




Dry Needling: An Emerging Technique in Physical Therapist Practice

Dry Needling: An Emerging Technique in Physical Therapist Practice

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ACKNOWLEDGEMENTS
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 LTC Shane Koppenhaver, PT, PhD, OCS, FAAOMPT
 CPT Ronald (Kane) McAndrew, PT, DPT, OCS

PAIN

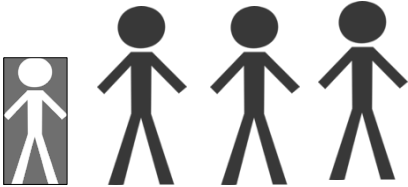
#1 cause of adult disability in the US

PAIN

1 in 6 people live with chronic pain



75% adjustments to their lifestyle because of pain



Trigger Point Dry Needling

What do you know? How do you know that?


Claim + Evidence + Reasoning = Explanation

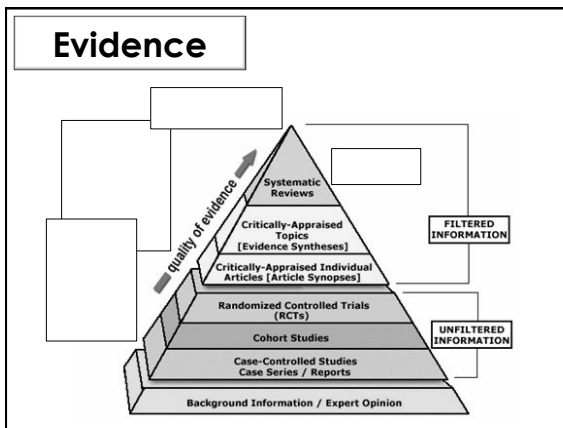
Why does your evidence support your claim?

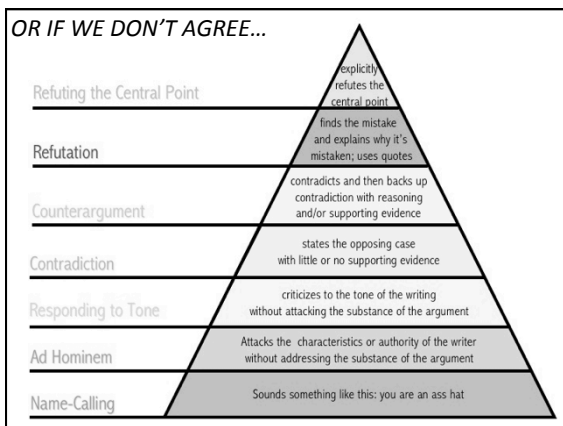
Objectives

1. Does it work?

2. Is it safe?







Effectiveness

Are there conditions where the use of a monofilament needle to pierce the skin provides some benefit?

Acupuncture for pain: An overview of Cochrane reviews

Chinese Journal of Integrative Medicine
March 2011, Volume 17, Issue 3, pp 187-189

Table 1. Cochrane Reviews of Acupuncture for Pain Conditions

First author	Condition	Number of RCTs	Quality of RCTs	Quality of review	Conclusion (quote)	Result
Mathiheimer (2010) ¹⁰ US	Peripheral joint osteoarthritis	16	Variable	Excellent	... significant benefits	+
Linde (2009) ¹⁰ Germany	Migraine prophylaxis	22	Variable	Excellent	...as effective as, or possibly more effective than, prophylactic drug treatment...	+
Linde (2009) ¹¹ Germany	Tension-type headache	11	Variable	Excellent	...could be valuable...	+
Trink (2006) ¹¹ Canada	Neck disorder	10	Variable	Excellent	...moderate evidence...	+
Casimiro (2005) ¹⁰ Canada	Rheumatoid arthritis	2	Poor	Excellent	...preclude its recommendation	-
Green (2005) ^{10b} Australia	Shoulder pain	9	Variable	Excellent	... little evidence...	+/-
Fulan (2005) ^{10c} Canada	Low back pain	35	Variable	Excellent	...may be useful...	+/-
Green (2002) ^{10d} Australia	Lateral elbow pain	4	Variable	Excellent	... insufficient evidence...	+/-

Notes: RCT: randomized clinical trial; +: positive; -:negative; +/-: inconclusive

Acupuncture vs. TDN

Acupuncture

- Eastern (traditional)
 - Meridians, Energy flow, Qi
- Western (medical)
 - Incorporates a neuroanatomical basis for site selection & a neurophysiological basis for treatment effects

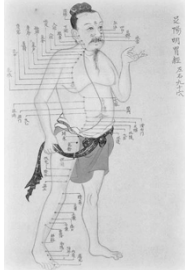
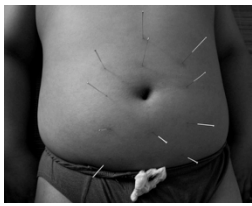
The 12 Meridians

- Lung
- Large Intestine
- Stomach
- Spleen/Pancreas
- Heart
- Small Intestine
- Bladder
- Kidney
- Heart/Governing
- Triple Burner
- Gall Bladder
- Liver

TDN


- Focused on skeletal muscles
- Especially intramuscular trigger points

Zhen Ci Yan Jiu, 2011 Apr;36(2):137-44.
[A systematic review of randomized controlled clinical trials of abdominal acupuncture treatment of cervical spondylosis].
 [Article in Chinese]
 Wang YW, Fu WB, Qu AH, Fan L, Huang YE.

Traditional Acupuncture Guided by Meridians, Energy flow, Qi



Effectiveness
 Are there conditions where TDN provides benefit?



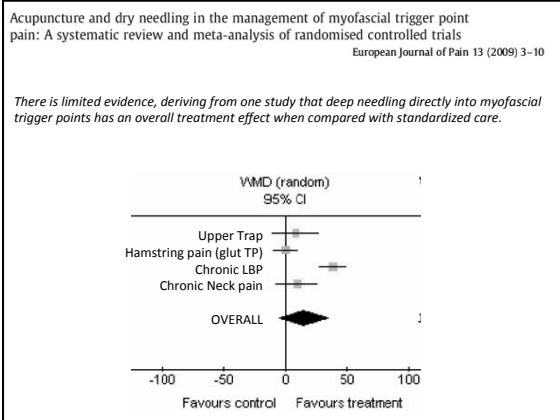
REVIEW ARTICLE Arch Phys Med Rehabil Vol 82, July 2001

Needling Therapies in the Management of Myofascial Trigger Point Pain: A Systematic Review

T. Michael Cummings, MB, ChB, Adrian R. White, BM, BCh

- Included 23 papers
- **Conclusions**
 - ...appears to be an **effective treatment**
 - Any effect of these therapies is likely because of the **needle or placebo rather than the injection** of either saline or active drug.
 - ...efficacy beyond placebo is neither supported nor refuted
 - Controlled trials are needed to investigate whether needling has an effect beyond placebo.”



Effectiveness of acupuncture/dry needling for myofascial trigger point pain
Physical Therapy Reviews 2011 VOL 16 NO. 2

First author (year)	Total n allocated	Population	Acupuncture/dry needling interventions	Control/comparator	Reported outcome* (#-intervention, C-control)
Exclusion criteria: Active control Sui (2007) ²⁰	40	Elderly patients. Myofascial pain upper trapezius	Direct acupuncture needling of clinically identified MTrPs in upper trapezius	Direct acupuncture needling of clinically identified MTrPs in upper trapezius plus needling paraspinous muscle points	* resulted in more continuous subjective pain reduction than C
Sui (2007) ²⁰	39	Elderly patients. Regional myofascial pain with active MTrPs in upper trapezius	Direct acupuncture needling of clinically identified MTrPs in upper trapezius	0.5% lidocaine injection directly into MTrP	No significant between-group difference (P=0.8). Both groups reported significant reduction in pain at end of treatment (P<0.001)
Navez-Palmares (2008) ²¹	122	None specific chronic LBP	Direct acupuncture needling of clinically identified trigger points (upper and lower trapezius)	Percutaneous electrical nerve stimulation	No between-group mean difference (P=0.5). Both groups reported comparable reduction in pain
Nerando (2008) ²²	45	Headaches triggered by palpation of MTrPs located in head and neck muscles	Direct MTrP needling with a syringe	Direct MTrP injection with 0.25% lidocaine	Significant reduction in pain in all three groups at 12 weeks (P<0.05)
Nerando (2008) ²²	45	Headaches triggered by palpation of MTrPs located in head and neck muscles	Direct MTrP needling with a syringe	Direct MTrP injection with 0.25% lidocaine associated with cortisol Direct MTrP injection with 0.25% lidocaine Direct MTrP injection with botulinum toxin	* significant reduction in pain at 12 weeks (P<0.05) * significant reduction in pain in both groups at 12 weeks (P<0.05) No between-group mean difference
Infused needling Ohou (2008) ²³	20	Patients with chronic pain in shoulder region with clinically identified MTrPs in upper trapezius	Acupuncture needle inserted aseptically into classic acupuncture points: Weiguan (TE4) and Quchi (LI11) but using a 'tapirone pecking' technique to stick in and a LTR at the site of the acupoint	Buried needle held in place using an adhesive rubber connector and left in situ	* superior to C (P<0.5)
Shen (2007) ²⁴	15	Chronic myofascial jaw pain	Acupuncture needling of LI4 (Hegu) classic acupuncture point	Sham non-penetrating acupuncture at the site of LI4 (Hegu)	* superior to C (P<0.027)
Tan (2010) ²⁵	35	Patients with pain and clinically identified MTrPs in upper trapezius	Acupuncture needling of clinically identified MTrPs in anterior/carp radialis longus muscle NOT	Sham non-penetrating acupuncture at the site of clinically identified MTrPs in anterior/carp radialis longus muscle	* mean pain intensity significantly reduced immediately following treatment* compared with C

REVIEW Open Access
JOURNAL OF FOOT AND ANKLE RESEARCH

Effectiveness of dry needling and injections of myofascial trigger points associated with plantar heel pain: a systematic review

Matthew P. Cozzetti^{1,2}, Karl B. Landorf², Shannon E. Munteanu^{1,2}

- Results:
 - 3 quasi-experimental trials included
 - All found reduction in pain
- Conclusion
 - There is limited evidence for the effectiveness of dry needling and/or injections of MTrPs associated with plantar heel pain.
 - However, the poor quality & heterogeneous nature of the included studies precludes definitive conclusions being made.

Plantar heel pain

REVIEW Open Access

Effectiveness of dry needling and injections of myofascial trigger points associated with plantar heel pain: a systematic review

Matthew P. Cochet^{1*}, Karl B. Lindorf², Shannon E. Munsau^{1,2}


Two of the included trials combined trigger point dry needling with acupuncture.

While the two techniques have a number of similarities they are vastly different conceptually.

Furthermore, an assessment of the effectiveness of trigger point dry needling and/or injections might be problematic when it is combined with acupuncture as it makes it difficult to isolate the effectiveness of either technique.

Short-term efficacy of physical interventions in osteoarthritic knee pain. A systematic review and meta-analysis of randomised placebo-controlled trials

BMC Musculoskeletal Disorders 2007, 8:51



Study or sub-category	N	Treatment Mean (SD)	N	Control Mean (SD)	WMD (fixed, 95% CI)
01 Electroacupuncture	25	25.00 (12.00)	25	8.00 (8.90)	
Yoshida 9	48	48.00 (24.30)	47	28.00 (24.20)	
Sangster	48	89.00 (21.40)	49	28.40 (28.20)	
Yan	121		121		
Subtotal (95% CI)					◆

Test for heterogeneity: $\chi^2 = 1.07$, $df = 2$ ($P = 0.59$), $I^2 = 0\%$
 Test for overall effect: $Z = 9.32$ ($P < 0.0001$)

-100 -50 0 50 100
 Favours control Favours treatment

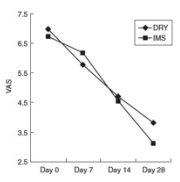
Dry Needling of Trigger Points with and Without Paraspinal Needling in Myofascial Pain Syndromes in Elderly Patients

THE JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE
 Volume 13, Number 6, 2007, pp. 617-623

Single-blinded, randomized controlled trial

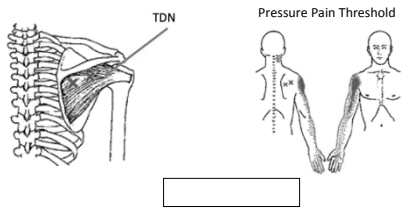
Subjects: Forty (40) subjects, between the ages of 63 and 90 with myofascial pain syndrome of the upper trapezius muscle.

Interventions: DRY Group treated with dry needling of all the TrPs. The IMS Group received the same plus additional paraspinal needling at C3-C5 multifidus.



Dry Needling to a Key Myofascial Trigger Point May Reduce the Irritability of Satellite MTrPs Am J Phys Med Rehabil; Vol 86, 2007

14 subjects with bilateral shoulder pain



TDN to infraspinatus

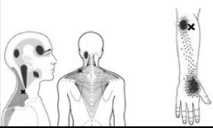
- increased PPT at the deltoid and extensor carpi radialis longus
- increased shoulder ROM and decreased shoulder pain

Remote Effects of Dry Needling on the Irritability of the Myofascial Trigger Point in the Upper Trapezius Muscle Am J Phys Med Rehabil 2010;89:133-140.

35 people with active Upper Trap TPs

R

Sham TDN | TDN to TP in the extensor carpi radialis longus




RESULTS

- Neck ROM increased
- Neck Pain decreased
- PPT increased

Effectiveness

Are there conditions where TDN provides benefit?

- Limited evidence of effectiveness (RCT, SR) for
 - Chronic LBP
 - Heel Pain
 - Myofascial Pain in Elderly
 - Knee Pain (Combined with E-Stim)
- Emerging studies (case reports, case series) suggesting possible benefits for
 - Lateral Epicondylalgia
 - Neck Pain
 - Shoulder Pain



Ongoing Research

Can we match the right patient with the right treatment?

Baseline Examination Factors Associated with Clinical Improvement after Trigger Point Dry Needling in Patients with Low Back Pain
 Koppenhaver SL, Walker MJ, Smith RW, Booker JM, Walkup ID, Su J, Ross MD, Flynn TW
 Center for Physical Therapy Research, U.S. Army-Baylor University Doctoral Program in Physical Therapy, Fort Sam Houston, TX, USA

N= 68
 Mean Age= 42
 Mean ODI = 32

Baseline History & Physical Exam

- History
- Subjective questionnaires (ODI, NPRS, FABQ)
- NPRS
- Standard neuro-musculoskeletal evaluation

Dry Needling Treatment

- 2-3 sec insertions using "sparrow pecking" technique
- Bilateral LM at L3/4, L4/5, and L5/S1 to depth of lumbar lamina
- Target "taut" bands of tissue

1 Week Follow up

- Follow up physical exam
- ODI score
- Clinical improvement based on % change in ODI.

1 week later

Results

3 variables best predicted clinical improvement after TDN


Pain with Contralateral Arm Lift


Palpable Contraction with Contralateral Arm Lift

No Aggravation with Standing

$R^2 = 0.20, p= 0.001$

What About Risks?





Safety of Acupuncture: Results of a Prospective Observational Study with 229,230 Patients and Introduction of a Medical Information and Consent Form

Claudia M. Witt* Daniel Pach* Benno Brinkhaus* Katja Wruck* Brigitte Tag* Sigrid Mank* Stefan N. Willich* Forsch Komplementmed 2009;16:91-97

Common		Uncommon	
Bleeding/hematoma	6.14%	Local infection	0.01%
Pain	2.04%	Vertigo	0.22%
Fatigue	1.15%	Nausea	0.15%

Rare			
Pneumothorax	0.001%	2 cases	0 required treatment
Systemic Infection	0.001%	5 cases	3 required treatment
Nerve Injury	0.014%	31 cases	18 required treatment


Spine SPINE Volume 36, Number 13, pp E891-E893
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CASE REPORT

An Acute Cervical Epidural Hematoma as a Complication of Dry Needling

Jun-Hwan Lee, KMD, PhD* Hyangsook Lee, KMD, PhD,† and Dae-Jean Jo, MD, PhD‡

- 58 y/o woman received TDN to neck and arm by Family Practice MD
- Experienced sudden weakness and n/t of right arm & leg 1 hour after TDN
- Presented to ER 5 hours later with quadriparesis and neck pain





Underwent emergency decompressive laminectomy

Risk Perspective

Rare			
Pneumothorax	0.001%	2 cases	0 required treatment
Systemic Infection	0.001%	5 cases	3 required treatment
Nerve Injury	0.014%	31 cases	18 required treatment

- Risk of vertebral artery dissection with cervical manipulation ≈ 0.0001 (1 in 1 million) Cleland 2007
- Risk of sudden death from exercise ≈ 0.001 (1 in 100,000) Thompson 1996



Risk in Context



Intervention	Reported Risk per 10,000	Potential Complication
Cervical Spine Manipulation <i>Low Estimate</i>	0.005	Paralysis, Stroke, Death
Vigorous Exercise	0.002	Sudden Death
Cervical Spine Manipulation <i>High Estimate</i>	0.9	Paralysis, Stroke, Death
NSAIDS	100 – 300	GI bleed
NSAIDS- with developed bleed	20	Death
Acupuncture	0.001	Pneumothorax or Systemic Infection
Acupuncture	0.014	Nerve Injury

CLINICAL REVIEW 640 JABFM September-October 2010 Vol. 23 No. 5

Dry Needling in the Management of Musculoskeletal Pain



Leonid Kalichman, PT, PhD, and Simon Vulfsons, MD


JABFM
JOURNAL OF THE AMERICAN BOARD OF FAMILY MEDICINE

Dry needling is a treatment modality that is minimally invasive, cheap, easy to learn with appropriate training, and carries a low risk.


Tim's Opinion

- In conditions with a solid evidence base start with the evidence
- Trial of TDN if above fails
- Combining TDN with usual or best care
- A clear rationale and expected response should support your use
- The history of PT is wrought with bandwagons...if you think it is "the magic bullet" then...



Questions?



A Curriculum for Dry Needling in an Entry Level Professional DPT Program

Joe Donnelly, PT, DHS, OCS
Clinical Associate Professor
Department of Physical therapy
Mercer University

Curriculum

- OSHA blood borne pathogens and sharps handling
- Gross Anatomy
- Applied anatomy
- Foundational musculoskeletal sciences
- Neuroscience
- Management of the patient/client with musculoskeletal conditions I and II
- Neuromusculoskeletal Interventions I, and III
- Psychosocial considerations

Gross and Applied Anatomy

- Muscles of the appendicular and axial skeleton and, peripheral nervous system structures are learned
- Palpation as a test and measure is taught and valued
- Competency assessment



Pedagogy

- Collaborative Clinical Reasoning
 - Reasoning Strategies
 - Diagnostic
 - Narrative
 - Forward
 - Ethical problem solving
 - Management strategies
 - Clinical pattern development
 - Foundational musculoskeletal sciences
 - Management of Musculoskeletal Conditions I and II
 - Neuromusculoskeletal Interventions I and III



Clinical Reasoning Hypothesis Categories

- Activity limitations and participation restrictions
- Patient's perspectives on their experiences
- Pathobiological mechanisms
- Physical Impairments and associated structure or tissue sources (sources of symptoms)
- Contributing factors
- Precautions / contraindications
- Management and interventions
- Prognosis



Myofascial Pain Clinical Patterns

- | | |
|---------------------------------|------------------------|
| • Migraines | • Neck pain |
| • Tension type headaches | • CTS |
| • TMJ dysfunction | • Radiculopathy |
| • Epicondylalgia | • WAD |
| • LBP | • FMS |
| • Post laminectomy syndrome | • CRPS |



Foundational Musculoskeletal Sciences

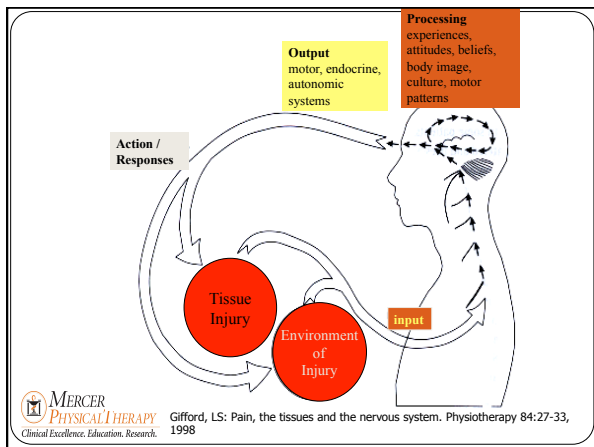
- Muscle response to injury
 - Pathophysiology of Active and Latent MTrP's
- Physical stress theory
 - Bracing, taping and splinting
- Clinical reasoning
 - Development of clinical patterns
- Application of anti-inflammatory modalities (thermal, ionto, US)
- Neurogenic vs non-neurogenic inflammation

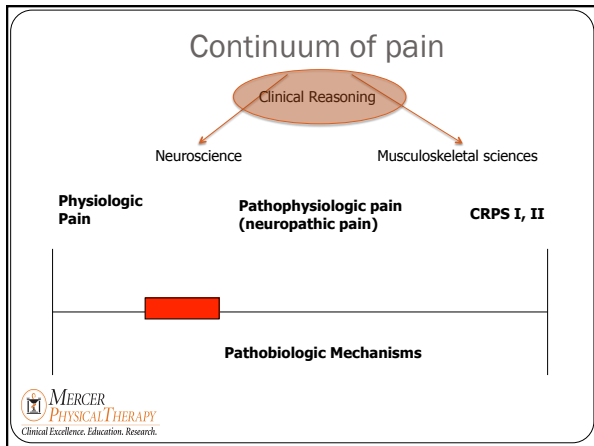


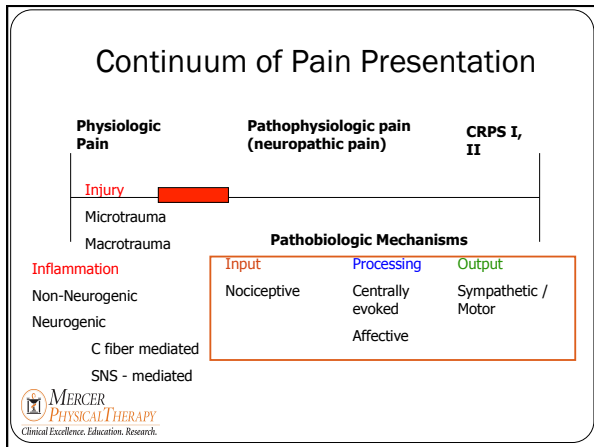
Neuroscience

- Somatosensory system
- Current theories of the anatomical, physiological, and psychological basis of pain and pain relief.
- Muscle and its role in nociception
- Peripheral sensitization
- Central sensitization
- Continuum of pain
- Neurogenic inflammation









Management of patients/clients with Musculoskeletal Conditions I, II

- Clinical reasoning and pain sciences
- Clinical Pattern development
 - Glut max, med, min, piriformis, multifidus, QL, longissimus, iliocostalis, Quads, RF, Adductors, Gastroc, soleus, tib post, foot intrinsics.
- Orthopaedic examination scheme
- Grand rounds presentations

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Psychosocial considerations

- Distinction among acute, recurrent, and chronic pain
- Psychological and behavioral components of pain experience and relationship to acute or chronic nature of pain
- Anxiety, fear, crisis reactions, stress
- Impact on spirituality and meaningfulness, hope and hopelessness
- Psychological effect of unrelieved pain on perceptions of control and self-efficacy
- Depression, wish to die, suicidal risks
- Impact of persistent pain on habits, roles, occupational performance, and future quality of life



Neuromusculoskeletal Interventions I and III

- Manual therapy techniques
 - STM, MTrP release, spray and stretch
 - Thrust/ non-thrust manipulations
- Functional retraining
- PNF
- Bracing, taping, kinesiotaping
- Dry Needling



A Curriculum for Dry Needling in a Residency in Orthopaedic Physical Therapy Program

Mercer University
Department of Physical Therapy
Post-professional Programs
Residency in Orthopaedic Physical Therapy
Residency in Neurologic Physical Therapy
Fellowship in Physical Therapist Education



Curriculum

- Foundations of Orthopaedic Physical Therapy
- Basic Spine
- Basic extremity
- Advanced spine
- Advanced extremity
- CI credentialing
- Teaching entry level DPT
- Practice management and healthcare policy



Curriculum

- Foundations of Orthopaedic Physical Therapy
 - ✓ Collaborative clinical reasoning
 - ✓ Orthopaedic examination
 - ✓ Pain Sciences
 - ✓ Biomechanics of tissue and response to stress
 - ✓ Pathophysiology MTRP's
 - ✓ OSHA blood borne pathogens and sharps handling
- Basic Spine
 - Grand rounds presentations
 - Clinical reasoning forms
- Basic extremity
 - Grand rounds presentations
 - Clinical reasoning forms



Curriculum

- Advanced Spine
 - Clinical reasoning reflection
 - Thrust manipulation
 - Diagnostic imaging
- Advanced extremity
 - Clinical reasoning reflection
 - Thrust manipulation
 - Pain sciences role of muscle nociception
 - Dry needling of extremity muscles



Dry Needling: An Emerging Technique in Physical Therapist Practice



- Jan Dommerholt, PT, DPT
Joseph M. Donnelly, PT, DHS, OCS;
Timothy W. Flynn, PT, PhD, OCS,
FAAOMPT

Objectives

1. Identify key components of myofascial pain and dysfunction
2. Discuss the differences and similarities between active and latent myofascial trigger points
3. Discuss dry needling in the context of pain sciences
4. Compare and contrast various dry needling approaches



Is Dry Needling within the Scope of Physical Therapy Practice?

Scope of PT Practice

Australia
Belgium
Canada
Chile
Denmark
Ireland
The Netherlands

New Zealand
Norway
South Africa
Spain
Sweden
Switzerland
US (most states)
among others

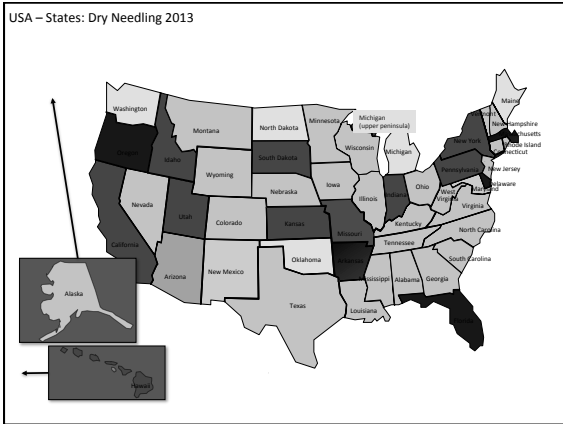
1997 – first formal dry needling course in the United States

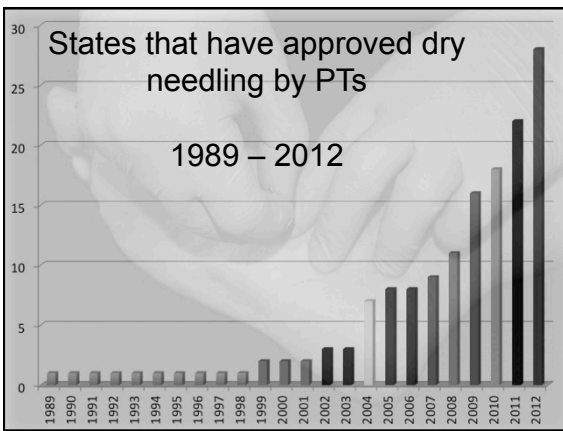
Janet G. Travell, MD Seminar Series



Maryland was the first state to approve dry needling in 1984





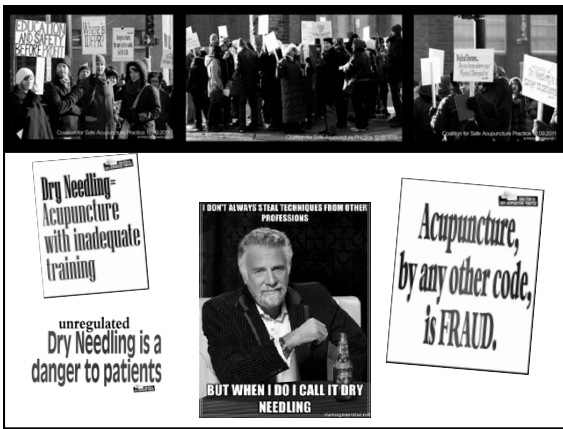


Physical Therapists & the Performance of Dry Needling
An Educational Resource Paper

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.

Produced by the APFA Department of Practice and APFA State Government Affairs
January 2012
#17 page





World Health Organization Definitions of Acupuncture and Specific Techniques

Traditional Term and WHO Coding	Pin Yin	Definition
5.1.53 Acupuncture Point	腧; 腧法	the insertion of needles into humans or animals for remedial purposes or its methods
5.1.55 Extra Points	經外奇穴; 奇穴	acupuncture points not located on the meridians, also known as non-meridian point
5.1.68 Ouch Point	阿是穴; 天應穴	an acupuncture point with no specific name nor definite location, the site of which is determined by tenderness or other pathological responses, also known as the <i>ashi</i> point
5.1.127 Lifting-Thrusting Method	提插法	a needle manipulation involving lifting and thrusting the needle
5.1.168 Intermuscular Needling	分刺	an ancient needling method by puncturing directly into the muscle
5.1.219 Acupuncture Point Injection	穴位注射	injection of liquid medicine into the acupuncture point
5.1.225 Trigger Point Needling	發痛點刺鍼	a type of acupuncture in which the trigger points are needled for therapeutic purposes

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'?
- People who are willing to use **dry needling** don't want to learn to use their hands... maybe they don't really like "feeling" other people's nervous systems change - they want to always keep some kind of physical object between them and it - maybe they see the "object" as "objective"



Dry Needling Approaches

- Not all techniques are created equal



International Federation of Orthopaedic Manipulative Physical Therapists

The application of OMT is based on a comprehensive assessment of the patient's NMS system and of the patient's functional abilities. This examination serves to define the presenting dysfunction(s) in the articular, muscular, nervous and other relevant systems;

www.ifompt.com

Clinical reasoning

a process in which the therapist, interacting with the patients and significant others, structures meaning, goals and health management strategies based on clinical data, client choices and professional judgment and knowledge

Jones MA, Rivett DA. (2004) Clinical reasoning for manual therapists. Edinburgh: Butterworth Heinemann

Paradigm Shift

external clinical evidence can inform, but not replace individual clinical expertise

- Evidence – based physical therapy



- **Evidence – informed Physical therapy**

Pencheon D: What's next for evidence-based medicine? *Evidence-Based Healthcare Public Health*, 2005, 9:319-321

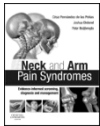
Muscle pain always follows

- Joint injury or dysfunction
- Nerve injury or dysfunction

Muscle pain is irrelevant as pain is produced by the brain

Endodontist

- Nearly perfect ergonomics, shoulders low, forearms supported, wrists in slight extension
- But.....severe neck and shoulder pain

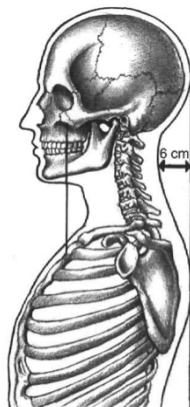


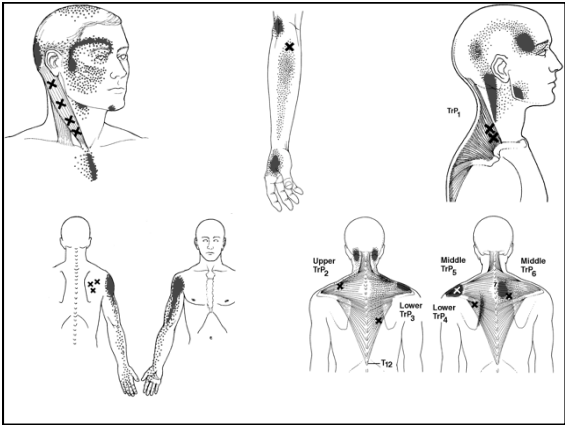
Franssen, J., C. Bron, J. Dommerholt: Myofascial Trigger Points in the Workplace.
In Fernández-de-las-Peñas, C., J.A. Cleland, P. Huijbregts: Neck and Arm Pain Syndromes: Evidence-Informed Screening, Diagnosis, and Management.
Elsevier, 2011: Chapter 6:78-93

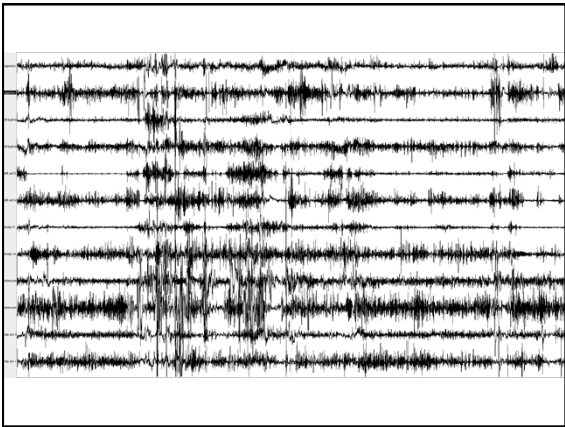
Perfect Posture

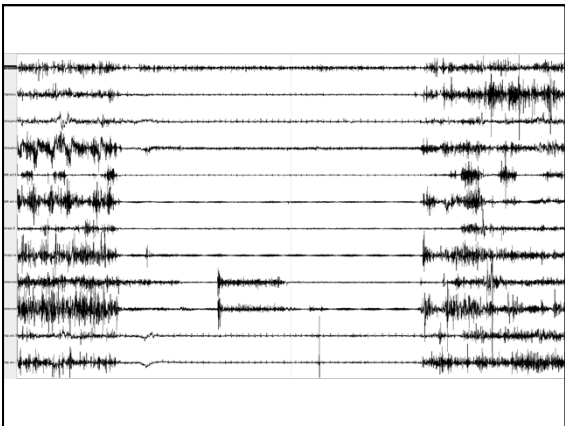
- Proper spinal alignment
- Normal curvature
- No forward head posture

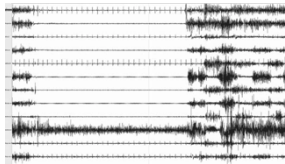
No guarantee



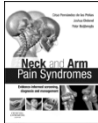








Cytological Analyst: Pain neck/shoulders/arms with multiple TrPs



Franssen, J., C. Bron, J. Dommerholt: Myofascial Trigger Points in the Workplace.
 In Fernández-de-las-Peñas, C., J.A. Cleland, P. Huijbregts: Neck and Arm Pain Syndromes: Evidence-Informed Screening, Diagnosis, and Management.
 Elsevier, 2011: Chapter 6:78-93

Unique Characteristics of Muscle Pain

- *Aching, cramping* pain, difficult to localize and *referred* to deep somatic tissues
- Muscle pain *activates unique cortical* structures
- *Inhibited* more strongly by descending pain-modulating pathways
- Activation of *muscle* nociceptors is much more *effective* at inducing *neuroplastic* changes in dorsal horn neurons

Strong activation of the anterior cingulate cortex and periaqueductal gray (PAG)

Myofascial Pain:

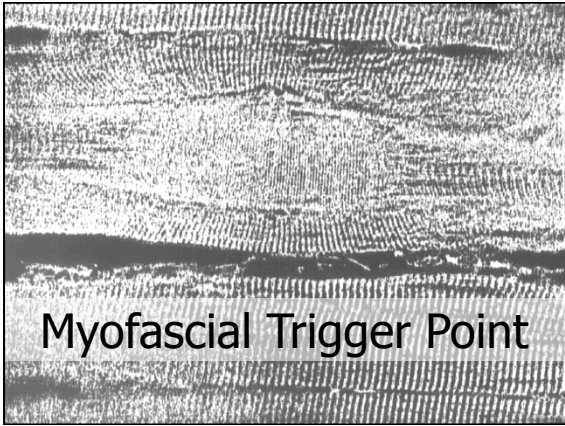
activates anterior cingulate cortex/ periaqueductal gray (PAG)
 → associated w/ affective-emotional pain component and w/ heightened attention to painful stimuli

Cutaneous Pain:

No involvement of ant. cing. cortex.

Svensson P, Minoshima S, Beydoun A, Morrow TJ, and Casey KL, Cerebral processing of acute skin and muscle pain in humans. J Neurophysiol. **78**(1): 450-60, 1997

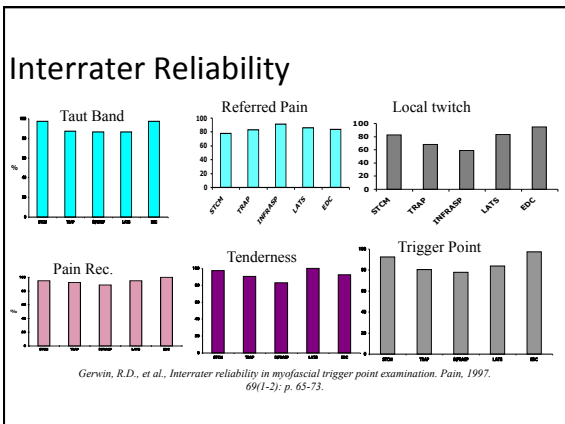
Niddam DM, Chan RC, Lee SH, Yeh TC, and Hsieh JC, Central modulation of pain evoked from myofascial trigger point. Clin J Pain. **23**(5): 440-8, 2007



Reliability of Physical Examination for Diagnosis of Myofascial Trigger Points
A Systematic Review of the Literature
 Nicholas Lucas, BSc, MHS, MPainMed*†, Petra Macaskill, BA, MAppStat, PhD,‡
 Les Irwig, MBCh, PhD,† Robert Moran, BSc, MHS,‡
 and Nikolai Bogduk, MBBS, PhD, MD, DSc§

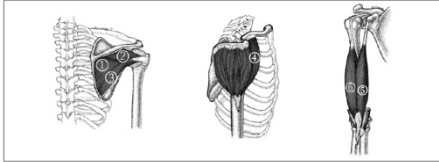
- Data on the reliability of physical examination for trigger points are conflicting
- Examiners are not representative of those who would normally use the test in practice
- Evidence for the diagnostic reliability of TPs is available from only a limited number of studies

Clin J Pain. 25(1), 2009



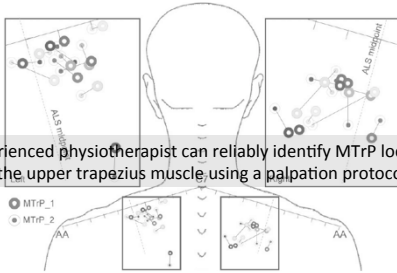
Interrater Reliability of Palpation of Myofascial Trigger Points in Three Shoulder Muscles

Carol Bron, PT, MT
Jo Franssen, PT
Michel Wensing, PhD
Rob A.B. Oostendorp, PhD, PT, MT



The Journal of Manual & Manipulative Therapy
Vol. 15 No. 4 (2007), 203-215

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



An experienced physiotherapist can reliably identify MTrP locations in the upper trapezius muscle using a palpation protocol

Barbero et al J Manual Manipulative Ther. Vol 20 (4):171-177, 2012



Original article
Standardized manual palpation of myofascial trigger points in relation to neck/shoulder pain; the influence of clinical experience on inter-examiner reproducibility

Corrie Myburgh^{a*}, Henrik Hein Lauridsen^{a,b}, Anders H. Larsen^c, Jan Hartvigsen^a

- Identification of clinically relevant TP(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.

MSc Veterinary Physiotherapy

Mapping the Location Pattern of Myofascial Trigger Points in the Superficial Musculature of Racing Greyhounds

Roddy McConnell

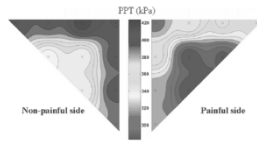
23 racing greyhounds (19 dogs; 4 bitches; aged 1.8-5.5 years; mean age 3.4 years) from 4 race kennels in the Republic of Ireland

- ✦ High MTrP density was found in key propulsive muscles in the greyhound in particular the biceps femoris, triceps brachii and gastrocnemius, which is in line with other research in the field
- ✦ There was no significant link established between canine lameness and MTrP incidence ($p > 0.05$)

Topographical mapping and mechanical pain sensitivity of myofascial trigger points in the infraspinatus muscle

Hong-You Ge ^{a,*}, César Fernández-de-las-Peñas ^b, Pascal Madeleine ^a, Lars Arendt-Nielsen ^a

- Multiple MTrPs were identified in the infraspinatus muscle on the painful side
- Multiple latent MTrPs were identified bilaterally



European Journal of Pain 12 (2008) 859–865

► Chen Q, Bensamoun SF, Basford JR, Thompson JM, An KN. Identification and Quantification of Myofascial Taut Bands with Magnetic Resonance Elastography. *Arch Phys Med Rehab* **2007**, 88:1658-61.

► Chen Q, Basford JR, An KN. Identification of Myofascial Taut Band Using Magnetic Resonance Elastography. *Clin Biomech* **2008**, 23 :623-9.

Sikdar S, et al. Novel Applications of Ultrasound Technology to Visualize and Characterize Myofascial Trigger Points and Surrounding Soft Tissue
Arch Phys Med Rehabil. 2009;90:1829-38

Two- and Three-Dimensional Ultrasound Imaging to Facilitate Detection and Targeting of Taut Bands in Myofascial Pain Syndrome

Hariharan Shankar and Sapna Reddy *Pain Medicine* 2012

This is a successful demonstration of utility of ultrasound imaging of taut bands in the management of myofascial pain syndrome

Objective Sonographic Measures for Characterizing Myofascial Trigger Points Associated With Cervical Pain

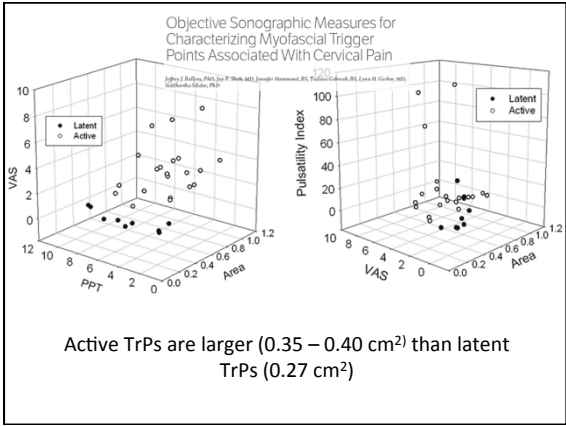
Jeffrey J. Ballyns, PhD, Jay P. Shah, MD, Jennifer Hammond, BS, Tadesse Gebreab, BS, Lynn H. Gerber, MD, Siddhartha Sikdar, PhD

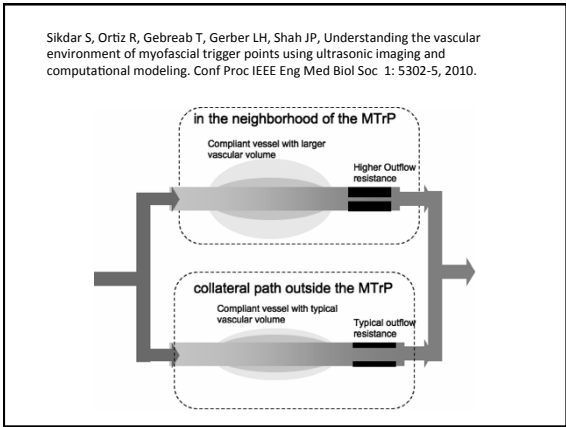
J Ultrasound Med 2011; 30:1331–1340

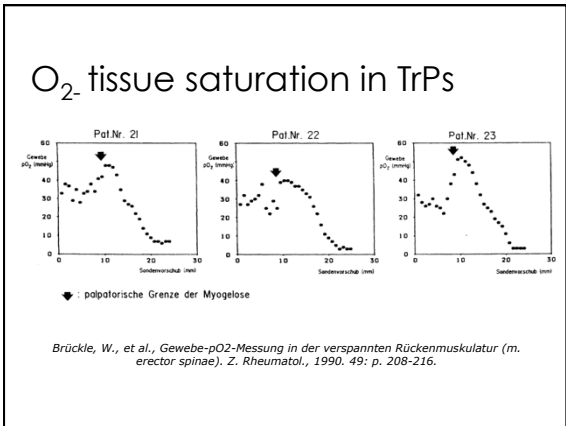
Office-Based Elastographic Technique for Quantifying Mechanical Properties of Skeletal Muscle

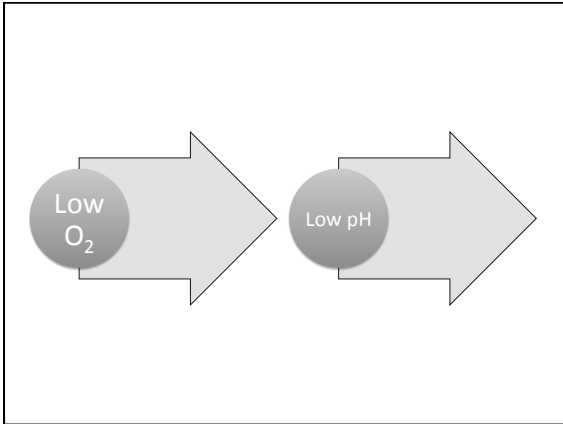
Jeffrey J. Ballyns, PhD, Diego Turco, PhD, Paul Otto, MS, Jay P. Shah, MD, Jennifer Hammond, BS, Tadesse Gebreab, BS, Lynn H. Gerber, MD, Siddhartha Sikdar, PhD

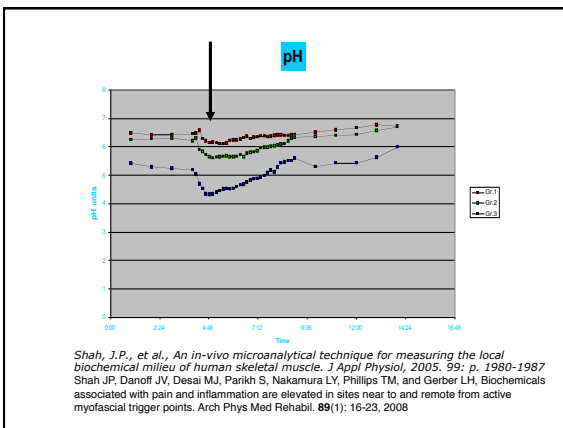
J Ultrasound Med 2012; 31:1209–1219











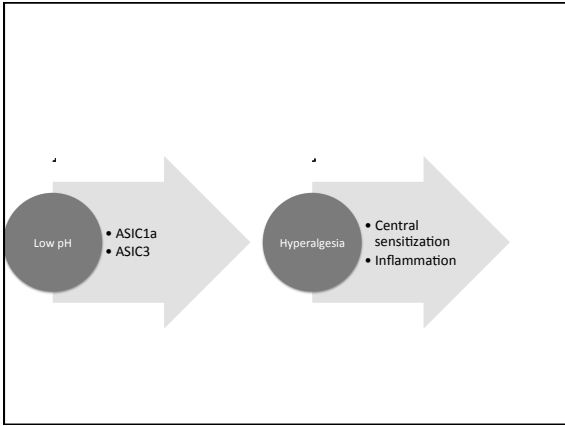
ASIC3 in muscle mediates mechanical, but not heat, hyperalgesia associated with muscle inflammation

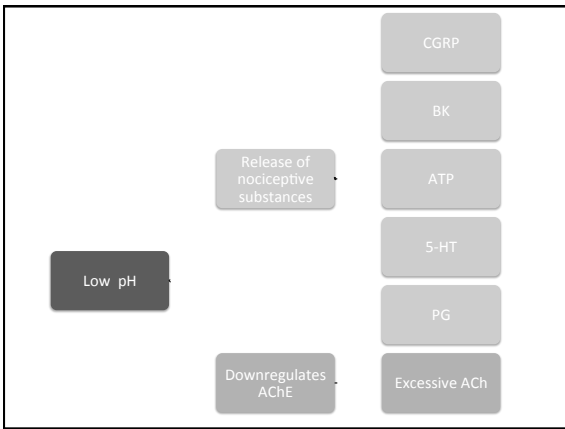
Kathleen A. Sluka^{a,b,c,e}, Rajan Radhakrishnan^{a,b,c,1}, Christopher J. Benson^{b,c,d}, Jayasheel O. Eshcol^d, Margaret P. Price^d, Kazimierz Babinski^c, Katherine M. Audette^{b,c}, David C. Yeomans^f, Steven P. Wilson^g

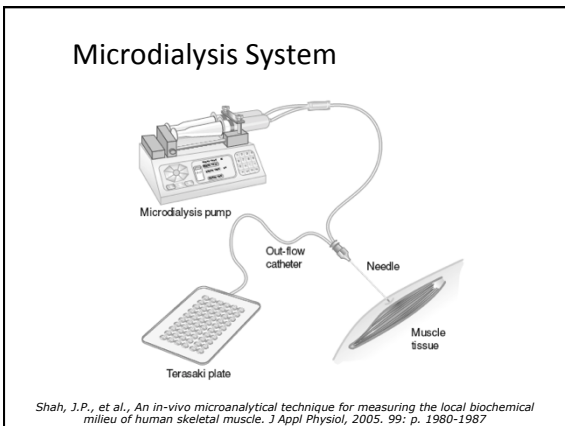
- Acidic pH has a profound effect on the initiation and perpetuation of muscle pain
- A more acidic milieu may activate ASIC1 or ASIC3 muscle nociceptors, which in turn could produce mechanical hyperalgesia

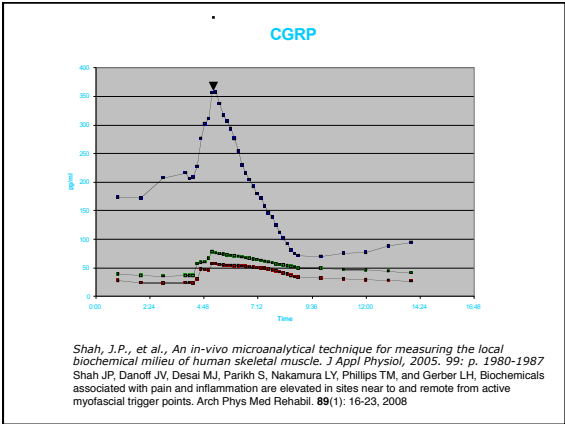
Four line graphs showing 'Response (g)' on the y-axis and 'Time' (0, 24h, 72h, 1wk, 2wk) on the x-axis. The top-left graph is labeled 'Inflamed Mechanical' and compares ASIC3+/+ (filled circles) and ASIC3-/- (open circles). The top-right graph is labeled 'Control Mechanical'. The bottom-left graph is labeled 'Inflamed Heat' and compares ASIC3+/+ (filled circles) and ASIC3-/- (open circles). The bottom-right graph is labeled 'Control Heat'. In the inflamed conditions, ASIC3+/+ mice show significantly higher responses to mechanical stimuli compared to ASIC3-/- mice, while responses to heat are similar between genotypes.

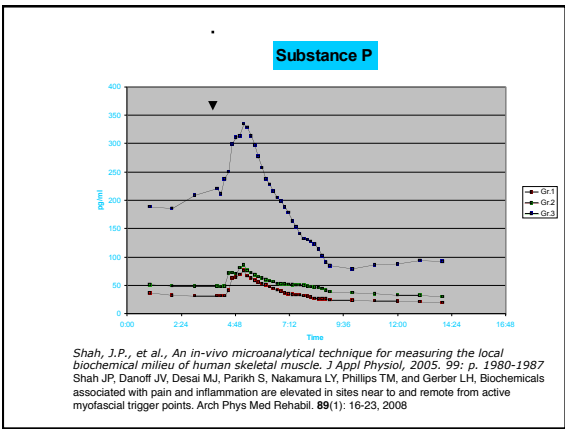
Pain 129 (2007) 102–112







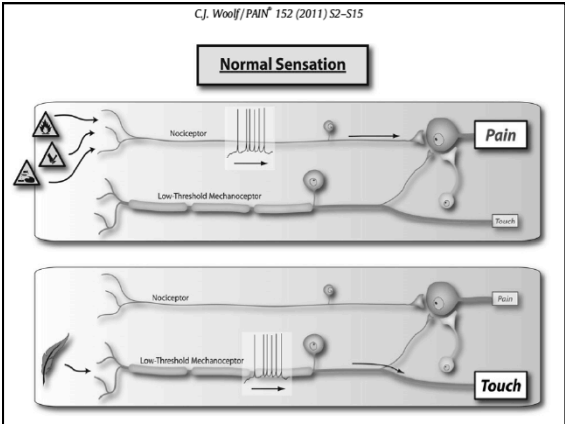


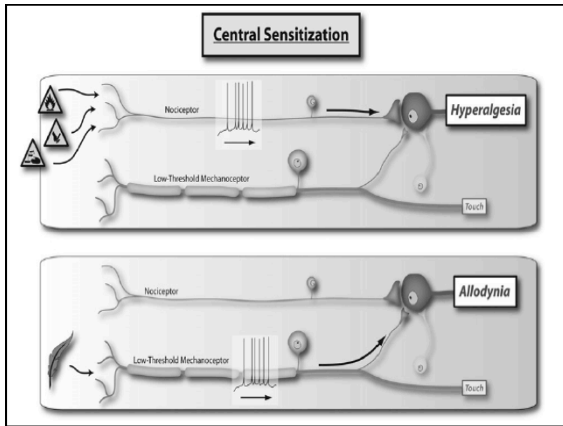


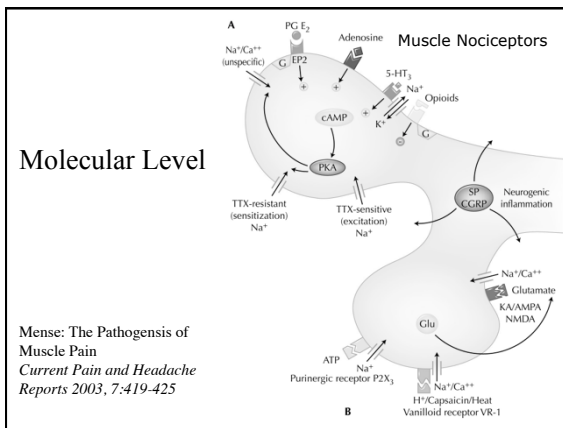
- Norepinephrine
 - TNG – α
 - Interleukin 1, 6, 8, 12
 - Substance P
 - Serotonin
 - Calcitonin Gene Related Peptide
- Shah, J.P., et al., *An in-vivo microanalytical technique for measuring the local biochemical milieu of human skeletal muscle. J Appl Physiol*, 2005, 99: p. 1980-1987
 Shah JP, Danoff JV, Desai MJ, Parikh S, Nakamura LY, Phillips TM, and Gerber LH, Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. *Arch Phys Med Rehabil*. 89(1): 16-23, 2008

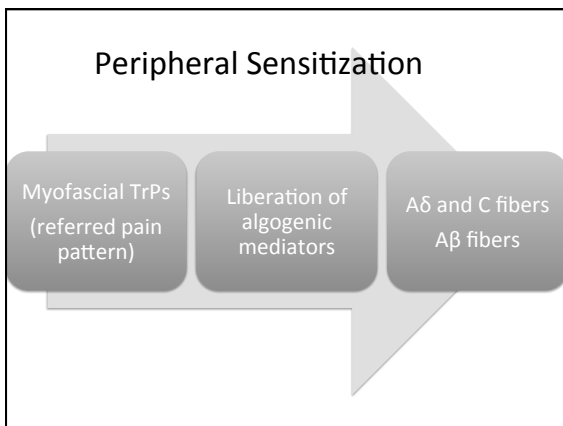
TrPs are persistent sources of nociceptive input, which excite muscle nociceptors and contribute to peripheral and central sensitization

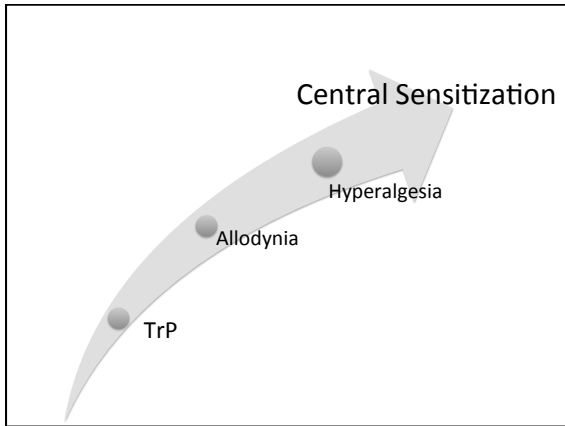
A nociceptor is a receptor specialized in detecting stimuli that objectively can damage tissue and subjectively are perceived as painful

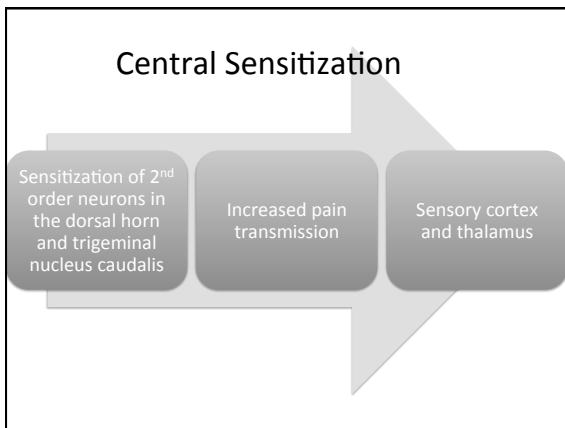


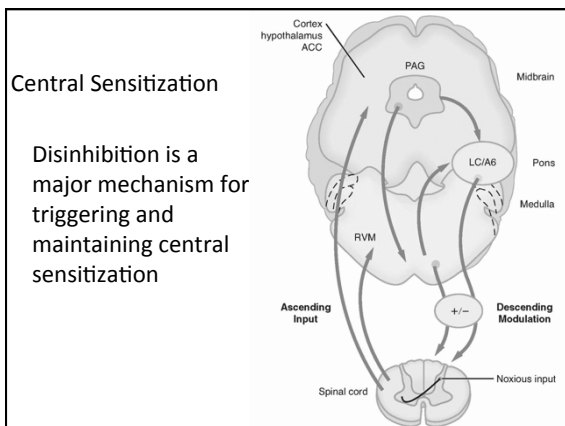












Fernández de las Peñas C, Galán del Rio F, Fernández Carnero J, Pesquera J, Arendt-Nielsen L, Svensson P, Bilateral widespread mechanical pain sensitivity in women with myofascial temporomandibular disorder: evidence of impairment in central nociceptive processing. *J Pain* 10(11): p. 1170-1178, 2009

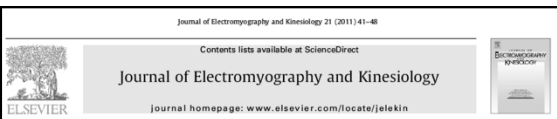
Contribution of Myofascial Trigger Points to Migraine Symptoms

Maria Adele Giamberardino, Emmanuele Tafuri, Antonella Savini, Alessandra Fabrizio, Giannapia Affaitati, Rosanna Lerza, Livio Di Ianni, Domenico Lapenna, and Andrea Mezzetti
Headache Center, Department of Medicine and Science of Aging, "G. D'Annunzio" University, Ce.S.I., "G. D'Annunzio" Foundation, 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

J Pain 2007;8(11): p. 869-78



Effects of postural and visual stressors on myofascial trigger point development and motor unit rotation during computer work

Jeffrey A. Hoyle^{a,*}, William S. Marras^b, James E. Sheedy^c, Dennis E. Hart^d

trigger points redeveloped after 1 hour of continuous typing in all conditions

Otolaryngic Myofascial Pain Syndromes

William S. Teachey, MD

General otolaryngology practice

Over a period of 5 months, 106 of 257, 41%, of consecutive new patients presented with a chief complaint caused by a myofascial disorder

Current Pain and Headache Reports 2004, 8:457-462

Trigger points in episodic tension-type headache:

upper trapezius (75%)

temporalis (74%)

SCM (60%)

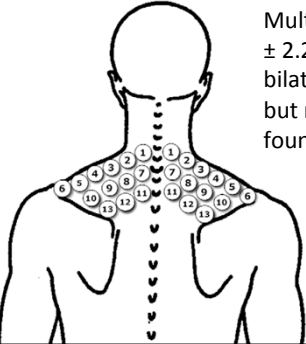
Trigger Points

- 93.9% of migraineurs

- 29% of controls

Calandre EP, Hidalgo J, Garcia-Leiva JM, Rico-Villademoros F. Eur J Neurology 2006; 13:244-249

Contribution of the local and referred pain from active myofascial trigger points in fibromyalgia syndrome
 Hong-You Ge^{a,*}, Hongling Nie^a, Pascal Madeleine^a, Bente Danneskiold-Samsøe^b, Thomas Graven-Nielsen¹, Lars Arendt-Nielsen^a

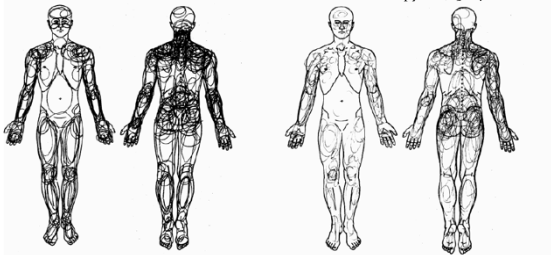


Multiple active MTrPs (7.4 ± 2.2) were identified bilaterally in FMS patients, but no active MTrPs were found in controls.

PAIN 147 (2009) 233–240

Reproduction of overall spontaneous pain pattern by manual stimulation of active myofascial trigger points in fibromyalgia patients
 Hong-You Ge^a, Ying Wang^c, César Fernández-de-las-Peñas^{1,2}, Thomas Graven-Nielsen¹, Bente Danneskiold-Samsøe^a, Lars Arendt-Nielsen^a

Arthritis Research & Therapy 2011, 13:R48

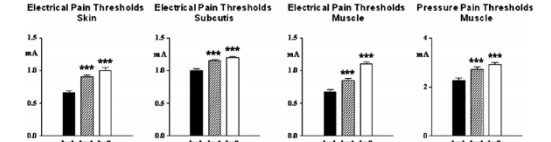


Overall spontaneous pain Local and referred pain from active MTPs

Effects of treatment of peripheral pain generators in fibromyalgia patients
 Giannapia Affaitati^a, Raffaele Costantini^b, Alessandra Fabrizio^a, Domenico Lapenna^a, Emmanuele Tafuri^a, Maria Adele Giamberardino^{a,*}

European Journal of Pain 15 (2011) 61–69

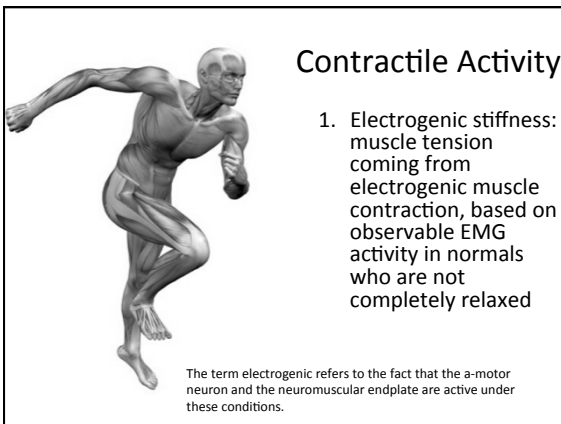
In fibromyalgia patients, local treatment of trigger points not only relieves local symptoms but also significantly improves the widespread FS symptoms in terms of reduction of both spontaneous diffuse pain and tenderness at all tender point sites.



Measurement	Day1	Day4	Day8
Electrical Pain Thresholds Skin (mA)	~0.6	~0.9	~1.0
Electrical Pain Thresholds Subcutis (mA)	~0.8	~1.1	~1.2
Electrical Pain Thresholds Muscle (mA)	~0.6	~0.9	~1.0
Pressure Pain Thresholds Muscle (mA)	~2.0	~2.8	~3.0

Moseley summarized,
“any strategy that has an inhibitory effect on nociceptive input is probably appropriate in the short term unless it simultaneously activates non-nociceptive threatening inputs”





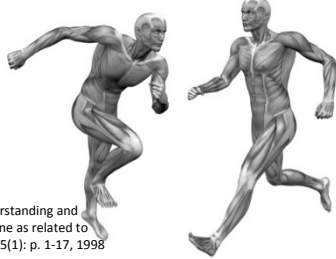
Contractile Activity

2. Electrogenic spasm that specifically identifies pathological involuntary electrogenic contraction
May or may not be painful

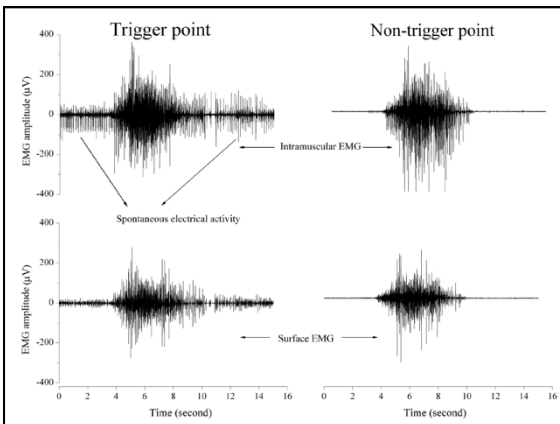


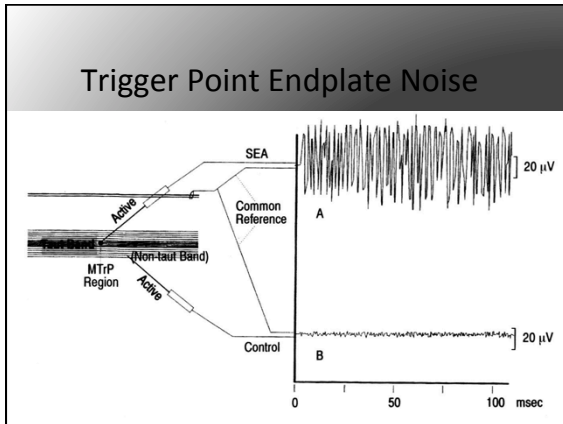
Contractile Activity

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



Simons DG, Mense S, Understanding and measurement of muscle tone as related to clinical muscle pain. Pain 75(1): p. 1-17, 1998





Macgregor J, Graf von Schweinitz D, Needle electromyographic activity of myofascial trigger points and control sites in equine cleidobrachialis muscle—an observational study. *Acupunct Med* 24(2): p. 61-70, 2006.

Hong C-Z, Yu J, Spontaneous electrical activity of rabbit trigger spot after transection of spinal cord and peripheral nerve. *J Musculoskeletal Pain* 6(4): p. 45-58, 1998.

Simons DG, Hong C-Z, Simons LS, Endplate potentials are common to midfiber myofascial trigger points. *Am J Phys Med Rehabil* 81(3): p. 212-222, 2002

Couppé C, Midttun A, Hilden J, Jørgensen U, Oxholm P, Fuglsang-Frederiksen A, Spontaneous needle electromyographic activity in myofascial trigger points in the infraspinatus muscle: A blinded assessment. *J Musculoskeletal Pain* 9(3): p. 7-17, 2001.

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

Induction of muscle cramps by nociceptive stimulation of latent myofascial trigger points

Hong-You Ge · Yang Zhang · Shelle Boudreau · Shou-Wei Yue · Lars Arendt-Nielsen

- 14 subjects
- Injections with glutamate or isotonic saline in latent TrP or non-TrP tissue (gastrocnemius)
- Needle EMG vs surface EMG

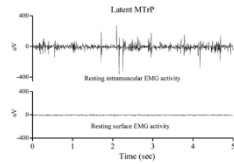


Fig 1 Resting intramuscular and surface electromyographic (EMG) recordings of a latent myofascial trigger point (MTrP). Note that only intramuscular EMG recording (upper trace), but not surface EMG (lower trace), shows spontaneous electrical activity

Exp Brain Res 187(4):623-629, 2008

Induction of muscle cramps by nociceptive stimulation of latent myofascial trigger points

Hong-You Ge · Yang Zhang · Shelle Boudreau · Shou-Wei Yue · Lars Arendt-Nielsen

- Activation of nociceptive muscle afferents may electrically induce muscle cramps by increasing the response of group II spindle afferents and the afferent input to motor neurons
- Does not explain the induction of muscle cramps with peripheral denervation
- Noxious stimulation of latent MTrPs may decrease inhibitory input to motor neurons and as a result induce muscle cramps

Exp Brain Res 187(4):623-629, 2008

Nociceptive and Non-nociceptive Hypersensitivity at Latent Myofascial Trigger Points

Lian-Tao Li, MD, PhD,*† Hong-You Ge, MD, PhD,† Shou-Wei Yue, MD, PhD,* and Lars Arendt-Nielsen, PhD†

- Confirms the existence of nociceptive hypersensitivity at latent MTrPs and provides the first evidence that there exists non-nociceptive hypersensitivity (allodynia) at latent MTrPs
- Finally, the occurrence of referred muscle pain is associated with higher pain sensitivity at latent MTrPs

Clin J Pain 25(2):132-137, 2009

Ge HY, Serrao M, Andersen OK, Graven-Nielsen T, Arendt-Nielsen L. Increased H-reflex response induced by intramuscular electrical stimulation of latent myofascial trigger points. *Acupunct Med.* 2009 Dec;27(4):150-4.

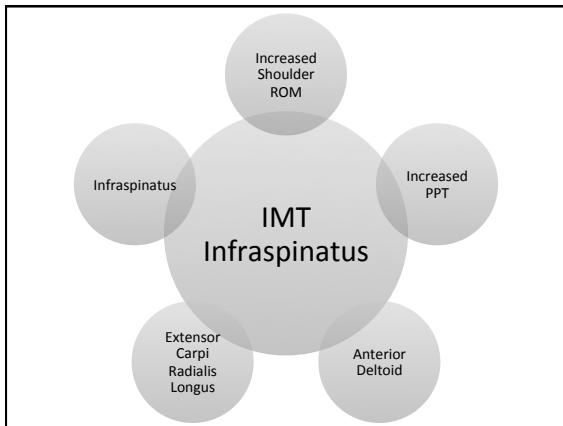
Ge HY, Zhang Y, Boudreau S, Yue SW, Arendt-Nielsen L. Induction of muscle cramps by nociceptive stimulation of latent myofascial trigger points. *Exp Brain Res.* 2008 Jun;187(4):623-9.

Li LT, Ge HY, Yue SW, Arendt-Nielsen L. Nociceptive and non-nociceptive hypersensitivity at latent myofascial trigger points. *Clin J Pain.* 2009;25(2):132-7.

Wang YH, Ding XL, Zhang Y, Chen J, Ge HY, Arendt-Nielsen L, et al. Ischemic compression block attenuates mechanical hyperalgesia evoked from latent myofascial trigger points. *Exp Brain Res.* 2010 Apr;202(2):265-70.

Xu YM, Ge HY, Arendt-Nielsen L. Sustained nociceptive mechanical stimulation of latent myofascial trigger point induces central sensitization in healthy subjects. *J Pain.* 2010;11(12):1348-55.

Zhang Y, Ge HY, Yue SW, Kimura Y, Arendt-Nielsen L. Attenuated skin blood flow response to nociceptive stimulation of latent myofascial trigger points. *Arch Phys Med Rehabil.* 2009 Feb;90(2):325-32.



Dry Needling to a Key Myofascial Trigger Point May Reduce the Irritability of Satellite MTrPs

- TrP dry needling of the infraspinatus (randomly selected side)
- TrP on the contralateral side was not
- Shoulder pain intensity, ROM, shoulder internal rotation, and pressure pain threshold of the MTrPs in the infraspinatus, anterior deltoid, and extensor carpi radialis longus muscles were measured in both sides before and immediately after dry needling

Am J Phys Med Rehabil 2007; 86(5):397 - 403

Dry Needling to a Key Myofascial Trigger Point May Reduce the Irritability of Satellite MTrPs

- Active and passive ROM of shoulder internal rotation, and the pressure pain threshold of MTrPs on the treated side, were significantly increased ($P < 0.01$)
- Pain intensity of the treated shoulder was significantly reduced ($P < 0.001$) after dry needling

Am J Phys Med Rehabil 2007; 86(5):397 - 403

Myofascial Trigger Point

- Active vs latent
- Disturbed motor function
- Muscle weakness and stiffness
- Restricted range of motion
- Vasoconstriction
- Vasodilation
- Goose bumps
- Lacrimation
- Local tenderness/pain
- Referred pain

Central De-Sensitization:
Undoing the Damage

Goal of treatment:
remove noxious stimuli to
produce desensitization

Dry Needling

- Meta Review
- Respectable data-base



Acupuncture and dry-needling for low back pain (Review)

Furlan AD, van Tulder MW, Cherkov DC, Tsukayama H, Lao L, Koes BW, Berman BM

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



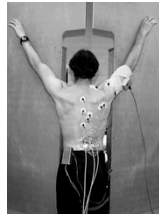
Furlan AD, van Tulder MW, Cherkov DC, Tsukayama H, Lao L, Koes BW, Berman BM: Acupuncture and dry-needling for low back pain. The Cochrane Database of Systematic Reviews 2005, Issue 1

Dry Needling

LATENT TRIGGER POINT RESEARCH

Latent myofascial trigger points: their effects on muscle activation and movement efficiency

Karen R. Lucas^{a,*}, Barbara I. Polus^a, Peter A. Rich^b



Dry needling of latent MTrPs restores normal muscle activation patterns

Lucas, K.R., Polus, B.I., and Rich, P.S., Latent myofascial trigger points: their effect on muscle activation and movement efficiency. J Bodywork Movement Ther. 2004; 8: 160-166

Dry Needling

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

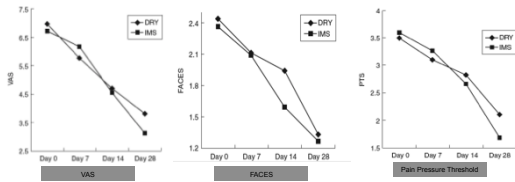


DiLorenzo et al: Hemiparetic Shoulder Pain Syndrome Treated with Deep Dry Needling Dying Early Rehabilitation: A Prospective, Open-Label, Randomized Investigation. J Musculoskeletal Pain 12(2) 2004

Dry Needling

Dry Needling of Trigger Points with and Without Paraspinal Needling in Myofascial Pain Syndromes in Elderly Patients

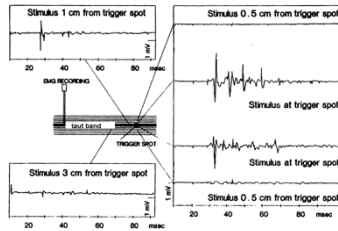
HYUK GA, M.D., M.S., JI-HO CHOI, M.D., Ph.D., CHANG-HAE PARK, M.D., and HYUN-JUNG YOON, M.D.



J Altern Compl Med 13(6), 2007: 617-623

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:



Hong C-Z and Torigae Y. Electrophysiological characteristics of localized twitch responses in responsive taut bands of rabbit skeletal muscle, 1994;2:17-43.

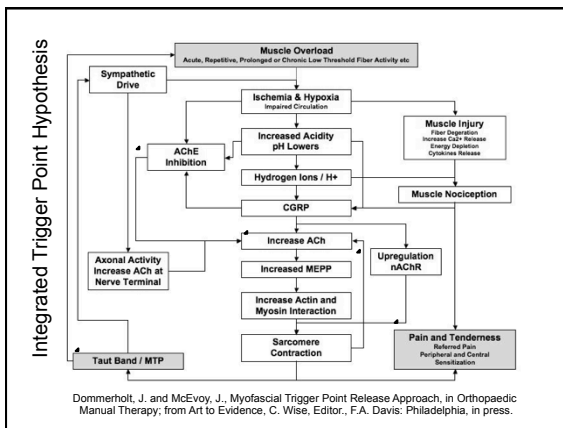
Diagnostic criteria

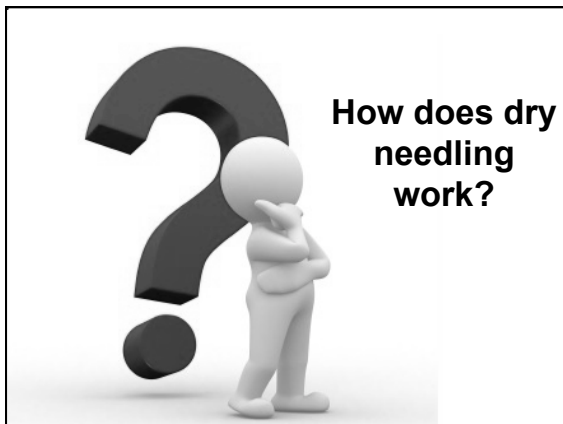
- taut band
- spot tenderness within the taut band
- local twitch response

Contralateral LTR

- ⊕ Unilateral neck pain \geq 6 months
- ⊕ Active MTrP in trapezius or levator scapulae
- ⊕ LTR elicited by needle stimulation caused contralateral LTR in 61.5%
- ⊕ Active MTrPs may represent a central nervous system abnormality, involving segmental changes
- ⊕ Different degrees of chronicity, degree of plasticity, glia cell activation?

Bilateral activation of motor unit potentials with unilateral needle stimulation of active myofascial trigger points. J.F. Audette, F. Wang, H. Smith. Am J Phys Med Rehabil 83(5): 368-374, 2004

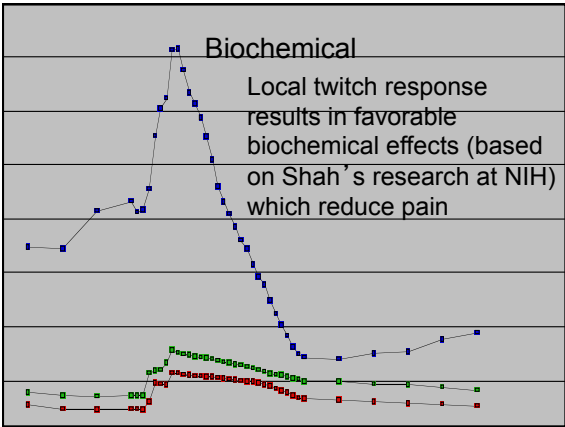




Exact Mechanism is unknown

Mechanical
 Results in disruption of muscle fiber adhesions and increases circulation to the region

Neurophysiological
 Local twitch response is a spinal cord reflex that results in immediate release of muscle hypertonicity



Possible Adverse Side Effects

Soreness
 (typically 1 h -2 days)

Slight bleeding / bruising

Fatigue

Fainting / Lightheadedness

Pneumothorax

somasimple.com

- So, could you tell me [...] why we shouldn't apply dry needling?
- Because it hurts.
 - What *I* don't get is how needles can be considered by them as non-threatening! I think needles are less threatening to *them*! Not to the patients or to the patients' nervous systems! It's *they* who do not want to have to learn to actually touch people the right way. Needles give them some sort of distance psychologically, so they can keep themselves sort of removed from the dyad.

Needles are *supposed* to be threatening. And they are.

Legrain V, Iannetti GD, Plaghki L, Mouraux A: The pain matrix reloaded: a salience detection system for the body. *Prog. Neurobiol.* 93(1): 111-24, 2011

- pain intensity can be dissociated from the magnitude of responses in the "pain matrix",
- the responses in the "pain matrix" are strongly influenced by the context within which the nociceptive stimuli appear, and
- non-nociceptive stimuli can elicit cortical responses with a spatial configuration similar to that of the "pain matrix".

The conditioned pain modulation (CPM)

Bjorkedal E, Flaten MA: Expectations of increased and decreased pain explain the effect of conditioned pain modulation in females. *Journal of pain research* 5: 289-300, 2012.

- The inhibition of one source of pain by a second noxious stimulus, termed the conditioning stimulus.
- This procedure can activate an endogenous pain inhibitory mechanism that inhibits early nociceptive processing."
- In other words, if we can "convince" the patient that the conditioning stimulation (i.e., dry needling) will lead to a reduction in pain, it will lead to a larger inhibitory CPM.

Adverse events following dry needling: A prospective survey of Chartered Physiotherapists

- Brady S, McEvoy J, Dommerholt J, Doody C: Adverse events following trigger point dry needling: a prospective survey of chartered physiotherapists. submitted, 2012.

Common Adverse Events: (1-10/100)

Adverse Event	Number	No per 100 treatments
Bleeding	516	7.75
Bruising	325	4.88
Pain during treatment	219	3.29
Pain after treatment	159	2.39

Uncommon Adverse Events (1-10/1000)

Adverse Event	Number	No per 1000 treatments
Aggravation of symptoms	62	9.31
Drowsiness	17	2.55
Feeling faint	13	1.95
Nausea	10	1.5
Headache	8	1.2

Rare (1-10/10,000)

Adverse Event	Number	No per 10,000 Treatments (estimated)
Fatigue	3	4.51
Emotional	3	4.51
Itching	1	1.5
Numbness	1	1.5
Shaky	1	1.5

Risk of a significant adverse event by physiotherapists:

0.04%

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
