Manual Therapy from a Pain Neuroscience Education Approach

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Objectives

• Describe the history of manual therapy conceptual models as well as current thought processes of manual therapy as an intervention for the brain in addition to tissue specific effects

• Summarize research on the inexact science of joint palpation as a basis for determining manual therapy intervention

• Develop a plan to educate patients using pain neuroscience metaphors while applying manual therapy
Objectives

- Recognize the role of the patient expectations in delivering manual therapy and PNE
- Explain the importance of combining PNE with manual therapy and exercise and not simply performing PNE alone
- Utilize manual therapy and PNE in ways that promotes patient self-efficacy and independence

Outline

- History of MT Conceptual Models
- The Inexact Science of Palpation
- MT, PNE, & Pt Expectations
- Pain Neuroscience Education Research
- PNE: Hands On or Hands Off?
- PNE Metaphors & MT in the Clinic
- MT & Somatosensory Cortex
- How PNE & MT Promote Self-Efficacy
- Practical Application: MT & PNE in the Clinic

MT Conceptual Models
OA & the Biomedical Model

- Common discordance
  - Degree of OA & Symptoms
    (Bedson 2008, Baert 2013, Baert 2014)
  - Joint Replacement
    - Doesn’t always ↓ Pain
      (Skou 2013)
- Subgroup Pts w/ OA
  - Dominant Pain Mechanism: CS
    (Lluch 2014)

(Childs et al, 2015; Fritz et al, 2015; Rhon and Fritz, 2015).

Beneficial early on in care

Dominant Pain Mechanism

Nociception

(Childs et al, 2015; Fritz et al, 2015; Rhon and Fritz, 2015).

Biomedical Model

(Puertedura 2016)
Chronic Low Back Pain

Biomedical Model

(Delitto et al, 2012; Gore et al, 2012; Rubinstein et al, 2011)

Chronic LBP

“Very little evidence that manipulation under anesthesia is effective for chronic LBP”

(Digiorgi, 2013; Gordon, Cremata, and Hawk, 2014)

Chronic LBP

“Perhaps we need to manipulate the brain not just the joints and other tissues to bring about a change in the pain experience”

(Puentealura 2016)
Where do we see Biomedical Used Clinically?

- Palpate for Alignment
- Palpate Decreased Motion
- Palpate for Pain
- Goal: Improve Alignment
- Goal: Improve Tissue Motion
- Goal: Improve Joint Motion

(Douw, Nijs 2017)

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Does your Post Op TKA Pt have Central Sensitization?

- 20% of Pts s/p TKA experience minimal, no, or worsening improvement (Beswick 2012)
- Why?
  - Peripheral & Central Sensitization?
  - Tissue Sensitivity Increased
    - Knee
    - Other Joints

(Skou 2013)

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Does your Post Op TKA Pt have Central Sensitization?

- 40 pts w/ Revision TKA
  - 20 with pain in revised knee
  - 20 without pain in revised knee
- Quantitative Sensory Testing
  - 1st Pain Noted
  - Intolerable Pain Noted
  - Multiple Knee Sites, Tib Ant, Forearm

(Skou 2013)
Author’s Conclusion

“This study demonstrated widespread sensitization in patients with chronic pain after re-TKA, suggesting involvement of similar peripheral and central sensitization mechanisms as found in chronic knee OA pain, although some of the peripheral nociceptive drivers are obviously different. This may suggest precautions for future surgical knee interventions.” (Skou 2013)

Potential Mechanisms of MT

• Reduce:
  • Pain Expectancy
  • Fear of Movement
  • Change Brain Responses

(Ellingsen 2018)

• Activate Brain’s natural pain medicine
  • (Short term brain-orchestrated endogenous analgesia)
• Help gain some movement back
• Prelude for more active approaches

(Wright 1995)
Inexact Science of Palpation

Limitations of Biomedical Model
• Transient Motion Changes
  (Gal et al., 1997; Ceccato et al., 2006; Coppieters and Ashman, 2007; Coppieters and Butler, 2007)
• Do Not Last
  (Tullberg et al., 1998; Hsieh et al., 2002)
• Palpation = Poor Reliability
  (Troyanovitch et al., 1998; Seffinger et al., 2004)

(Bialosky, Bishop, Price 2009)

Limitations of Biomedical Model
• Nerve Biased Techniques: Not Specific
  (Kleinrensink et al., 2000)
• Joint Based Techniques Dissipated Over: Large Area
  (Herzon et al., 2001; Ross et al., 2004)
• Right Technique on Right Patient
  (Kent et al., 2005; DeLand et al., 2006).

(Bialosky, Bishop, Price 2009)
Manual Therapy Still Works But Why?

Mobilization Works How?

- Local Physiological Mechanisms
- Central Mechanisms
  - Activation of inhibitory pathways in spinal cord
  - Activation of descending inhibitory pathways in brainstem

(Moss 2007)

MT, PNE, & Pt Expectations
Why use Manual Therapy?

- PT Pts rank **Touch** as important (Lurie 2008, Veerbeek 2004)
- Importance of **Therapeutic Alliance**
  - Definition: + Social Connection b/w Pt & PT (Crepeau 2011)
- In Line with PNE Concepts
  - **Biopsychosocial Model**

![Image](Louw Nij 2017)

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Dry Needle or Soft Tissue?

- **135 Pts w/ Chronic LBP**
- 0-10 How Effective?
  - Dry Needle
  - Massage
- 10 weeks
  - Modified Roland Disability

![Image](Kalaoukalani 2001)

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Dry Needle or Soft Tissue?

- Treatment w/ High Expectations:
  - Improved: **86%**
- Treatment w/ Low Expectations:
  - Improved: **68%**

- Pt Expectations May Influence Treatment Independent of Treatment Itself

![Image](Kalaoukalani 2001)
Video

Manual Therapy & Placebo
• Hypothesized to effect all clinical pain outcomes
• RCTs: Control Group
  • Not effective – not any better than placebo
  • Did Pain Change?
• Linked to Size of Pt Expectation

(Bialosky 2011)

Manual Therapy & Placebo
• Mechanism:
  • Descending Inhibition of Nervous System
  • Changes Brain Activity
  • Functional MRI

(Bialosky 2011)
Manual Therapy & Placebo

• Less Effective with Negative Mood
  • Fear of Pain (Lyby 2010)
  • Anxiety (Morton 2007)

• Placebo Hypoalgesia Linked to Improvements Above (Morton 2007)

• Recommend: Assess & Intervene Negative Mood

(Bialosky 2011)

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PNE/MT Research

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So PNE is all I need?

• Systematic Review
  • 14 RCTs
  • 13/14 decreased Pain & Disability with Combination Treatments

(Marris 2019)
Systematic Review Results

• Meta Analysis Showed:
  • Statistically Significant Changes
    • Short & Long-Term Pain
    • Short & Long-Term Disability
  • Large Effect
    • Short-Term Pain
    • Long-Term Disability

(Marris 2019)

So PNE is all I need?

• High quality studies were found that support the evidence that pain education in addition to traditional PT interventions was more effective than traditional PT only, wait-list, or control groups

(Marris 2019)

PNE during Manual Therapy

62 Pts w/ Chronic LBP

Neuroplasticity

Mechanical

(Louw, Farrell 2017)
Neuroplasticity Education

“...” (Louw, Farrell 2017)

Neuroplasticity Ed During Manual Therapy

“I’m pushing on L4”

“What level did I just push on?”

“I’m pushing on L5”...

(Louw, Farrell 2017)

Mechanical Education

(Louw, Farrell 2017)
Neuroplasticity Ed During Manual Therapy

“Your back seems stiff”

“I feel it starting to loosen up”

(Louw, Farrell 2017)

Results

Low Back Pain  Leg Pain  Flexion ROM  SLR

SLR Improved 5.1 vs 1.4

(Louw, Farrell 2017)

“Although a lot more research is needed. This preliminary work shows that PNE may in fact enhance the effect of manual therapy interventions”

(Louw Nijs 2017)
PNE RCT
• 45 Pts Chronic Neck Pain
• 2X Week 8 Weeks
• Assessments
  • Baseline, 4 Weeks, 8 Weeks, 16 Weeks
• Outcomes
  • DNF Endurance
  • NDI
  • TSK
  • FABQ
  • Visual Analogue Fatigue Scale

(Beltran 2015)

Deep Neck Flexor Endurance Test
(video)

1-Control
Manual Only
2-Experimental
Manual + PNE
3-Experimental
Manual + PNE + Ex

(Beltran 2015)
• Manual Therapy Techniques

• Exercise Protocol

PNE Content
• Pain Physiology
• Aerobic Exercise
• Diaphragmatic Breathing
• Promoting Return to Work
• Relaxation Techniques
• Graded Activity Exposure Neck Movements

FABQ Changes

<table>
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<tr>
<th>Group</th>
<th>Baseline</th>
<th>4 Weeks</th>
<th>8 Weeks</th>
<th>16 Weeks</th>
<th>Overall Change</th>
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(Beltran 2015)
### NDI Changes

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(Beltran 2015)

### TSK-11 Changes

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(Beltran 2015)

### Neck Flexor Endurance Changes

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(Beltran 2015)
### Visual Analogue Fatigue Scale

![Visual Analogue Fatigue Scale](image)

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### Knee Manual Therapy

- 38Pts w/ Mild – Moderate Knee Pain & OA
- 10 minutes: 3X 3 minutes with 2 30 second rests

![Knee Manual Therapy](image)
Knee Pressure Pain Threshold

Mean % Change in PPT

Improvement

Worsening

- Treatment
- Manual Contact
- No Contact Control

(Moss 2007)

Heel Pressure Pain Threshold

Mean % Change in PPT

Improvement

Worsening

- Treatment
- Manual Contact
- No Contact Control

(Moss 2007)

Manual Therapy & PPT

- Knee: 27% (Moss 2007)
- Elbow: 15% (Paungmali 2003)
- Clinical Significance: 15%
TUG (Sit to Stand Time)

Mean % Change in Time

- Treatment
- Manual Contact
- No Contact Control

(Moss 2007)

PNE: Hands On or Hands Off?

Manual Therapy & PNE? For OA

- **Musculoskeletal PTs** unique skill set CS
  - Locally applied physical treatments
  - Central non-physical treatments

(Lluch 2015)
Traditional OA Manual Therapy

1. Find structure at fault
2. Reproduce Pain (Asterisk sign)
3. Perform Manual Therapy
4. Recheck Pain (Asterisk sign)

Knee Pain Cause: Local Tissue (Knee)

PNE + Manual Therapy for OA

Knee Pain Cause: Nervous System + Local Tissue Knee
“Hands on” vs “Hands off”

Central Sensitization → Psychosocial Approach

Reduced Nociceptive Input → Hands Off?

(Lluch 2015)

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Manual Therapy PNE
OA Mechanisms

Peripheral Effects (Increased ROM)

Temporal Activation Descending Pain Mechanisms

(Lluch 2015)

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Pain Neuroscience Education Neurobiological Model

Traditional Physical Therapy Biomedical Model

(Louw Nijs 2017)
Pain Neuroscience Education Is Hands Off

Manual Therapy is Hands On

(Pouw Nijs 2017)

70

Pain Neuroscience Education

Manual Therapy

(Pouw Nijs 2017)

71

Manipulation RCT

- 36 Pts w/ LBP
- Duration of 4 years

(Bialosky, Bishop, Robinson 2009)

Manipulation 3X15 REIL 5 mins Biking

72
• Manipulation Affected Thermal Pain Sensitivity more than Extension or Biking
• Dorsal Horn Excitability as Mechanism of Manual Therapy

(Bialosky, Bishop, Robinson 2009)

PNE Metaphors & MT In the Clinic

PNE Explanation of Pain Sensitivity

(Louw Nijs 2017)
PNE Explanation of MT Rationale to Pts

Crucial Outcome of PNE

Central Sensitization

Healing Tissue

Tissue Damage

Functioning Pain

Before Pain

Alarm Activates

After Pain

Firing Level

Lots of Room for Activities

Graded Mobilizations

Normal Electrical Level

(Louw Nijs 2017)

(Louw Nijs 2017)

Pain. Which may come into conflict with central PNE message of FUNCTIONAL GAINS prior to pain relief
This is helping your brain decrease the sensitivity in your back.

MT & Somatosensory Cortex

79

80

81
Sensory Discrimination Case Series

- 16 pts Chronic LBP ~12 years
- High Fear Avoidance
- 5 minutes localization

(Sensory Discrimination Case Series)

1 2 3

4 5 6

7 8 9

82

Sensory Discrimination Case Series

- Within Session Improvement
- Lumbar Flexion 4.8 cm
- Low Back Pain Decreased ~2/10

(Sensory Discrimination Case Series)

1 2 3

4 5 6

7 8 9

83

Sensory Discrimination Case Study

- Lumbar Surgery
- 0-3 Weeks 2X Week (6 visits)
- 5 minutes

(Sensory Discrimination Case Study)

1 2 3

4 5 6

7 8 9

(Louw, Schmidt 2015)
Sensory Discrimination Case Study

• Within Session Improvement
• Lumbar Flexion 3.5 cm
• Straight Leg Raise 8 Degrees
• Pressure Pain Threshold Improved
  • Leg (Hypoalgesia)
  • Back

(Louw, Schmidt 2015)
How PNE & MT Promote Self-Efficacy

Importance of Language

- Pts w/ LBP > 12 months interviewed?
  - “What’s your understanding of your pain?”
  - “What do you think is going on during a flare?”
  - “What do you think is going to happen in the future?”
- Secondary Analysis:
  - Imaging
  - Visit Note Documentation
  - Referral Letters

2 Major Language Categories

- Degeneration
  - Wear & Tear - “Degeneration” “Narrowing”
  - Aging - “Age” “Old”
- Mechanical
  - Compressive - “Trapped” “Impingement” “Compression”
  - Pulling Force - “Spasm” “Pulled” “Contracting”
  - Displaced - “Slipped” “Out” “Moved”
Importance of Language

“Degeneration” “Slipped” “Out” “Pulled” “Trapped” “Impingement”

(Sloan 2010)

Importance of Language

“Degeneration” “Wear & Tear” “Narrowing”

Poor Perceived Prognosis

(Sloan 2010)

Importance of Language

“The explanation of radiology findings to patients presents an opportunity to challenge unhelpful beliefs, thus facilitating uptake of active treatment strategies.”

(Sloan 2010)
Awesome. So all I need to do to make my knee feel better is lay down and have you work?

This is helping your brain decrease the sensitivity in your knee.

For now, that's true but remember the pain relief from what I'm doing will last about 45 minutes.

45 minutes? How can I get it to last longer than that?

For now, that's true but remember the pain relief from what I'm doing will last about 45 minutes.

Exercise? How is that supposed to help me? That's not going to fix my arthritis.

Exercise also helps the brain filter out the danger messages coming from the knee to decrease pain.

So both manual therapy & exercise are effective in part due to what they do to my brain?

Yes, after I do this manual work, let me show you the exercises that will be important for managing your pain.

Yes, using the window of pain relief from what I'm doing to take an active approach like exercise is important.

FMRI Changes Manual Therapy
15 CLBP & 16 Controls

Back Straining Videos
Neutral Exercises

Ellingsen 2018
**FMRI Changes Manual Therapy**

**FMRI Brain Scan**

How fearful are you of performing this exercise?

<table>
<thead>
<tr>
<th>0</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
</table>

How painful do you think it will be?

<table>
<thead>
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<th>50</th>
<th>100</th>
</tr>
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</table>

(Ellingsen 2018)

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**FMRI Changes Manual Therapy**

1 manipulation

Changes in Blood Oxygen Level and FMRI post manip

(Ellingsen 2018)

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**Conclusion**

- Expectation of Pain
- Fear of Movement

(Ellingsen 2018)
Applying PNE & MT in the Clinic

Which one first?

- **Recommendation:** Before
- **Why?**
  - Pain System has become sensitized prior to
  - Desensitizing technique of Manual Therapy
  - Changes Pt’s cognitions around pain
  - Better success with manual therapy & exercise
  - Danger messages during Manual interpreted differently
    (Luch 2015)

Manual Therapist

Wants to use:

- **Step 1** De-educate
- **Step 2** Re-educate

(Louw Nijs 2017)
Pain Sensation vs Stimulus Intensity

Louw, Nijs 2017

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Hyperalgesia

- Increased pain sensitivity to normally painful stimulus

Allodynia

- Painful response to non-nociceptive stimulus

(Sluka 2016 p. 28 & 205)
Pain Sensation

Stimulus Intensity

Proposed Space for Manual Therapy

Central Sensitization

Allodynia

Hyperalgesia

Proposed Space for Manual Therapy

Video

Algometer
Central Sensitization

Peripheral Sensitization

Your pain is due to:
- Injury
- Poor Alignment
- Wear & Tear in the Joints
- Poor Posture

Biomedical explanations can increase Fear (Darlow 2013,)

Avoid Passive Coping “PT will fix me” (Louw Nijs 2017)
Symptom Modification Tests

• High Reps
• High Frequency
• Goal:
  • Decrease Fear
  • Change Movement Pattern

(Lehman 2018)

Recommended In-Service Articles


Questions?

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Works Cited


Works Cited


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