Integration of pain sciences and dry needling to enhance movement and function for upper quarter dysfunctions

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Diagnosis

Patient profile and body chart

Examination

Mechanism

Central Sensitization
Nocioceptive
Peripheral Neuropathic

Diagnosis

Yellow flags
Cervical vs Shoulder
Cervical Radiculopathy
So after a long day in the trenches fighting the chiropractic board......
Patient Profile

- 60 yr old female
- PMH: 10+ yr history of chronic migraines
- PSH: gallbladder removal 10 yr ago
- Chronic, episodic right shoulder and arm pain, worries that it will never go away completely
- NDI: 85%
- Hesitant to answer 2 item depression screen (Arroll, 2003)
- Yes to ½ fear avoidance questions (Calley, 2010)
Objective

Neuro Exam: Dermatome WNL, DTR 2+ B/L, Mytome WNL, ULTTA: negative

Cervical Examination:
• AROM
  – Flex 40, no pain, no pain with OP
  – Ext 40, caused P2, No P1 with OP
  – SB: Rt 35 Lt 30, Rt SB P2* (2/10), No P1 with OP
  – Rot: Rt 70 Lt 60, No pain, P2* (2/10) with Rt Rot OP
• Cervical Special Test
  – Spurlings: Increased P2
  – Distraction: Decreased P2, no change P1 or P3
  – Cervical accessory: UPA Rt C6 produce P2 (3/10), capsular end feel
  – 1st rib: hypomobile, P2 (2/10)
Objective Examination cont.

Shoulder Examination:

• AROM
  – ABD: P1 in mid range 70-100, ROM WNL
  – HBB: P1 (6/10) at end of range, L3
  – Aggravation of P3 after summation of AROM

• MMT: ER 4/5 P1/P3 (+ infraspinatus test)

• +Hawkins-Kennedy 7/10 P1

• Supine shoulder PROM: all WNL no pain

• Shoulder accessory: hypo post glide and inf glide

• Palpation: Extremely provocative for P1 at infraspinatus and teres minor (8/10)
What is it?

– “Central sensitization is defined as an augmentation of responsiveness of central neurons to input from unimodal and plymodal receptors (Meyer et al. 1995).”

– What does it look like?

• Nervous system changes quickly, even with acute pain
• “Top-down mechanisms (altered sensory processing in the brain, malfunctioning of descending anti-nociceptive mechanisms, increased activity of pain facilitory pathways, temporal summation of second pain or wind-up, and long-term potentiation of neuronal synapses in the anterior cingulate cortex)
• Bottom-up mechanisms (increased responsiveness to a variety of peripheral stimuli including mechanical pressure) “decreased load tolerance

• Review
• Clinical pain is not simply the consequence of a “switching on” of the “pain system” in the periphery by a particular pathology, but instead reflects to a substantial extent, the state of excitability of central nociceptive circuits. The induction of activity-dependent increases in synaptic function in these circuits triggered and maintained by dynamic nociceptor inputs, shifts the sensitivity of the pain system such that normally innocuous inputs can activate it and the perceptual responses to noxious inputs are exaggerated, prolonged and spread widely. These sensory changes represent the manifestation of central sensitization,
• (1) exacerbate structural and functional muscle changes induced by tendon tear,
• (2) compromise the reversal of these changes during surgery and rehabilitation,
• (3) contribute to pain generation and persistence of pain,
• (4) impair shoulder function through reduced proprioception, kinematics, and muscle recruitment,
• (5) help explain interindividual differences and response to treatment
  – Is CS characteristic of the medical diagnosis?*
  – Does the patient exhibit at least a few consistent signs of CS?**
  – Does the patient exam support CS? ***
  – Pain disproportionate to the nature and extent of injury or pathology
  – Disproportionate, nonmechanical, unpredictable pattern of pain provocation in response to multiple/nonspecific aggravating/easing factors
  – Strong association with maladaptive psychosocial factors (eg, negative emotions, poor self-efficacy, maladaptive beliefs, and pain behaviors, altered family/work/social life, medical conflict)
  – Diffuse/nonanatomic areas of pain/tenderness on palpation

• Dry needling applied to distal trigger points has an inhibitory effect on proximal trigger points through a proposed mechanism of diffuse noxious inhibitory control, a supraspinal mechanism- i.e. breaks the neural circuit responsible for the muscle trigger point.

– Manual therapy has been shown to have short term central analgesic effects

– Manual therapy may also “serve as a peripheral source of nociceptive input to the CNS and thus will sustain the process of central sensitization.”
## Description by Smart:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually intermittent and sharp with movement/mechanical provocation; may be a more constant dull ache or throb at rest</td>
<td>Pain variously described as burning, shooting, sharp, or electric-shock-like</td>
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<tr>
<td>Pain localized to the area of injury/dysfunction (with/without some somatic referral)</td>
<td>Pain in association with other dysesthesias (eg, crawling, electrical, heaviness)</td>
</tr>
<tr>
<td>Clear, proportionate mechanical/anatomic nature to aggravating and easing factors</td>
<td>Night pain/disturbed sleep</td>
</tr>
<tr>
<td>Antalgic postures/movement patterns</td>
<td></td>
</tr>
<tr>
<td>Mechanism</td>
<td>CERVICAL</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Central Sensitization</td>
<td>Cervical ROM only caused P2 neck pain (not shoulder P1 or UE P3)</td>
</tr>
<tr>
<td>Nociceptive</td>
<td>No change in shoulder pain with Spurling’s or distraction</td>
</tr>
<tr>
<td>Peripheral Neuropathic</td>
<td>No shoulder or UE symptoms with cervical mobility testing</td>
</tr>
</tbody>
</table>

3/3 for Park (2005) Test-item cluster: **+LR 10.56**
Description by Smart:

- History of nerve injury, pathology, or mechanical compromise
- Pain referred in a dermatomal or cutaneous distribution
- Pain/symptom provocation with mechanical/movement tests (eg, Active/Passive, Neurodynamic) that move/load/compress neural tissue
- **Test-item cluster for cervical radiculopathy by Wainner**

<table>
<thead>
<tr>
<th>Test</th>
<th>-LR</th>
<th>+LR</th>
<th>Jane</th>
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<tbody>
<tr>
<td>Spurling’s A</td>
<td>0.58</td>
<td>3.5</td>
<td>Negative</td>
</tr>
<tr>
<td>Distraction</td>
<td>0.62</td>
<td>4.4</td>
<td>Negative</td>
</tr>
<tr>
<td>ULTT A</td>
<td>0.12</td>
<td>1.3</td>
<td>Negative</td>
</tr>
<tr>
<td>Rotation &lt; 60</td>
<td>0.23</td>
<td>1.8</td>
<td>Negative</td>
</tr>
</tbody>
</table>
Mechanisms are not mutually exclusive
What does the evidence show us about treatment targeting central sensitization?

• Pain Neuroscience Education
• Manual Therapy
• Exercise Intervention
• Dry Needling?
Pain Neuroscience Education

• GOAL: Address deleterious behaviors related to inappropriate pain beliefs
  – Meeus 2010: one 30-minute educational session was found to reduce

• GOAL: Reduce potential negative effect on descending pain inhibitory mechanisms
  – Seminowicz 2006

• GOAL: Improve movement and exercise performance
  – Moseley 2004
  – Moseley 2005
  – Nijs 2008
DM2

Insert info from Louww SR as well

Daniel Maddox, 8/22/2015
Manual Therapy

• GOAL: Prevent transition to a centrally sensitized state or lessen nociceptive input that may sustain a centrally sensitized state
  – Staud 2002
  – Vierck 2006
  – Nijs 2006
• GOAL: Invoke Centrally-mediated Hypoalgesia
  – Sterling 2001
  – George 2006
  – Bender 2007
  – Schmid 2008
  – Coronado 2012
  – De Oliveira 2013
Exercise

• GOAL: Decrease Pain, Perhaps Partially via Centrally-Mediated Hypoalgesia
  – Dupree Jones 2006
  – Bender 2007
  – Nijs 2012

• GOAL: Decrease Fatigue, Improve Sleep, and Improve Mood
  – Dupree Jones 2006
Dry Needling?

• GOAL: Decrease nociceptive input that may sustain a centrally sensitized state
  – See previously discussed mechanisms of CS and previously discussed evidence for DN in managing peripheral nociceptive pain

• Do we have evidence to suggest that dry needling may act on central mechanisms?
  – Tsai 2009
  – Srbely 2010
  – Cagnie 2013
What does the evidence show us about treatment targeting Peripheral Nociceptive Pain?

- Modalities
- Pain Neuroscience Education
- Manual Therapy and Exercise intervention
- Dry Needling?
Modalities

• GOAL: Decrease pain, Decrease Inflammation, Improve Function, Return to Activity
  – Cryotherapy
    • Algafly A, George K 2007
  – Transcutaneous Electrical Nerve Stimulation
    • DeSantana et al
  – Traction
    • Childs et al 2010
    • Raney et al 2009
Pain Neuroscience Education

• Goal: Prevention of chronic symptoms using Fear-Avoidance Model
  - Crombez et al 2012

See previously mentioned evidence for pain control.
Manual Therapy

• Goal: Decrease Pain, Improve ROM, Improve Strength

• Cervical Spine
  – Childs et al 2010

• Shoulder
  – Bang and Deyle 2000
  – Cleland et al 2004
  – Lieber et al 2001
  – Mintken et al 2010
  – Boyles et al 2009
Manual Therapy and Exercise

• Goals: Decrease pain, Increase Function, Increase Strength
• Shoulder
  – Walker et al 2008
  – McClatchie et al 2008
• Cervical Spine
  – Bronfort et al 2001
  – Hoving et al 2002
  – Jull et al 2002
  – Evans et al 2002
  – Chiu et al 2005
  – Franca et al 2008
  – Martel et al 2011
Dry Needling

• Removal of nociceptive input
  – Dommerholt 2011

• Decrease of chemicals associated with pain
  – Shah 2008

• See previously discussed mechanisms of CS and previously discussed evidence for DN in managing peripheral nociceptive pain
Nociceptive Treatment

• Exercise
• Manual Therapy
• Modalities
Exercise

**SYSTEMATIC REVIEWS:**
- Moderate quality evidence for short and long term benefit for pain and function versus a control or compared to surgical intervention
  - Kuhn et al, Kromer et al, Lombardi et al

**RANDOMIZED CONTROLLED TRIALS:**
- Exercise supervised by PT was superior to placebo and equally effective as SAD
- Specific exercise for SIS decreases need for surgery and improves function vs general exercise approach
- Program of exercise only as effective as manual therapy and exercise in reduction of pain and function short and long term
- Reduced costs for the exercise only group
  - Kromer et al, Brox et al, Holmgren et al
INEFFECTIVE: US, IFC, Pre-tensioned tape

SHORT TERM: LLLT

Passive Modalities
**Manual Therapy**

- **Bang J Orthop Sports Phys Ther 2007**
  - Improved ROM and strength in the manual therapy / exercise **AND** exercise only group
  - Favored manual therapy

- **Camarinos J Man Manip Ther 2009**
  - Systematic review: decreasing pain

- **Boyles Manual Therapy 2007**
  - Thoracic thrust
  - Short term benefit for pain

- **Mintken Phys Ther 2010**
  - Single arm CPR
  - Short term reduction in pain

- **Rhon Ann Intern Med 2014**
  - 6 sessions of PT with manual therapy = CSI
  - Less overall healthcare exposure and costs
Soft tissue directed interventions

Bron, Dommerholt et al. 2011

- Association of trigger points and subacromial impingement syndrome
- Infraspinatus, Teres Major, Upper Trapezius, Deltoid most common

Bron, de Gast et al. 2011

- Manual trigger point interventions decreased pain and improved function
## Background and Significance

<table>
<thead>
<tr>
<th>APTA &amp; AAOMPT recognize dry needling within the scope of PT practice</th>
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<td>APTA Dry Needling Resource Paper low number of studies as primary intervention</td>
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<tr>
<td>23 RCTs</td>
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<td>Quality of trials overall poor</td>
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</table>
Background and Significance

Hidalgo-Lozano *Exp Brain Res 2010*

- TrPs in the levator scapula, supraspinatus, infraspinatus, subscapularis, pectoralis major, and biceps brachii
- Decreased Pain Pressure Thresholds
- Demonstrated increased TrPs in symptomatic shoulders

Hsieh *Am J Phys Med Rehabil 2007*

- Within subject within session design bilateral shoulder pain
- TDN to Infraspinatus
- Side that received TDN had increased shoulder IR ROM, increased PPT, decreased pain

DRY NEEDLING
Background and Significance

Osborne *Acupunct Med* 2010

- Acupuncture
- Case series
- Within session improvements (ROM, strength, Pain assessed)

Johansson *Fam Pract* 2011

- Shoulder pain
- Compared corticosteroid with acupuncture
- Both groups had significant improvement pain and function but not between
2\textsuperscript{nd} visit

• 5 questions:

1. How did you feel after last visit? I was a little sore that night but I felt better. I haven’t had any numbness at all or shoulder pain

2. How do you feel now? I am 98% better.

3. How is sleeping, reading, driving (SE * signs)? They are 95% better. I am only having a little stiffness in my neck

4. How are OE * signs? Very little tenderness to palpation, no reproduction with shoulder ROM with OP. Still had P2 with cervical motions as in IE.

5. Show me your HEP: Performed correctly
Dry Needling demo or vid?

• Derek
Re-test

- Rx 1: Dry Needling to infraspinatus and teres minor, 1 each mms, multiple LTRs. Patient reported reproduction of P1 and P3 with each of muscle needled.
- Retest: AROM shoulder. No production of P1 with any motion and no P3 with MMT ER. No change in P2 with cervical motions.
And now the rest of the story

• At 2 month follow up:
  – NDI 2%
  – GROC +7 “A Very Great Deal Better”
  – NPRS 0/10
References

References