Objectives

1. Identify the scientific basis for dry needling
2. Discuss dry needling in the context of pain sciences
3. Discuss the interrater reliability of locating TrPs
4. Discuss biomechanical aspects of dry needling
5. Have fun and learn something new!

What are we talking about?

Dry Needling: Another Manual Physical Therapy Perspective
Dry Needling Approaches

Not all techniques are created equal

In the early 1900s physicians used needles, including ladies’ hat pins, to treat tender points in the low back region (Churchill 1821; Elliotson 1827; Churchill 1828; Osler 1912)

Is Dry Needling within the Scope of Physical Therapy Practice?

Scope of practice

Australia (>1,000)  
Belgium  
Canada  
Denmark  
Ireland  
The Netherlands  
New Zealand  
Norway  
South Africa (>7,000)  
Spain (>4,000)  
Sweden  
Switzerland (>2,500)  
UK (>5,500)  
US (most states)  
among others
The state of Maryland was the first state to approve dry needling in 1984.
Dry needling in NL (May 2007)

- Dry needling is within the scope of physiotherapy practice. It must be part of an outcome-oriented physiotherapy treatment plan.
- Dry needling is applied to the movement system and has a theoretical Western underlying rationale based on beta and gamma sciences.
- There is limited evidence that myofascial trigger point therapy is more effective with the use of needles.
- The KNGF believes that innovation and development are feasible.

On October 17, 2009, the American Academy of Orthopaedic Manual Physical Therapists approved dry needling as a procedure within the scope of physical therapy practice.

APTA documents can be downloaded from apta.org

Trigger point dry needling is an emerging, evidence-informed treatment modality within the context of physical therapy, medicine, veterinarian medicine, dentistry, chiropractic, and other disciplines dependent upon the jurisdiction.
Animals present a spatial map of their pain in the form of antalgic behaviors.

Consider joining
The Myopain Seminars Group and/or
The Myopain Seminars Veterinary Group
On www.LinkedIn.com

Dry Needling of a Shark

What is the taut band?

Sharks’ scales actually have teeth on them, so you can’t rub back and forth on their skin; you would actually cut all the skin of your fingers. You can only work from the head towards the tail, in one direction; then we use a needle - almost like acupuncture - to find the trigger point in the area of tense muscle or changed muscle tone. We put the needle in to shut off the pain receptor, then pull the needle out and stretch the muscle out.
Contractile Activity

1. Electrogenic stiffness: muscle tension coming from electrogenic muscle contraction, based on observable EMG activity in normals who are not completely relaxed

   The term electrogenic refers to the fact that the a-motor neuron and the neuromuscular endplate are active under these conditions.

Contractile Activity: Spasm

2. Electrogenic spasm that specifically identifies pathological involuntary electrogenic contraction

   May or may not be painful

Contractile Activity: Taut Band

3. Contracture arising endogenously within the muscle fibers independent of EMG activity


Spinal Cord Mechanism Involving the Remote Effects of Dry Needling on the Irritability of Myofascial Trigger Spots in Rabbit Skeletal Muscle

   Yung-Ling Hsieh, PE, PhD, Li-Wen Chen, MD, Mei, Yin-San Jee, MD, Chang-Zen Hsiao, MD

   The remote effect of dry needling depends on an intact afferent pathway from the stimulating site to the spinal cord and a normal spinal cord function at the levels corresponding to the innervation of the proximally affected muscle.
Does it work?

Manual therapy [incl. dry needling - JD] likely works through biomechanical and neurophysiological mechanisms. A limitation of the current literature is the failure to acknowledge the potential for a combined effect of these mechanisms.


Effectiveness of Dry Needling for Upper Quarter Myofascial Pain: A Systematic Review and Meta-analysis

David M. Kietrys, Kerstin M. Palombaro, Erica Azzaretto, Richard Hubler, Bret Schaller, J. Matthew Schlussel, Mary Tucker

CONCLUSIONS: Based on the best current available evidence, we recommend (Grade A) dry needling, compared to sham or placebo, for decreasing pain (immediately after treatment and at 4 weeks) in patients with upper quarter MPS.

Clin Rheumatol, published online Nov 9, 2012 DOI 10.1007/s10067-012-2112-3

Dry needling treatment is effective in relieving the pain and in improving the quality of life of patients with MPS

The effect of dry needling in the treatment of myofascial pain syndrome: a randomized double-blind placebo-controlled trial

Lincoln Thistle, Felix Abravanel, Olivia Brunner, Fraga Cabot, Paul Dennett, Michael A. Keating
Effectiveness of myofascial trigger point dry needling in the prevention of pain after total knee arthroplasty.

A randomized, double-blinded, placebo controlled study.

Orlando Mayoral, Isabel Salces, Ana Teresa Martín, Soledad Martín, Jesús Santiago, José Cotarelo, Constantino Rodríguez

Evidence-Based Complementary and Alternative Medicine, 2013, Article ID 694941

Myofascial pain in the lateral pterygoid muscle (n=36)

<table>
<thead>
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<th>Pre</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
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<tr>
<td>REAL-DN</td>
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<td>2.25</td>
<td>2.15</td>
<td>1.95</td>
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<tr>
<td>SHAM-DN</td>
<td>10.56</td>
<td>6.25</td>
<td>5.35</td>
<td>4.95</td>
</tr>
<tr>
<td>Natural History</td>
<td>10.56</td>
<td>6.25</td>
<td>5.35</td>
<td>4.95</td>
</tr>
</tbody>
</table>


Conclusion

We found that dry needling provided statistically significant improvements in plantar heel pain, but the magnitude of this effect should be considered against the frequency of minor transitory adverse events.

Dry needling appears to be a useful adjunct to other therapies for chronic low back pain

Meta Review

Respectable database

Dry needling of latent MTrPs restores normal muscle activation patterns


Dry Needling

- Less severe and less frequent pain
- Less analgesic medication
- Restoration of normal sleep patterns
- Increased compliance with the rehabilitation program


What about the reliability of locating TrPs?

somasimple.com

- Dry needling is not appropriate since it is unknown what we are jamming a needle into. There is no solid evidence that the mythical trigger point exists. Therefore, how can you jab a needle into something that your not sure is even present? Also, there is no way to know that the tender point we are feeling has anything to do with the patient’s pain experience. In essence what we are doing is poking a foreign object into a patient to effect an area of muscle that we’re not sure has anything to do with someone’s pain. What happened to ‘do no harm’?
**Recommended Criteria**

- **Taut band** palpable (if muscle is accessible)
- **Exquisite spot tenderness** of a nodule in a taut band
- **Patient’s recognition of current pain** complaint by pressure on the tender nodule (identifies an active trigger point)

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**Reliability of Physical Examination for Diagnosis of Myofascial Trigger Points**

*A Systematic Review of the Literature*

Nicholas Lucas, BSc, MHeC; MPainMed*; Petra Massaili, BA, MAppStat, PhD*; Ling Ieong, MBCHB, PhD*; Robert Moran, BSc, MHeC; L; and Nidal Bqiah, MBBS, PhD, MD, DCh*

- Data on the reliability of physical examination for trigger points are conflicting
- Examiners are not representative of those who would normally use the test in practice
- Evidence for the diagnostic reliability of TrPs is available from only a limited number of studies

*Clinical Journal of Pain. 25(1), 2009*

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**Interrater Reliability**

![Graph showing interrater reliability](Image)

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**Clinical precision of myofascial trigger point location in the trapezius muscle**

Excellent precision in manually diagnosing and locating a latent myofascial trigger point in the trapezius muscle

*Sciotti et al: Pain 93 (2001): 259-266*
Experienced clinicians can reach acceptable agreement in the diagnosis of TrPs in three shoulder muscles.

Test-retest reliability of myofascial trigger point detection in patients with rotator cuff tendonitis

- Fifty-eight patients (31 males and 27 females) with rotator cuff tendonitis
- The presence or absence of the taut band, spot tenderness, jump sign and pain recognition was highly reliable between sessions.
- Referred pain and local twitch response reliability varied depending on the muscle being studied.

Intra-rater reliability of an experienced physiotherapist in locating myofascial trigger points in upper trapezius muscle

An experienced physiotherapist can reliably identify TrP locations in the upper trapezius muscle using a palpation protocol.
Identification of clinically relevant TrP(s) in the region of the upper trapezius musculature is a reproducible procedure.

• When performed by two experienced clinicians, agreement is substantial.
• A pairing of one experienced and one inexperienced observer, both of who have undergone a standardization protocol, can yield moderate agreement.

Multiple TrPs were identified in the infraspinatus muscle on the painful side

Multiple latent TrPs were identified bilaterally


What about the biomechanical aspects of trigger points?
20 minutes
The ultrasound system performed with high accuracy (100%) with the current collection of sample ultrasound images.

• Shear modulus measured with ultrasound SWE reduced post DN and in prone compared with sitting, in agreement with reductions in palpable stiffness.

• These findings suggested that DN and posture have significant effects on shear modulus of MTrPs, and that shear modulus measurement with ultrasound Shear Wave Elastography may be sensitive enough to detect these effects.


Objective Sonographic Measures for Characterizing Myofascial Trigger Points Associated With Cervical Pain
Jeffrey J. Ballyns, PhD, Joseph P. Shah, MD, Jennifer L. Hammond, BS, Teddiss Gebreab, BS, Lynn V. Gerber, MD, Siddhartha Sikdar, PhD
J Ultrasound Med 2011; 30:1331-1340

Office-Based Elastographic Technique for Quantifying Mechanical Properties of Skeletal Muscle
Jeffrey J. Ballyns, PhD, Pradeep Tolla, PhD, Paul Orin, BS, Joe P. Shah, MD, Jennifer Hammond, BS, Teddiss Gebreab, BS, Lynn V. Gerber, MD, Siddhartha Sikdar, PhD
J Ultrasound Med 2012; 31:1209-1219

Active TrPs are larger (0.35 – 0.40 cm²) than latent TrPs (0.27 cm²)

MTrP - Retrograde Blood Flow
What about the neurophysiological aspects of trigger points?

Unique Characteristics of Muscle Pain

- Muscle pain activates unique cortical structures


O₂ tissue saturation in TrPs


Unique Characteristics of Muscle Pain

- Muscle pain activates unique cortical structures
Strong activation of the anterior cingulate cortex and periaqueductal gray (PAG)

Myofascial Pain:
activates anterior cingulate cortex/periaqueductal gray (PAG)
— associated w/ affective-emotional pain component and w/ heightened attention to painful stimulus
Cutaneous Pain:
No involvement of the anterior cingular cortex


Unique Characteristics of Muscle Pain

- Aching, cramping pain, difficult to localize and referred to deep somatic tissues


Active trigger points induce larger referred pain areas and higher pain intensities than latent TrPs

Modified Convergence Projection Theory
Siegfried Mense, MD, PhD

Recording electrode
Stimulating electrode
GS-nerve
GS muscle
Inflammation

Referred Pain
Referred pain

A BEFORE
Non p. deep
Druckspannung, 85 ps.TA

B AFTER


Effects of Intramuscular Anesthesia on the Expression of Primary and Referred Pain Induced by Intramuscular Injection of Hypertonic Saline

Troy K. Rubin, Simon C. Gandevia,

the maintenance of referred muscle pain depends on ongoing noxious inputs from the site of primary muscle pain

The Journal of Pain, 10(8): 829-835, 2009

Repeated noxious stimuli over time decreases in local but increases in referred pain, suggesting central changes in processing noxious inputs.

Changes in the Spatiotemporal Expression of Local and Referred Pain Following Repeated Intramuscular Injections of Hypertonic Saline: A Longitudinal Study


O₂ tissue saturation in TrPs

Acidic pH has a profound effect on the initiation and perpetuation of muscle pain.
- A more acidic milieu may activate ASIC1 or ASIC3 muscle nociceptors, which in turn could produce mechanical hyperalgesia.
Myofascial Seminars – The Obvious Choice

Release of nociceptive substances

Low pH

CGRP
BK
ATP
5-HT
PG
Excessive ACh

Downregulates AChE

Microdialysis System

Microdialysis of TrPs with 0.3 mm needle

Delivery tubes

Solute exchange surface – dialyzer membrane set 0.2 mm from the needle tip

Fluid in

Fluid out


CGRP


• Dry needling can modulate biochemicals associated with pain, inflammation, and hypoxia
  • Dosage dependent

TrPs are persistent peripheral sources of nociceptive input, which excite muscle nociceptors and contribute to peripheral and central sensitization


β-endorphin, 
substance P 
tumor necrosis factor-α (TNF-α) 
cyclooxygenase-2 (COX-2) 
hypoxia-inducible factor 1-alpha (HIF-1α) 
inducible nitric oxide synthase (iNOS) 
vascular endothelial growth factor (VEGF)

Yueh-Ling Hsieh, Shun-An Yang, Chen-Chia Yang, and Li-Wei Chou: Dry Needling at Myofascial Trigger Spots of Rabbit Skeletal Muscles Modulates the Biochemicals Associated with Pain, Inflammation, and Hypoxia. Evidence-Based Complementary and Alternative Medicine, Volume 2012
A nociceptor is a receptor specialized in detecting stimuli that objectively can damage tissue and subjectively are perceived as painful.

Molecular Level

Mense
The Pathogenesis of Muscle Pain
Current Pain and Headache Reports
2003, 7:419-425

Peripheral Sensitization

Central Sensitization

Secondary Hyperalgesia
(Referred Pain)

Hyperalgesia

Allodynia

TrP


Central Sensitization

Disinhibition is a major mechanism for triggering and maintaining central sensitization

Central De-Sensitization

Goal of treatment:
remove persistent nociceptive input to produce desensitization

Contribution of Myofascial Trigger Points to Migraine Symptoms

Maria Adele Giambenedino, Emmanuele Tafuri, Antonella Sozzi, Alessandra Fabrizio, Giannopila Affatati, Rosanna Lerza, Livio Di Ianni, Domenico Lapenna, and Andrea Mezzetti

Headache Center, Department of Medicine and Science of Aging, "G. D'Annunzio" University Chieti, Italy.

Migraine sites coincide with referred pain from TrPs

Pain is often contributed to by TrPs that enhance the level of central neuronal excitability


Enhanced central pain processing of fibromyalgia patients is maintained by muscle afferent input: A randomized, double-blind, placebo-controlled study


Multiple active MTrPs (7.4 ± 2.2) were identified bilaterally in FMS patients, but no active MTrPs were found in controls.

PAIN 147 (2009) 233–240
In fibromyalgia patients, local treatment of trigger points not only relieves local symptoms but also significantly improves the widespread FS symptoms in terms of reduction of both spontaneous diffuse pain and tenderness at all tender point sites.

What else is known about TrPs?

Integrated Trigger Point Hypothesis

[Diagram of integrated trigger point hypothesis]
Innervation zones and trigger points are located in well-defined areas in upper trapezius muscle.

- The degree of endplate noise is directly related to the irritability (sensitivity) of TrPs
- Active TrPs are spontaneously sensitive
- Latent TrPs require digital stimulation

The prevalence of EPN in the TrP regions was significantly higher (P < 0.01) in active TrPs than in latent TrPs
- The pain intensity and the pressure pain threshold were highly correlated with the prevalence of EPN in the TrP region (r=0.742 and -0.716, respectively)

Skin, subcutis and muscle

- Significant lowering of pain thresholds to electrical stimuli at both TrP and target levels at the baseline in muscle, skin and subcutis associated with active TrPs.
- Following treatment of the TrP all thresholds increased not only at the TrP site but also in the target site, and, thus, indirectly validated the interdependence of sensory changes at this level with the trigger activity.


Spatial Pain Propagation Over Time Following Painful Glutamate Activation of Latent Myofascial Trigger Points in Humans

Chao Wang,* † Hong-You Ge,* † José Mota Ibarra,* † Shou-Wei Yue,† Pascal Madeleine,* and Lars Arendt-Nielsen*

- TrPs are associated with an early occurrence of a locally enlarged area of pressure hyperalgesia associated with spreading central sensitization.
- Inactivation of TrPs may prevent spatial pain propagation.

The Journal of Pain, Vol 13, No 6, 2012:537-545
Eliciting a LTR

- The best results are accomplished when needling elicits a LTR
- The electrical discharge is most significant at the MTrP
- In the taut band, away from the MTrP, the LTR is much weaker:


- Ultrasonography was helpful for detecting LTRs in deeper muscles that were missed on visual inspection
- In addition, alleviation of pain was more significant when LTRs were elicited by using trigger point injection


61.5%


How does dry needling work?
Myofascial Seminars – The Obvious Choice

**Exact Mechanism is unknown**

**Mechanical**
- May prevent loss of strength, coordination, proprioception, etc

**Neurophysiological**
- Reduction of local and referred pain (secondary hyperalgesia)
- Local twitch response is a spinal cord reflex that results in immediate release of muscle hypertonicity

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**Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture**

ATP is released in response to either mechanical and electrical stimulation or heat

ATP acts as a transmitter that binds to purinergic receptors, including P2X and P2Y receptors

ATP is rapidly degraded to adenosine by several ectonucleotidases before re-uptake

Adenosine acts as an analgesic agent that suppresses pain through Gi-coupled A1-adenosine receptors

Adenosine is involved in the anti-nociceptive effects of acupuncture

Goldman et al. *nature NEUROSCIENCE* VOLUME 13 | NUMBER 7 | JULY 2010

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**Biochemical**

Dry needling with a LTR results in favorable biochemical effects, which remove nociceptive input and reduce pain

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**The Influence of Dry Needling of the Trapezius Muscle on Muscle Blood Flow and Oxygenation**

Barbara Caprio, PT, PhD,1 Tom Barre, PT,1 Binx De Reiter, PT,1 Torica Van Oosterhout, PT, PhD,1 Amy Case, PT, PhD,1 and Steven Stevens, PT, PhD,1

Dry needling enhances the blood flow in the stimulated region of the trapezius muscle

Journal of Manipulative and Physiological Therapeutics 35(9): 685-691, 2012
Possible Adverse Side Effects

- Soreness (typically 1 h - 2 days)
- Slight bleeding / bruising
- Fatigue
- Fainting / Lightheadedness
- Pneumothorax

Common Adverse Events:

(1-10/100)

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<tr>
<th>Adverse Event</th>
<th>Number</th>
<th>No per 100 treatments</th>
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<tbody>
<tr>
<td>Bleeding</td>
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<td>7.75</td>
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<tr>
<td>Bruising</td>
<td>325</td>
<td>4.88</td>
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<tr>
<td>Pain during treatment</td>
<td>219</td>
<td>3.29</td>
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<tr>
<td>Pain after treatment</td>
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Uncommon Adverse Events (1-10/1000)

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<td>Aggravation of symptoms</td>
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<tr>
<td>Drowsiness</td>
<td>17</td>
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<tr>
<td>Feeling faint</td>
<td>13</td>
<td>1.95</td>
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<tr>
<td>Nausea</td>
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<tr>
<td>Headache</td>
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Rare (1-10/10,000)

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<td>Fatigue</td>
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<td>Emotional</td>
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<tr>
<td>Itching</td>
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<tr>
<td>Numbness</td>
<td>1</td>
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<tr>
<td>Shaky</td>
<td>1</td>
<td>1.5</td>
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Risk of a significant adverse event by physiotherapists:

0.04%

Risk of a significant adverse event with

- Aspirin: 18.7%
- Ibuprofen: 13.7%
- Paracetamol: 14.5%
If pain is a puzzle, we should not throw away pieces of the jigsaw just because we are obsessed with a preconceived single solution

Patrick Wall