Teaching People About Pain
Pain Neuroscience Education

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Have you ever felt like this?

>100 Million Americans have some form of persistent pain

US Opioid Epidemic...

Americans, constituting only 5% of the world’s population, have been consuming 80% of the global opioid supply, and 99% of the global hydrocodone supply.

US Opioid Epidemic...

Each day 72 Americans Die From Prescription Opioids

The way we have looked at pain is...

Early History of Pain

- Aristotle: “Passion of the soul”
- Hippocrates: “Fluid imbalance”
- Prior to Renaissance: “Punishment or test from God”
- Chinese Medicine (3000 years ago) “Ying and yang”

Rene and the Renaissance Period

- Mechanical view
- Hollow tube with a cord, valves and spirits

Avoid the Fire...how is that working out?

Injury

- DISRUPTION
- DEPRESSION
- DISABILITY

Avoidance

- PAIN-RELATED FEAR
- PAIN CATASTROPHIZING
- NEGATIVE AFFECTIVITY
- THREATENING ILLNESS INFORMATION

Confrontation

- NO FEAR
- RECOVERY


Putting Out Fires

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

Putting Out Fires

Therapy
• Ice
• Manual Therapy
• TENS
• Electrical stimulation
• Ultrasound


Rene and the Renaissance Period
• Mechanical view
• Hollow tube with a cord, valves and spirits


Cutting Cords

Medical
• Surgery
• Nerve ablation/radiofrequency


It can easily be stated that at least 1/3 of lumbar surgery patients continue to have significant persistent pain, disability and functional loss.


Medical
• Surgery
• Nerve ablation/radiofrequency

Rene and the Renaissance Period
• Mechanical view
• Hollow tube with a cord, valves and spirits...to the brain
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

He’s still alive!

The REAL issue…
The Current Pain Model

Pathology
Symptoms
Intervention

Pathology
Symptoms


But we see this (in 1/3 of patients)...

Pathology
Symptoms


This also happens (thank goodness)

Pathology
Symptoms


We need a new model
The "ah-ha" moment... (for us)

Low Back Pain

Evidence Based Medicine

Guru

Expert

Clinician

Pioneers

RCT

Systematic

Review

Scientists

Teaching People About Pain... 1998


Pain

Neuroscience

Education

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, conducted by an independent therapist, and focused on the neurophysiologic 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.

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 processes pain allows patients to move better, exercise better, think different 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.

The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature

The results of this updated systematic review of PNE for MSK pain provides strong evidence for PNE improving pain ratings, pain knowledge, disability, pain catastrophization, fear-avoidance, attitudes and behaviors regarding pain, physical movement and healthcare utilization.


The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature

PNE: Education Delivery Methods

Educational format

- One-on-one vocal communication
- Two studies utilized group sessions.

Educational tools

- Prepared pictures
- Metaphors
- Hand drawings
- Workbook with reading/Q&A
- Neuropathology questionnaire

PNE: Content

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

Clinical Example


Why this approach for her?

Central Sensitization


**Suzy's case**

- What about my recent patient?
  - Doctor’s wife
  - 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

**The Body’s Living Alarm System**

- MOVEMENT = PAIN
- If I stop moving… I’ll stop hurting

**The Body’s Living Alarm System**


**Movement = Pain**

- If I stop moving… I’ll stop hurting

**The Body’s Living Alarm System**

- Metaphors for:
  - Central Sensitization
  - Peripheral Sensitization
  - Hyperalgesia
  - Allodynia


**After an interview, physical examination and pain neuroscience education**

"Education to behavior change is like throwing wet spaghetti at a brick."


Movement is the biggest pain killer on the planet

A six mile run stimulates endorphin release that is equivalent to 10mg of morphine.


There are thresholds for both the intensity (>50% Vo2max) and duration (>10 min) of exercise required to elicit exercise analgesia.


The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature

Moseley 2002
Moseley 2003
Moseley 2004
Ryan 2010
Meeus 2010

VibeFersum 2012
Gallagher 2013
Van Oosterveld 13
Ettersum 2014
Pires 2015
Loow 2014

PNE Movement
PNE Only

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

The other group: NONE


Pain Neuroscience Education

- Evidence is growing
- Various chronic musculoskeletal conditions
- Know who needs it
- Content established
- Delivery methods established
- Developed and validated abbreviated clinical applications

What's new?
What about PNE for acute conditions?


Preoperative Neuroscience Education: Single fMRI case


RCT - 1 Year

PNE study done preoperatively for patients scheduled to undergo lumbar spine surgery.

- No statistical significance:
  - Back Pain
  - Leg Pain
  - Catastrophization
  - Fear Avoidance
  - Pain Knowledge

BUT...

Improvements in:

- Patient’s feeling of preparedness physically, emotionally and psychologically
- Improved the patient’s feelings of the surgery meeting their expectations

And even a bigger change...

Healthcare Cost 1 year out...

45% less on medical tests and treatments...


Preoperative Neuroscience Education for Patients Undergoing Total Knee Arthroplasty

62 Pain Education Plus Traditional Education
60 Traditional Education Only

Track Postoperative Outcomes
6 Months
- Pain
- Function
- Medication
- Blood Pressure and Heart Rate
- Length of Hospital Stay
- Knee Range of Motion
- Satisfaction with Surgical Experience
- Healthcare Utilization

Preoperative Neuroscience Education for Patients Undergoing Total Knee Arthroplasty

Pain Neuroscience Education across Healthcare Disciplines

PNE: The list goes on...

PNE for PT Students
Cox T, Puentedura E, Louw A. An Abbreviated Therapeutic Neuroscience Education Session Improves Pain Knowledge in First Year Physical Therapy Students But Does Not Change Attitudes or Beliefs. Journal of Manual & Manipulative Therapy. 2015;Accepted for Publication - Nov 2015.

PNE enhances Manual Therapy

PNE via Telehealth
Louw A. Therapeutic neuroscience education via e-mail: a case report. Physiotherapy theory and practice. Apr 29 2014.

PNE change patients perceptions of HC Providers

PNE for TBI and PTSD
PNE for CRPS
• PNE affecting Opioid use in persistent pain
• PNE for TBI and PTSD
• PNE for CRPS
• Predictors for success with PNE
• Clinical Implementation Impact Study

One approach does not have the answer
One profession does not have the answer

Pain and Behavioral Shift:
“Despite The Pain…”

Biomechanical Models

https://www.youtube.com/watch?v=EAW87NsiGuI

3/23/2017

Bio-psycho-social approach

- Representation
- Pain mechanisms
- Pathoanatomy
- Evolutionary Biology
- Onion skins
- Beliefs/fears/threats
- Biomechanics
- Anatomy

Tissue Pathology


Tissue Pathology


These models are very prevalent

- 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

Scary Stuff

- If you look up spinal fusion on the internet, this is what you will find

Sample | Only - Click here

Sample | Only - Click here

Sample | Only - Click here

Sample | Only - Click here

Sample | Only - Click here

Sample | Only - Click here

Scary Stuff

- These models are very prevalent

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.


Lumbar Discs

40% of people with no back pain have a bulging disc


Masui T, Yukawa Y, Nakamura S, et al. Natural history of patients with lumbar disc herniation observed by magnetic resonance imaging for minimum 7 years. J Spinal Disord. Apr 2003;16(2):121-126.


Don’t think they believe this?

Patients who underwent discectomy and were shown their “bad disc” material recovered significantly better than those who were not shown their excised disc material:

- Leg pain (91.5 vs. 80.4%; p<0.05)
- Back pain (86.1 vs. 75.0%; p<0.05)
- Limb weakness (90.5 vs. 56.3%; p<0.02)
- Paraesthesia (80 vs. 61.9%; p<0.05)
- Reduced analgesic use (92.1 vs. 69.4%; p<0.02)


Lumbar Discs Heal

- Most herniated discs heal spontaneously
- 14 of 15 patients with massive lumbar disc herniation treated non-operatively had dramatic resolution
- No cases of cauda equina syndrome


Discs Heal

- The probability of spontaneous disc regression of various types of disc lesions
  - 96% for disc sequestration
  - 70% for disc extrusion
  - 41% for disc protrusion
  - 13% for disc bulging
- Rate of complete resolution
  - 43% for sequestrations
  - 15% for extrusions


Lumbar Discs

- Lumbar discs respond and look different between static and movement-MRI and different positions

Rotator Cuff

- 1/3 people over age 30 have abnormal findings on MRI
- 2/3 people over age 70 have abnormal findings on MRI
- After successful rotator cuff surgery 90% of people have abnormal findings on MRI


Knees

- 25% to 50% of MRI’s show knee degeneration in pain-free people
- MRI scans of 35% of collegiate basketball players with no knee pain show significant abnormalities


Bedson J, Odd FR. The concordance between clinical and radiographic knee osteoarthritis in a systematic review and meta-analysis. BMC Musculoskelet Disord. 2009;10(1).


Bio-psycho-social approach

Pain mechanisms
Evolutionary biology
Pathoanatomy
Anatomy
Biomechanics
Onion skins
Beliefs/fears/threats

Would this hurt?

What if?

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

Pain is 100% produced by the brain...

Pain is produced by the brain based on perception of threat

How Dangerous is this?

This is dangerous
More information

Facilitation

Inhibition

How Dangerous is this?

This not dangerous
Less information

Inhibition Neuronal adaption

"Tell me more"

"Stop bugging me"

Pain mechanisms

Bio-psycho-social approach

Representation

Pathoanatomy

Evolutionary Biology

Anatomy

Biomechanics

Onion skins

Beliefs/fears/threats
Evolutionary Models

- Nature versus Nurture
- Survival
- Protection

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

So What?

Pain is a LOT more complex than just:

Injury = Pain

Pain = Injury

Pain is produced by the brain...

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

Traditionally...


\[\text{Nijs J, Roussel N, Paul van Wilgen C, Kuba A, Smeets R. Thinking beyond muscles and joints: therapists' and patients' attitudes and beliefs regarding chronic musculoskeletal pain are key to exploring effective treatment. Man Ther. Apr 2013;18(2):96-102.}\]
What about a top-down approach?

It is well established that cognitions are correlated to pain

- Fear
- Catastrophizing
- Knowledge
- Anticipation and consequences of pain

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

PNE Evidence

We TREAT pain; not merely MANAGE it...

For chronic low back pain, the numbers needed to treat (NNT) and PNE:

- Function: 2:1
- Pain: 3:1
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