s neural signature has been activated and concluded the body is in danger and action is required

Moseley 2003; Moseley 2007
So What?

Edward H. Adelson
Descending Modulation
Pain and Tissues
Pain and Tissues (cont.)
Placebo Effect
Physical Therapy Enhancing Beliefs: The Endogenous Medicine

Positive expectation that manipulation will help

- **Suggested reading**
  - Development of a Clinical Prediction Rule to Identify Patients with Neck Pain Likely to Benefit from Thrust Joint Manipulation to the Cervical Spine
The Efficacy of Sham Surgery in Orthopedics: A Systematic Review of the Literature

Rejected by all major spine and orthopedic journals

Louw A, Diener I, Puentedura L and Fernandez de--Las Penas C. Submitted for Publication 2012 -- 2014
The Efficacy of Sham Surgery in Orthopedics: A Systematic Review of the Literature (cont.)

Number of hits from databases and secondary searches (n=12,673)

Review of titles and abstracts

Potentially eligible (n=471)

Review of full text articles

Eligible articles (n=46)

Removal of duplicates (n=43)

Eligible articles for review (n=6)

Not eligible (n=12,202)
Reasons
- Not published in English
- Animal study
- Not an RCT
- Not orthopedic surgery

Not eligible (n=425)
Reasons
- Not published in English
- Animal study
- Not an RCT
- Not orthopedic surgery
The Efficacy of Sham Surgery in Orthopedics: A Systematic Review of the Literature
Another Example of the Top Down Effect

Adapted from Gifford LS. Pain, the tissues and the nervous system. Physiotherapy. 1998;84:27-33.
Output Mechanisms

Teaching People About Pain

Adrenaline

- (Epinephrine)
- Adrenal medulla
Cortisol

- Hydrocortisone
- Adrenal cortex
Cortisol (cont.)

Tissues

- Sore
- Tired
- Sensitive
- Fatigued
Cortisol (cont.)

Brain

- Memory
- Sleep
- Concentration
- Blood pressure
- Reproduction
- Other
Cortisol (cont.)

Immune

- Cytokine signaling
  - IL: 1
  - IL: 6
    - TNF: \( \alpha \)
- Increased nerve sensitivity
- Persistent inflammation
- Brain plasticity
Side Effects of Pain

- Appetite changes
- Sleep changes
- Mood swings
- Memory changes
- Concentration changes
- Depression symptoms
- Fatigued
- Soreness
- Sensitive
- Deconditioned

Adrenaline
Cortisol

Visitor
Home
17
The Neuroscience of Pain

Now we can teach the patient about how pain works!
Poll Review
Chapter Five

2019 Update
Current State of Affairs

- Pain epidemic
- Opioid epidemic
- Suffering
- Failed treatment
- Different explanations
- Medical test

Woolf and Pfleger 2003; Johannes, Le, Johnston, et. al 2011; Institute of Medicine 2011; WHO 2015
Emerging Pain Science

- Ion channel expression
- Demyelination
- Glial cell activation
- Action potential windup
- Inappropriate synapsing
- Cell death
- Neuroplasticity

Woolf and Salter, 2000; Woolf 2007; Devor 2006; Moseley 2007; Melzack 1999
Our Focus: Teaching People About Pain

The “Ah-ha” Moment

Low Back Pain?
Taking it to Patients

• **Educational tools**
  – Prepared pictures
  – Metaphors
  – Hand drawings

• **Formats**
  – One on one
  – Groups
    • We already have the script

Louw, Butler, Diener, et. al., 2013; Moseley 2002; Louw, Diener, Butler, et. al., 2011
Teaching People About Pain: 2019: What’s New?
1. The Name

- Therapeutic neuroscience education
- Pain physiology education
- Pain biology education
- Explain pain
- Explaining pain
- Pain neurophysiology education
- Pain neurobiology education
- Etc.

Louw, Puentedura and Zimney 2016.
2. Evidence

Strong evidence for PNE improving pain ratings, pain knowledge, disability, pain catastrophization, fear-avoidance, attitudes and behaviors regarding pain, physical movement and healthcare utilization

Louw, Zimney, Puentedura, et. al., 2016; Tegner, Frederiksen, et.al. 2018; Marris, Theophanous, et. al., 2019; Wood and Hendrick 2018.
PNE Evidence vs. Medical Options

2:1
PNE NNT for Pain

3:1
PNE NNT for Function

6:1
Gabapentin for Pain

7:1
Antidepressant (SSRI) NNT for Pain

Louw, Zimney, Puentedura, et. al., 2016; Moore, Wiffen, Derry, et.al. 2011; Lynch and Watson 2006; Moseley and Butler, 2017.
The Ultimate Goal: Focus on Function

“Despite The Pain…”
“Information to Behavior Change is as Spaghetti is to A Brick”

Fordyce, Fowler, Lehmann, et. al., 1973
### PNE for Musculoskeletal Pain: A Systematic Review

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
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<tbody>
<tr>
<td>Moseley</td>
<td>2002</td>
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<td>Moseley</td>
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<td>Moseley</td>
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<td>Ryan</td>
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<td>Meeus</td>
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<td>VibeFersum</td>
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<td>Gallagher</td>
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<td>Van Oostervijk</td>
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<td>Tellez</td>
<td>2014</td>
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<td>Beltran</td>
<td>2015</td>
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<td>Pires</td>
<td>2015</td>
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<tr>
<td>Louw</td>
<td>2014</td>
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</table>

In all but one of these studies did patients have statistically significant (p<0.05) decrease in pain ratings.

- The other group
  - **None**

Louw, Zimney, Puentedura, et. al., 2016
3. PNE + Exercise Therapy

Changes in Pain Disability

Interaction effect: P<.001

Control Group
PNE + Group

Baseline Post education 3 months 6 months 12 months

Baseline

P=.04 P=.01 P=.01

NS

Malfliet, Kregel, et. al., 2018
3. PNE + Exercise Therapy (cont.)

Changes in Pain Vigilance and Awareness

Education

Exercise

Follow-up

Baseline
Post education
3 months
6 months
12 months

Interaction effect: P < .001

Control Group

PNE + Group

NS

P = .001

P = .005

P = .01

Malfliet, Kregel, et. al., 2018
3. PNE + Exercise Therapy (cont.)

Randomized clinical trial (n = 120)

- 50% ↓ pain
- 46% ↓ pain catastrophization
- 30% ↓ fear
- 32% ↓ vigilance
- 27% ↓ central sensitization
- 22% ↑ daily functioning

- All medium to large effect sizes

Malfliet, Kregel, et. al., 2018
4. PNE as a Stand-alone Intervention

Healthcare providers

– Increased knowledge of pain
– Positive shift in attitudes and beliefs regarding chronic pain
– Increased empathy
– Shift towards biopsychosocial approach
– Shift away from pharmacology and imaging

Louw, Vogsland, Marth, et. al., 2019; Cox, Louw, Puantedura, et. al., 2017; Louw, Neilson, Freund, et. al., 2019; Zimney, Louw, Johnson, et. al., 2018; Moseley 2003
4. PNE as a Stand-alone Intervention

Louw, Vogsland, Marth, et. al., 2019; Cox, Louw, Puentedura, et. al., 2017; Louw, Neilson, Freund, et. al., 2019; Zimney, Louw, Johnson, et. al., 2018; Moseley 2003
5. Clinical Application

What predicts success?

- Listening to the patient
- Spending time with the patient
- Patient developing trust in the clinician
- Thorough interview
- Thorough physical examination

Diener, Kargela and Louw 2016; Louw, Puentedura, Zimney, et. al., 2017; Louw, Zimney, Diener, et. al., 2016; Louw, Zimney, O’Hotto, et. al., 2016
Remember

“People don’t care how much you know until they know how much you care.”

-Theodore Roosevelt
6. Who Needs PNE?

- Central sensitization /nociceptive pain
- Chronic pain
- Patients with high levels of fear-avoidance patients displaying various pain catastrophization characteristics
- Patients ready to change (contemplation; preparation stages)

PNE: Theoretically

Vlaeyen, Crombez and Linton 2016; Louw, Puentedura, Zimney, et. al., 2017
5. Increased Chronic Pain Cases

Louw, Zimney, Puentedura, et. al., 2016; Tegner, Frederiksen, et.al. 2018; Marris, Theophanous, et. al., 2019; Wood and Hendrick 2018; Louw and Puentedura 2014; Meeus, Nijs, Van Ooosterwijk, et. al., 2010; Malfliet, Kregel, Meeus, et. al, 2018; Van Oosterwijk, Meeus, Paul, et. al., 2013; Meeus, Nijs, Vanderheiden, et. al., 2014; Van Oosterwijk, Nijs, Meeus, et. al., 2011; Louw, Farrell, et. al, 2019; Benedict, Nitz, Abt, et. al., 2019
Acute? Sub-Acute? Chronic?

Central Sensitization Nociplastic

Fear Avoidance

Pain Catastrophization

Klyne, Moseley, Sterling, et. al., 2019; Woolf 2007; Stavrinou, Della Penna, Pizzella, et. al., 2007; Beggs, Liu, Kwan, et. al., 2010; Zimney, Louw and Puentedura 2014; Archer, Seebach, Mathis, et. al., 2014; Traeger, Henschke, Hubscher, et. al., 2015; Williams, Hancock, Maher, et. al., 2014
PNE: Why Not?

Vlaeyen, Crombez and Linton 2016
6. PNE: Acute/Sub-Acute Pain

Vlaeyen, Crombez and Linton 2016; Zimney, Louw and Puentedura 2014; Traeger, Lee, Hubscher, et. al., 2018; Louw, Farrell, Choffin, et. al., 2019
PNE for Acute LBP

- 80 patients with LBP <3 months
- Subjective and objective measures
- Brief 15-minute verbal one-one PNE session
- Re-measure
  - Flexion
  - SLR
  - Pain rating
  - GROC

3 out of 4 ≥ MCID

Louw, Farrell, Choffin, et. al., 2019
PNE: Preoperative?

Vlaeyen, Crombez and Linton 2016
Preoperative PNE

- Lumbar surgery
- Total knee replacement
- Shoulder surgery
  - Significant decrease in healthcare utilization
  - Significant improved patient experience
  - Positive beliefs and expectations regarding surgery
  - Significant reduction of sensitization

Louw, Diener, Landers, et. al., 2014; Louw, Diener, Landers, et. al., 2017; Louw, Reed, Zimney, et. al., 2018; Louw, Reed, Zimney, et. al., 2019; Louw, Langerwerf, Rico, et. al., 2019
7. PNE: Community?
PNE: Community?

Louw, Podolak, Zimney, et. al., 2018; Podolak, Louw, Benz, et. al., 2019; Louw, Podolak, Benz, et. al., 2019
7. PNE: Community?

- Increased knowledge of pain
- Healthier beliefs about pain
- Superior results to biomedical education
- Less provocative than biomedical education
- 3rd grade to 8th grade
- Reduced fear of physical activity in the event of a painful experience
- Video as affective as live presentation
Pain Neuroscience Education
Question & Answer Session
# Pain Neurophysiology Questionnaire

**Adriaan Louw, PT, PhD**

<table>
<thead>
<tr>
<th>Questions</th>
<th>True</th>
<th>False</th>
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<tbody>
<tr>
<td>1. When part of your body is injured, special pain receptors convey the pain message to your brain.</td>
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<tr>
<td>2. Pain only occurs when you are injured.</td>
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<td>3. The timing and intensity of pain matches the timing and number of signals in danger messages.</td>
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<td>4. Nerves have to connect a body part to the brain in order for that part to be in pain.</td>
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<td>5. In chronic pain, the central nervous system becomes more sensitive to danger messages from tissues.</td>
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<tr>
<td>6. The body tells the brain when it is in pain.</td>
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<tr>
<td>7. The brain can send messages down your spinal cord that can increase the danger messages going up the spinal cord.</td>
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<tr>
<td>8. Nerves can adapt by increasing their resting level of excitement.</td>
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<td>9. Chronic pain means an injury hasn't healed properly.</td>
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<tr>
<td>10. Receptors on nerves work by opening ion channels (sensors) in the wall of the nerve.</td>
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<td>11. The brain decides when you will experience pain.</td>
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<tr>
<td>12. Worse injuries always result in worse pain.</td>
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<tr>
<td>13. When you are injured, the environment that you are in will not have an effect on the amount of pain that you experience.</td>
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<tr>
<td>14. It is possible to have pain and not know about it.</td>
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<tr>
<td>15. Nerves can adapt by making more ion channels (sensors).</td>
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<td>16. Second order messenger nerves post-synaptic membrane potential (excitement) is dependent on descending modulation.</td>
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<tr>
<td>17. Nerves adapt by making ion channels (sensors) stay open longer.</td>
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<tr>
<td>18. When you are injured, chemicals in your tissue can make nerves more sensitive.</td>
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<tr>
<td>19. In chronic pain, chemicals associated with stress can directly activate danger messenger nerves.</td>
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Bibliography

MedBridge

Teaching People About Pain – Live 2019 Update

Adriaan Louw, PT, PhD