Dry Needling in Sports Medicine: Is There a Role in Your Practice?

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Conflicts of Interest

• Owner: Structure & Function Education, PLLC
  – Teaches dry needling

• Advisory Board Member
  – Meyer PT
Acu-Puncture

- Acu = sharp, needle
- Puncture - to pierce a surface
Traditional Acupuncture (TA)

- Originating from China 2000 years ago
- Balancing ying and yang
- Clearing up meridians
- Includes tongue evaluation, pulse readings, palpation, and more
- Western Medical Acupuncture is a form of TA

Dry Needling vs. Acupuncture: the Ongoing Debate; Zhou 2015
Western Medical Acupuncture (WMA)

• Modern adaptation to traditional acupuncture
  – Based on anatomy, physiology and pathology

• Different Types
  – Dry Needling (DN)
    • Earliest reports of dry needling are 1979 in Lewit paper
    • Interest has risen in the US with health care professionals in the 2000’s
    • Superficial and deep techniques
  – Peripheral Neuromodulation
    • Stimulates somatic nerves to influence autonomic nerves via somatovisceral reflex
  – IMS
    • Using electrical stimulation
  – Trigger Point Dry Needling
    • 95% overlap with ah shi points

Dry Needling vs. Acupuncture: the Ongoing Debate; Zhou 2015
Tools in the Tool Box

• No one discipline owns a specific technique
  – Homeopathic and Naturopathic physicians and acupuncturists all prescribe herbs
  – Physical Therapists, Chiropractors, and Osteopaths all perform manipulation
  – Athletic Trainers, Physical Therapists, and Chiropractors all use tape, exercise and physical agent modalities
PAIN AND DRY NEEDLING MECHANISMS
Nerve Fibers

Diameter And Velocity

A Alpha  Somatic Motor
    Proprioception
    Muscle Spindle
    GTO

A Beta    Touch/ Pressure

A Gamma  Motor to muscle spindles

A Delta  Pain/ cold / touch

B  Pregangliotic Sympathetic

C  Dorsal Root- Pain/ hot/ other mechanoreceptors
    Sympathetic Postgangliotic

Myelinated

Unmyelinated
A Beta, A Delta and C fibers

- **A Beta- Touch and pressure**
  - Type II, myelinated
- **A Delta- FAST pain**
  - Larger diameter so conducts impulses fibers
  - Signal gets to brain fast for acute, sharp pain
- **C fibers- SLOW pain**
  - Smaller diameter so conducts impulses slower than A Delta fibers
  - Signal gets to brain later and accounts for the dull pain that follows initial sharp sensation
Pain

• Cell damage and pain sensation
  – Releases bradykinin, CGRP, histamine, substance P, nerve growth factor, etc.
  – These can cause pain and inflammation, vasodilation

• Needle insertion stimulates A Beta, A Delta and C Fibers
  – CGRP, NO, Adenosine locally
    • Vasodilators and pain modulators
Pain Pathway- Ascending

• A Beta, A delta and C fibers go to the dorsal horn and connect to secondary neurons
  – Glutamate and substance P are released here

• Segmental effect
Pain Pathway- Ascending

- Ascend via the contralateral lateral spinothalamic tract to the thalamus and PAG
- Third order neurons go to the somatosensory cortex
- Spinoreticular tract goes to the brainstem before the thalamus and hypothalamus, with further projections into the cortex.
  - This is the emotional aspects of pain

Physiological Effects of Dry Needling, Cagnie, 2013
Pain Pathway- Descending

• PAG is high in concentration of opioid receptors and opioids causing analgesia
  – Descending pathways go to dorsal horn and inhibit pain transmission
    • Glycine and GABA are inhibitory neurotransmitters
  – Noradrenaline and serotonin as well as dopamine are released
    • Electroacupuncture specifically (Chou, 2012)
  – Enkephlins and Beta-endorphins are released
PAIN THEORIES
Specificity Theory

- Specific pain receptors transmit signals to the brain
- Motor response is elicited
- Does NOT account for any psychological aspect of pain or previous experience
Cartesian Model
Gate Control Theory

**OPEN GATE**

- Strong Signal to Brain
- C-Fiber
- Pain Stimulus

**CLOSED GATE**

- Weak Signal to Brain
- Inhibitory Interneuron
- C-Fiber
- Pain Stimulus
- Touch from skin (A Beta Fiber)

Theories of pain: from specificity to gate control, Moayedi, 2013
Neuromatrix Theory of Pain

- Pain is produced in the brain and spinal cord, not peripheral tissue.
- Several parts of the central nervous system work together to produce pain.
- Shifts focus from peripheral tissue and peripheral nervous system to the central nervous system.
- Explains things such as phantom limb pain, fibromyalgia, NSLBP, etc.
Conditioned Pain Modulation

• CPM is a “pain-inhibits pain” theory
  – Two noxious stimuli are applied at the same time
  – The second in the area, but not in the same spot as the first
  – The second stimulus gets processed by the dorsal horn and can inhibit the first noxious stimuli
• Could be why dry needling near the area is helpful
• Give cause to why we do not have to be in an exact location to see good results

Physiologic Effects of Dry Needling, Cagnie, 2013
PHYSIOLOGICAL CONSIDERATIONS
Effects on Blood Flow

- When A Delta and C fibers are stimulated, CGRP, NO and SP are released
  - Associated with inflammation
  - Vasodilators
  - Increased blood flow locally
- Unclear as to if this is a local response or has more diffuse effects

CGRP Produces Skeletal Muscle Vasodialation ... Sato, 2000
Peripheral and Spinal Mechanisms ..., Butts, 2016
Effects on Nervous System

• Needling will increase beta-endordphin release and inhibit pain
• Needling will activate A Beta, Delta and C fibers, decreasing pain via counter-irritation or hyperstimulation analgesia
• Gate Control Theory
  – Cagnie, 2013
• DN may stimulate inhibitory dorsal horn interneurons via enkephalin, GABA, and Glycine
BIOMECHANICAL CONSIDERATIONS
Needle Manipulation

• Pistoning
• Winding
• Winding + Pistoning
• Periosteal Pecking
  – With or without estim
Trigger Points

• Tenderness is the only moderately reliable identification of a trigger point, and only in the upper trap (Myburgh, 2008)

• Experts were unable to identify taut bands, trigger points or twitches when blinded to patient condition (Wolfe and Simons, 1992)

• Injection of botox into trigger point in infraspinatus decreases end plate activity but does not influence pain (Qerama, 2006)
Pistoning TrP

- TDN appears to be an effective treatment intervention for relief of trigger point-associated pain, regardless of body region
- Outcome measures related to pain reduction
  - TDN is more effective than stretching and percutaneous electric nerve stimulation (PENS)
  - At least equally as clinically effective as manual MTrP release and other needling treatments
- “More research is needed to determine the role of the local twitch response (LTR) and other protocol-related variables”

Effectiveness of trigger point dry needling... Boyles, R., 2015.
Muscle Twitch

• 2 of the 14 most common points treated by Lewit were not muscle tissue
  – Lewit 1979

• Superficial (not in muscle tissue) needling is effective
Conclusion- Muscle Twitch

• We do NOT need a twitch in order to be effective
Needle Grasp of Tissue

- 60 human subjects
- US guided for same depth
- NO/ BI/ Uni Conditions

Biomechanical response to acupuncture needling in humans. Langevin, 2001
Needle Grasp of Tissue

• Evidence to show physical winding of the tissue around the needle
  – May include skin and subcutaneous tissue, muscle, fascia, etc.
  – Collagen, elastic fibers, fibroblast, adipocytes, and mast cells, CGRP + nerve fibers have all been found histologically on the needle after removal
    • Kimura et al, 1992
Needle Grasp and Pistoning

• Because of this winding of tissues around the needle, pistoning may be more effective if winding is done first
• Evidence to show tissue movement occurred 4 cm away from needle
• Evidence that after 5 minutes, there was a “loosening” of the tissue/needle bond
Periosteal Pecking

• Aka periosteal stimulation therapy (PST)
• Aka osteopuncture
• Pain in OA of the knee was significantly reduced with use of PST with e-stim in a study with 88 people who were in pain for longer than 3 months
  – Touched bone (med and lat femoral condyle, fibular head and tibial flare), stimulated with 100 Hz for 30 minutes
• Improvements in pain for 1 month post treatment

Efficacy of periosteal stimulation therapy for the treatment of OA...Weiner et al, 2007
Periosteal Pecking

• 144 patients received intramuscular acupuncture, periosteal pecking or control (nothing)

• Both groups were more effective in decreasing neck and low back pain than the control, but there was no significant difference between PP and intramuscular acupuncture
CONTRAINDICATIONS AND PRECAUTIONS
Contraindications

• Patients with known
  – HIV
  – Hepatitis B and C
  – If you have a known BBP you should not dry needle your patients until consulting with an infectious disease control professional

• Cancerous tissue

• Pregnancy
Contraindications

• Metal allergy
• Blood diseases, including but not limited to:
  – Leukemia and lymphoma
  – Severe aplastic anemia
• True needle phobia
• Specific to the LB
  – Moderate scoliosis
  – Spina bifida
Precautions

• Patient on blood thinners
  – Coumadin, Aspirin, Plavix and more
• Cancer
  – Discuss with patient and MD
• Uncontrolled diabetes
  – diabetic ulcers and foot/ ankle dry needling
• Disease that compromises your bony safety block
  – Ex: osteoporosis and the scapula
ADVERSE EVENTS
Adverse Events

- Retrospectively reviewed electronic medical records in a Korean hospital
  - Dec 2010 to Oct 2014

- Classified as:
  - Mild: no follow up medical attention needed and does not affect ADL’s
  - Moderate: significant impact on ADL’s; may require additional medical attention but resolves after
  - Severe: requires intense medical intervention and leaves post event symptoms
  - Casualty: causes death

Safety of Acupuncture  Kim, Medicine, 2016
### Adverse Events

- **80,523 patients were treated with acupuncture**

<table>
<thead>
<tr>
<th>AE</th>
<th>N</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forgotten Needle</td>
<td>47</td>
<td>Mild- 47</td>
</tr>
<tr>
<td>Presyncope</td>
<td>4</td>
<td>Mild-2, Moderate-2</td>
</tr>
<tr>
<td>Pneuomothorax</td>
<td>4</td>
<td>Mild-1, Moderate-3</td>
</tr>
<tr>
<td>Infection</td>
<td>2</td>
<td>Severe-2 (inpatients)</td>
</tr>
</tbody>
</table>
Adverse Events

• Prospective questionnaire (Ireland)
  – Form A for mild events
  – Form B for severe events

• 39 physiotherapists voluntarily participated
  – Sept 2011 to June 2012
  – Focused on SDN or DDN
    • DDN was trigger point DN

Adverse events following trigger point dry needling Brady et al, J. Man Manip, 2014
Results

- 1463 adverse events were recorded in 7629 treatments
- 19.18 per 100 treatments (20%)

Table 3 Types of Adverse Events (AEs) reported in 7629 treatments with trigger point dry needling (TrP-DN)

<table>
<thead>
<tr>
<th>Event</th>
<th>Cases reported</th>
<th>Number per 100 treatments</th>
<th>Number (%) of physiotherapists reporting none</th>
<th>Extreme values recorded by individual practitioners per 100 treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding</td>
<td>576</td>
<td>7.55</td>
<td>4 (10.25)</td>
<td>32.23, 30</td>
</tr>
<tr>
<td>Bruising</td>
<td>355</td>
<td>4.65</td>
<td>3 (7.69)</td>
<td>26.09, 21.84</td>
</tr>
<tr>
<td>Pain during treatment</td>
<td>230</td>
<td>3.01</td>
<td>9 (23.08)</td>
<td>20.75, 20.69</td>
</tr>
<tr>
<td>Pain after treatment</td>
<td>167</td>
<td>2.19</td>
<td>14 (35.9)</td>
<td>20.69, 18.4</td>
</tr>
<tr>
<td>Aggravation</td>
<td>67</td>
<td>0.88</td>
<td>22 (56.41)</td>
<td>10.99, 5.75</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>20</td>
<td>0.26</td>
<td>32 (82.05)</td>
<td>4.44, 3.26</td>
</tr>
<tr>
<td>Feeling faint</td>
<td>17</td>
<td>0.22</td>
<td>28 (71.79)</td>
<td>4.17, 2.5</td>
</tr>
<tr>
<td>Headache</td>
<td>11</td>
<td>0.14</td>
<td>31 (79.49)</td>
<td>1.15, 1.1</td>
</tr>
<tr>
<td>Nausea</td>
<td>10</td>
<td>0.13</td>
<td>31 (79.49)</td>
<td>2.7, 2.22</td>
</tr>
<tr>
<td>Fatigue</td>
<td>3</td>
<td>0.04</td>
<td>37 (94.87)</td>
<td>1.77, 2.7</td>
</tr>
<tr>
<td>Emotional</td>
<td>3</td>
<td>0.04</td>
<td>37 (94.87)</td>
<td>1.59, 2.7</td>
</tr>
<tr>
<td>Shaky</td>
<td>1</td>
<td>0.01</td>
<td>38 (97.44)</td>
<td>3.03</td>
</tr>
<tr>
<td>Itching</td>
<td>1</td>
<td>0.01</td>
<td>38 (97.44)</td>
<td>0.47</td>
</tr>
<tr>
<td>Claustrophobia</td>
<td>1</td>
<td>0.01</td>
<td>38 (97.44)</td>
<td>0.16</td>
</tr>
<tr>
<td>Numbness</td>
<td>1</td>
<td>0.01</td>
<td>38 (97.44)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Results

• No Form B’s were returned, indicating no serious events occurred
  – forgotten needles, pneumothorax, fainting, vomiting, prolonged aggravation; or other significant events
COMMON REACTIONS TO NEEDLING
Common Reactions to Dry Needling

• UK Based members of the British Acupuncture Council
  – 1955 members
  – 638 clinicians agreed to participate

• 9408 patients answered survey
  – “Did you experience during or immediately afterward any of the following...”
Results

• 94.7% of patients reported at least one short term reaction
• Average per patient was 1.8 reactions
Table 2  Type and frequency of short term reactions associated with acupuncture (n=9408)

<table>
<thead>
<tr>
<th>Type of event</th>
<th>Number of reported reactions</th>
<th>Short term reaction rate per 100 treatments</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>‘Positive’ reactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>7436</td>
<td>79.1</td>
<td>78.2, 79.8</td>
</tr>
<tr>
<td>Energised</td>
<td>3072</td>
<td>32.7</td>
<td>31.7, 33.6</td>
</tr>
<tr>
<td>Other ‘positive’</td>
<td>166</td>
<td>1.8</td>
<td>1.5, 2.1</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td>10674</td>
<td>113.5</td>
<td></td>
</tr>
<tr>
<td><strong>Tiredness or drowsiness reactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2295</td>
<td>24.4</td>
<td>23.5, 25.3</td>
</tr>
<tr>
<td><strong>‘Negative’ reactions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain where needle was inserted</td>
<td>1154</td>
<td>12.3</td>
<td>11.6, 12.9</td>
</tr>
<tr>
<td>Bruising</td>
<td>378</td>
<td>4.0</td>
<td>3.6, 4.4</td>
</tr>
<tr>
<td>Pain other than at site of needling</td>
<td>373</td>
<td>4.0</td>
<td>3.6, 4.4</td>
</tr>
<tr>
<td>Faint / dizzy</td>
<td>248</td>
<td>2.6</td>
<td>2.3, 3.0</td>
</tr>
<tr>
<td>Worsening of condition</td>
<td>165</td>
<td>1.8</td>
<td>1.5, 2.0</td>
</tr>
<tr>
<td>Nauseous</td>
<td>111</td>
<td>1.2</td>
<td>1.0, 1.4</td>
</tr>
<tr>
<td>Sweating</td>
<td>79</td>
<td>0.8</td>
<td>0.7, 1.0</td>
</tr>
<tr>
<td>Bleeding</td>
<td>66</td>
<td>0.7</td>
<td>0.6, 0.9</td>
</tr>
<tr>
<td>Disorientation / anxiety / nervousness / insomnia / emotional</td>
<td>63</td>
<td>0.7</td>
<td>0.5, 0.9</td>
</tr>
<tr>
<td>Ache/discomfort other than at needle point</td>
<td>49</td>
<td>0.5</td>
<td>0.4, 0.7</td>
</tr>
<tr>
<td>Other ‘negative’</td>
<td>33</td>
<td>0.4</td>
<td>0.2, 0.5</td>
</tr>
<tr>
<td>Itching / pins &amp; needles / tingling / burning sensation</td>
<td>33</td>
<td>0.4</td>
<td>0.2, 0.5</td>
</tr>
<tr>
<td>Irritation / ache at needle point</td>
<td>24</td>
<td>0.3</td>
<td>0.2, 0.4</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td>2776</td>
<td>29.7</td>
<td>28.6, 30.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15745</td>
<td>167.5</td>
<td></td>
</tr>
</tbody>
</table>
In Conclusion

• We have theories about the mechanism by which dry needling works, but exact mechanisms are unknown

• Many schools of thought regarding the use of needle manipulation
  – Pistoning, winding, combo, periosteal pecking

• We do not know the most effective parameters for dosing dry needling
  – Placement, intensity, frequency, use of needle manipulation
In Conclusion

• Dry needling can cause serious side effects, especially if performed by an untrained person
  – Pneumothorax, organ puncture

• Dry needling is a safe treatment when administered by someone with proper training
Stay In Touch

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