DRY NEEDLING FOR ATHLETES AND ACTIVE ADULTS

Understanding Neuroinflammation and the Autonomic Nervous System in Exercise

Dr. Nick Sanders PT, DPT, CIDN, CSCS
Integrative Dry Needling Institute

1

Before we start

- Please keep muted during the lecture portion of presentation- we will have discussion times after the lectures.
- BUT, if you have you have a question during the lecture just use the raise your hand feature on your tool bar under reactions.
- We are tracking the time you are on the zoom and may need to report that to the licensure board if you are audited. Please stay on the zoom the entire time to get the full credit of the course. We will have short breaks!
- You will be required to take and pass a short quiz that we will complete at the end of this webinar.
- The final task will be to do a course evaluation- upon completion it will release the course completion certificate with your CEU hours on it.

Anything else before we start?

2

Today

- **Lecture 1. Introduction of neuro-inflammation and exercise.**
  - Introducing a neuro-inflammatory model
  - The role of pain in movement
  - Factors involved in overtraining.
  - The inflammatory effects of exercise.
    - What is inflammation?
    - What happens with inflammation when we exercise.
    - What happens with DOMS.

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3

3

Today

- **Lecture 2. Assess Dry Needling Dosage in Sport**
  - What happens with inflammation when we needle.
  - How can we better assess how someone will respond to needling.
  - QST testing
  - Other methods of assessing for overtraining syndrome.
- **Lecture 3. Applying DN and other techniques to exercise specific applications.**
  - Performance, General recovery, Tendinopathy, Sprains / Strains Etc.

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4

Today

- **Case Review**
  - Similar to the foundation course we will go into breakout groups and review 6 different cases.
  - You will have a chance to answer the questions you have been provide by email.
  - We will present them and discuss our thoughts as we work through the case from there.

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Understanding Exercise and Inflammation

Lecture 1: Introduction of neuro-inflammation in exercise, the effects on the peripheral and central nervous systems.

Nick Sanders PT, DPT, CSCS, CIDN

6

Exercise, DN, and Inflammation

- Why do we care about exercise and inflammation?
- What happens when we exercise? When we dry needle?
- What effect does inflammation have on the peripheral and central nervous systems.
- How can we make decisions on DN and manual therapies for exercise recovery and performance.

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7

Nick Sanders

PT, DPT, CSCS, CIDN

- Co-Creator of Neuro Release Treatment Course
  - Integrative Dry Needling.
- Owner PHYT For Function LLC.
  - Cash Based Clinic in Hudson, OH.
  - Adjunct Professor Youngstown State University 2017
- Certified Integrative Dry Needling with Dr. Frank Gargano 2012.
- Certified Strength and Conditioning Specialist Through The National Strength and Conditioning Association
- Continuing Education
  - Mulligan Manual Therapy, SFMA, Blood Flow Restriction, Postural Restoration Institute, Original Strength

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Text **NICKSANDERS626** to **22333** once to join

Can we make this work?

- Yes
- No
- all of the above
- None of the above

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Respond at **pollev.com/nicksanders626**
Text **NICKSANDERS626** to **22333** once to join, then **A, B, C, or D**

How much dry needling experience do you have?

- I have not done any dry needling **A**
- I have taken courses but I have not treated a patient **B**
- I am just starting with dry needling **C**
- I have significant dry needling experience **D**

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Which topics/ questions would you most like answered during this presentation?

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11

Introductions:

Tell us who you are, where you're from, what you do, and goals / questions you hope to get answered with the presentation.

12

Why do we care about exercise and inflammation?

Inflammation linked from performance gains to chronic disease and everything in-between.

Inflammation is how we heal but it's also one of the main triggers for nociceptor excitation, involved in the transition from acute to chronic pain, and implicated in many disease conditions.

13

13

The Problem.

It's challenging to differentiate the positive healing and growth aspects of inflammation vs. the negative consequences that lead to chronic long term pain problems and how we as therapists play a role.

14

14

15

15

What is the role of pain/nociception in movement quality?

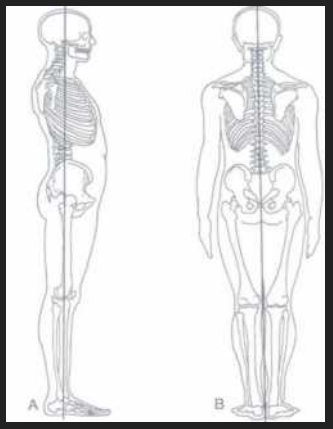
What role does pain play in movement quality. DOMS vs. Injury.

16

16

NEURO-INFLAMMATION AND MOVEMENT QUALITY

17



Sethi 2016

18

STRUCTURAL THEORY CAMP

- Tissue damage guides treatment
  - High tech imaging and diagnosis specific
- Focus on tight vs weak muscles.
- Correction of tissue structure and position.
- SFMA, PRI, Janda etc…

PAIN SCIENCE CAMP

- Focuses on perception of pain
  - Less focused on the diagnosis
- Focus on moving in a pain free manner, mindfulness, education
- Posture less important
- www.painscience.com

19

WHAT CAUSES CHANGE IN MOVEMENT?

- Acute Injury
- Previous Injury
  - Pain Protection theories
- Nerve Tension
- Lifestyle Adaptations
- Training Adaptations
- Perception of movement.
- Learned Patterns
- Avoidance

20

WHERE THE TWO CAMPS START TO COME TOGETHER

A Neuro-Inflammatory Approach to Pain and Movement

KNEE OA EXAMPLE

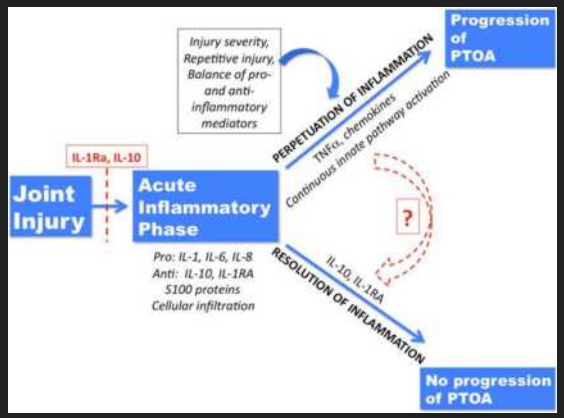
STRUCTURAL THEORY CAMP

- Mechanical Loading
  - Obesity drives increased strain on knee.

NEURO-INFLAMMATORY CAMP

- Metabolic and inflammatory components.
  - Endocrine and metabolic effects of adipose tissue.

Inflammation in Joint Injury and Post-Traumatic Osteoarthritis (Lieberthal 2015)



Lieberthal 2015 PMID: 26521728

Inflammation in Joint Injury and Post-Traumatic Osteoarthritis (Lieberthal 2015)

Table 1

Important features of the inflammatory response after joint injury supported by r and animal models of PTOA

Feature	Refere
Signs of inflammation occur early after joint injury.	9, 11,
Inflammation is sustained at lower levels.	11, 18,
Patterns of inflammation change with time after injury.	20, 21,
The extent/severity of the initial injury influences severity of synovial inflammation.	10, 23,
Multiple joint tissues and cell types contribute to inflammation after injury.	27, 30,
Inflammation can occur even in the absence of joint instability.	35-37
Inflammation contributes to cartilage damage and pain responses after joint injury.	45, 54,
Certain aspects of post-injury inflammation may be protective and important for repair.	13, 88,
Inflammation is a modifiable feature of PTOA.	30, 38,

Lieberthal 2015 PMID: 26521728

25

OBESITY

LOCAL AND SYSTEMIC FACTORS IN INFLAMMATION

Just as local inflammatory networks have been shown to play a role in osteoarthritis pathogenesis, systemic factors have also been implicated, and the strongest influence appears to be obesity. Obesity has long been recognized as a risk factor for OA [62]. While some of the risk may be due to increased joint loading, the association of obesity with the development of OA in non-weight bearing joints suggests that other mechanisms are involved [63]. The systemic effect of obesity on OA development is believed to be mediated, in part, by inflammatory substances (free fatty acids, reactive oxygen species cytokines and adipokines) produced by adipose tissue which can be released into the bloodstream [64]. Specific adipokines such as the molecules leptin and adiponectin have inflammatory and catabolic influences on joint tissues [65].

Lieberthal 2015 PMID: 26521728

26

KNEE OA


JOURNAL ARTICLE

The role of fat and inflammation in the pathogenesis and management of osteoarthritis

Hema Urban, Christopher B Little

Rheumatology, Volume 57, Issue suppl_4, May 2018, Pages iv10–iv21, https://doi.org/10.1093/rheumatology/kex399

Published: 09 February 2018 **Article history**

PDF Split View Cite Permissions Share

- Increasing obesity/adiposity results in an environment of low-grade systemic inflammation that contributes to an increase in inflammation in OA.
- The infrapatellar fat pad behaves differently compared with other adipose tissues and stimulates local inflammation in OA.
- The emerging role of adipose-derived inflammation highlights potential therapeutic targets for OA disease modification.

27

What is the role of pain/nociception in movement quality?


HHS Public Access

Author manuscript

J Hand Ther. Author manuscript; available in PMC 2021 Jan 1.

Published in final edited form as:

J Hand Ther. 2020 Jan-Mar; 33(1): 60–66.

Published online 2018 Jul 17. doi: 10.1016/j.jht.2018.06.001

PMCID: PMC6335190

NIHMSID: NIHMS990200

PMID: 30025839

The interaction between pain and movement

Shannon L. Merkle, OTR/L, CHT, PhD,[a,b,*] Kathleen A. Sluka, PT, PhD,[a] and Laura A. Frey-Law, PT, PhD[a]

4 Theories on pain and movement.

Merkle, 2020. PMID: 30025839

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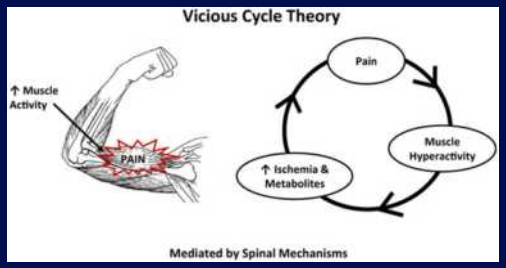
28

What is the role of pain/nociception in movement quality?



Increased muscle activation / guarding leads to energy crisis, Increased pain sensitization, and further guarding.

Merkle, 2020. PMID: 30025839 29

29

What is the role of pain/nociception in movement quality?

Strength Inhibition theory.

- **General demonstration of peak force in the presence of pain.**
- **Inhibition vs. pain guarding?**

Merkle, 2020. PMID: 30025839 30

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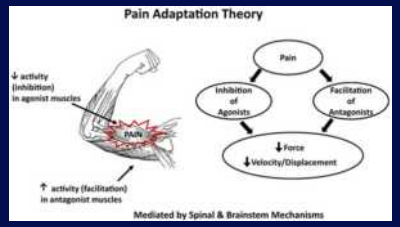
What is the role of pain/nociception in movement quality?



- **Increased antagonist firing.**
- **Decreased agonist firing.**

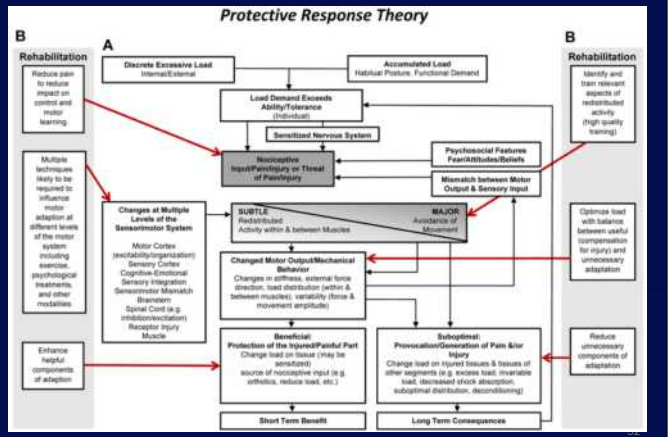
Merkle, 2020. PMID: 30025839 31

31

What is the role of pain/nociception in movement quality?

- **A = Motor adaptations to pain.**
- **B= Rehabilitation**
- **Some level of of sensorimotor change.**

Merkle, 2020. PMID: 30025839



32

What is the role of pain/nociception in movement quality?

- **"Motor output is highly adaptable, can be influenced by multiple mechanisms at various levels along the nervous system, and may vary between individuals despite similar diagnoses."**

Merkle, 2020. PMID: 30025839

33

33

Summary

Movement quality and illness are not just mechanical constructs.

We must consider the chemical and nervous system impacts of disease and health.

34

34

Exercise and Fatigue

35

35

Fatigue and Injury Risk

Peripheral and central fatigue mechanisms have been potentially linked to injury risk

(Abstract only)

"Acute fatigue can decrease single leg postural control, decrease ankle joint position sense, decrease isokinetic strength of hamstring and quadriceps muscles and can affect isokinetic hamstring:quadriceps ratios."

"altered injury risk profile for lateral ankle sprain, patellofemoral pain syndrome and hamstring injuries. "

Review > Sports Med. 2020 Apr;50(4):767-784. doi: 10.1007/s40279-019-01235-1.

Does Acute Fatigue Negatively Affect Intrinsic Risk Factors of the Lower Extremity Injury Risk Profile? A Systematic and Critical Review

Jo Verschueren [1], Bruno Tassignon [1], Kevin De Pauw [1, 2], Matthias Proost [1], Amber Teugels [1], Jeroen Van Cutsem [1], Bart Roelands [1], Evert Verhagen [3], Romain Meeusen [4, 5]

Affiliations + expand

PMID: 31782066 DOI: 10.1007/s40279-019-01235-1

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Verschueren, 2020. PMID: 31782066

36

36

Fatigue and Injury Risk

Peripheral and central fatigue mechanisms have been potentially linked to injury risk

24 male athletes with and without CLBP

Measured Total Reaction Time, Premotor time, and electromechanical delay before and after fatigue

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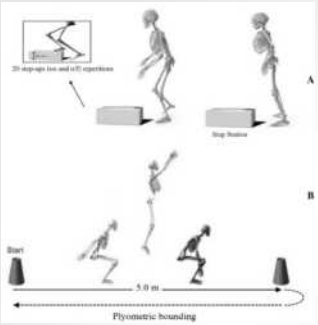
Abdollahi, 2022. PMID: 36284126

Fatigue and Injury Risk

4 minute fatigue protocol

20 Step ups + 5 meter bounds. As many rounds as possible in 4 minutes.



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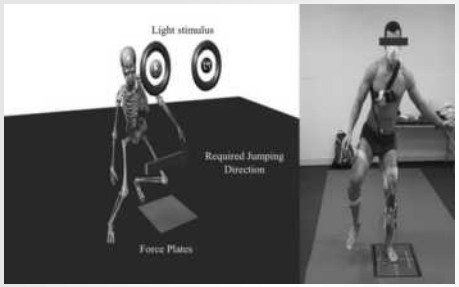
Abdollahi, 2022. PMID: 36284126

Fatigue and Injury Risk

Data Obtained with simulataneous Ground Reaction Force and Muscle EMG.

Primary findings was that the CLBP had longer TRT in plantar plantar flexors and knee flexion groups after fatted. PMT was longer in vastus laterals, vastus medals, semimembranoissi, and medial gastric

n athletes with CLBP, longer PMT and TRT may be related to compromised spinal and/or supraspinal pathways due to injury that may affect timing to unexpected events,[...]. If so, these results may provide insight into potentially injurious loading strategies during maneuvers



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Abdollahi, 2022. PMID: 36284126

Fatigue and Injury Risk

"In athletes with CLBP, longer PMT and TRT may be related to compromised spinal and/or supraspinal pathways due to injury that may affect timing to unexpected events[...]. If so, these results may provide insight into potentially injurious loading strategies during maneuvers"

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Abdollahi, 2022. PMID: 36284126

Fatigue and ACL

Life (Basel). 2021 May; 11(5): 443. PMCID: PMC8157175
Published online 2021 May 14. doi: 10.3390/life11050443 PMID: 34069060

Does Compression Sensory Axonopathy in the Proximal Tibia Contribute to Noncontact Anterior Cruciate Ligament Injury in a Causative Way?—A New Theory for the Injury Mechanism

Balázs Sonkodi,[1,*] Rita Bardoni,[2] László Hangody,[3] Zsolt Radák,[4] and István Berkes[1]

Stéphane Pallu, Academic Editor and Hugues Portier, Academic Editor

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Sonkodi, 2021. PMID: 34069060

Fatigue and ACL

"Athletes seem to be at the greatest risk for NC-ACL injury towards the end of half-time, at the finishing of games and at season end [28]. Furthermore, we could learn from reported ski accidents that close to one third of ACL injuries happen at the first day of skiing and 57% within the first two days [29]. Not to mention the 'one last run' and 'last hour' ski related ACL injuries. The above mentioned implies that unaccustomed and strenuous fatiguing eccentric exercise, e.g., skiing is a typical one, could increase the risk of NC-ACL injury, as we could see in DOMS inducing exercises. Accordingly, the current authors are proposing that NC-ACL injuries happen under a cognitive demand derived acute stress reaction (ASR) when insufficient force production is unacceptable in unaccustomed and strenuous fatiguing eccentric exercise moments [27,30]."

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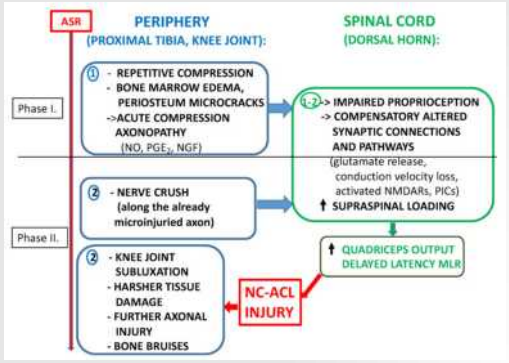
Sonkodi, 2021. PMID: 34069060

Fatigue and ACL



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Sonkodi, 2021. PMID: 34069060

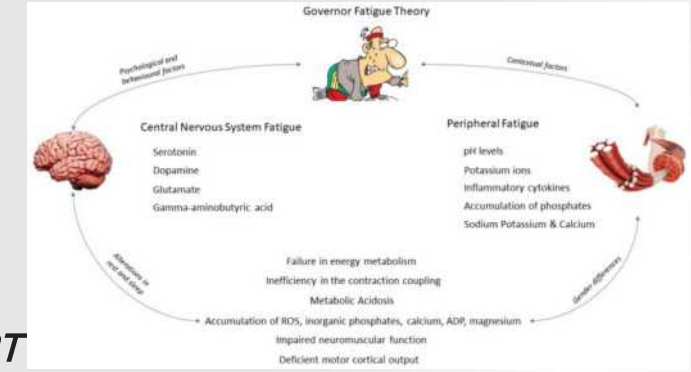
Fatigue and Injury Risk

Int J Environ Res Public Health. 2022 Apr; 19(7): 3909. PMCID: PMC8997532
Published online 2022 Mar 25. doi: 10.3390/ijerph19073909 PMID: 35409591

Central and Peripheral Fatigue in Physical Exercise Explained: A Narrative Review

José Francisco Tornero-Aguilera,[1,2] Jorge Jiménez-Morcillo,[1] Alejandro Rubio-Zarapuz,[1,2] and Vicente J. Clemente-Suárez[1,2,3,*]

Paul B. Tchounwou, Academic Editor



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Exercise and Fatigue Thought Points.

What is fatigue actually?

- Chemical, Neural, and Mechanical factors.
- How do we train it?
  - Adding cognitive or distractive tasks to activities.
  - Getting used to inflammation?
- What can we do to recover?
  - Sleep, nutrition, lymphatic work

45

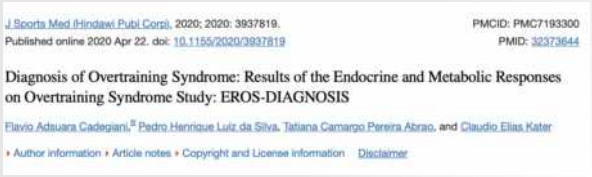
45

Inflammation and Overtraining.

46

46

The Multiple Components of Overtraining.



J Sports Med (Hindawi Publ Corp). 2020; 2020: 3937819. PMCID: PMC7193300
Published online 2020 Apr 22. doi: 10.1155/2020/3937819 PMID: 32373644

Diagnosis of Overtraining Syndrome: Results of the Endocrine and Metabolic Responses on Overtraining Syndrome Study: EROS-DIAGNOSIS

Flavio Adsuara Cadegiani,[1] Pedro Henrique Luiz da Silva, Tatiana Camargo Pereira Abrao, and Claudio Elias Kater

› Author information › Article notes › Copyright and License information Disclaimer

Chronic insufficient energy availability and the depletion of repair mechanisms lead to multiple dysfunctional adaptations in hormonal, immune, inflammatory, and metabolic pathways and ultimately to the clinical manifestations of OTS

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Cadegiani, 2020. PMID: 32373644

47

47

Components of Overtraining.

Sports Health | SAGE

Sports Health. 2022 Sep-Oct; 14(5): 665–673. PMCID: PMC9460078
Published online 2021 Sep 9. doi: 10.1177/19417381211044739 PMID: 34496702

Diagnosing Overtraining Syndrome: A Scoping Review

Justin Carrard, MD,[1] Anne-Catherine Rigort, BSc,[1] Christian Appenzeller-Herzog, PhD,[2] Flora Colledge, PhD,[3] Karsten Königstein, MD,[1] Timo Hinrichs, MD,[1] and Arno Schmidt-Trucksäss, MD[1]

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"The diversity of the tools and biomarkers identified in the present work highlights the fact that OTS affects multiple body systems"

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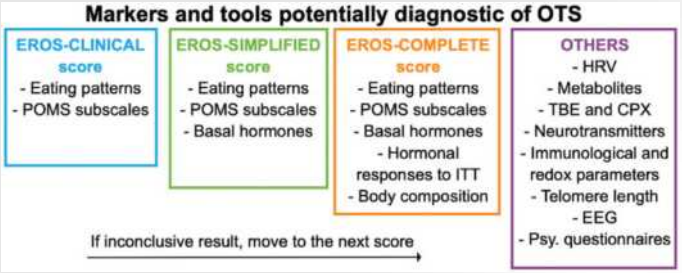
Carrard, 2022. PMID: 34496702

48

48

Components of Overtraining.



Carrard, 2022. PMID: 34496702

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Sympathetic Nervous System, Macrophages, and Joint Pain


frontiers in Immunology

Front Immunol. 2022; 13: 812962. PMCID: PMC8959978
Published online 2022 Mar 10. doi: 10.3389/fimmu.2022.812962 PMID: 35355986

The Neuroimmune Interplay in Joint Pain: The Role of Macrophages

Daniela P. Vasconcelos, Clive Jabangwe, Meriem Lamghari, and Cecília J. Alves

"The severity of joint inflammation correlates with the degree of synovial macrophages infiltration, and depletion of these macrophages has a profound therapeutic benefit"

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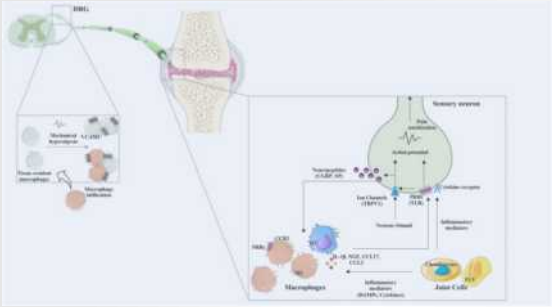
Muscle Guarding and the nervous system

- Inflammatory mediators & macrophages have an effect on the joint cells.
- Triggers an action potential from nociceptors in the joint.
- Nociceptive signaling through the dorsal root ganglion to the brain.
- Sympathetic nervous system release CGRP and SP
- CGRP and SP tend to be vasodilators.
- Triggers increased macrophage infiltration.
- Repeat the cycle.



Vasconcelos DP 2022. PMID 35355986

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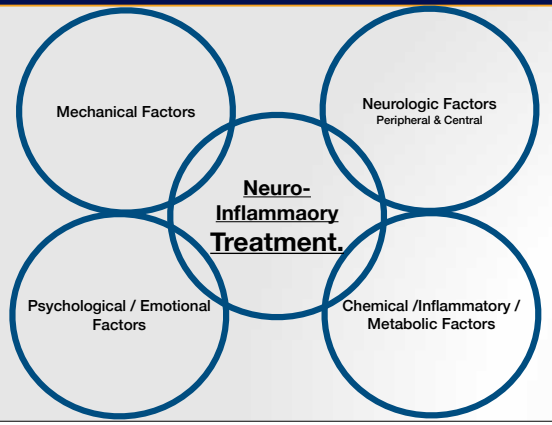
A Neuro-Inflammatory Approach.



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What barriers, limitations, or challenges would you consider to a neuroinflammatory model?

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53

Goals of the Neuro-Release Technique

Reduce pain, restore movement, and improve functional activities.

Reduce Tissue Tension | Improve (micro) circulation | Normalize physiological processes

- **The effects of the 720o neurological approach can be:**
  - Local
  - Segmental
  - Systemic

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54

54

Discussion:

Questions?

- **If you are not already using a neurologic approach how would do you see this fitting into your current model?**
- **What barriers do you anticipate?**
- **What limitations do you expect?**

55

Everybody do this.....

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56

56

What are the inflammatory effects of exercise?

1. **What is Inflammation**
2. **Relationship to pain**
3. **Local effects at the muscle.**
4. **Systemic peripheral effects of exercise.**
5. **Central nervous system effects**

What is Inflammation?

> Inflammation is the immune system's response to harmful stimuli, such as pathogens, damaged cells, toxic compounds, or irradiation [1], and acts by removing injurious stimuli and initiating the healing process [2]. Inflammation is therefore a defense mechanism that is vital to health [3

Chen 2018

What's in the mix?

Inflammatory cytokines (release my immune cells: Monocytes, lymphocytes, macrophages.

- Modulate the immune response pro and anti inflammatory cytokines.
- Commonly researched
  - IL-6 pro-inflammation
  - IL-10 anti-inflammation

Table 2

Summary of cytokines and their functions

Cytokine	Family	Main sources	Function
IL-1β	IL-1	Macrophages, monocytes	Pro-inflammation, proliferation, apoptosis, differentiation
IL-4	IL-4	Th cells	Anti-inflammation, T-cell and B-cell proliferation, B-cell differentiation
IL-6	IL-6	Macrophages, T-cells, adipocyte	Pro-inflammation, differentiation, cytokine production
IL-8	CXC	Macrophages, epithelial cells, endothelial cells	Pro-inflammation, chemotaxis, angiogenesis
IL-10	IL-10	Monocytes, T-cells, B-cells	Anti-inflammation, inhibition of the pro-inflammatory cytokines
IL-12	IL-12	Dendritic cells, macrophages, neutrophils	Pro-inflammation, cell differentiation, activates NK cell
IL-11	IL-6	Fibroblasts, neurons, epithelial cells	Anti-inflammation, differentiation, induces acute phase protein
TNF-α	TNF	Macrophages, NK cells, CD4+lymphocytes, adipocyte	Pro-inflammation, cytokine production, cell proliferation, apoptosis, anti-infection
IFN-γ	INF	T-cells, NK cells, NKT cells	Pro-inflammation, innate, adaptive immunity anti-viral
GM-CSF	IL-4	T-cells, macrophages, fibroblasts	Pro-inflammation, macrophage activation, increase neutrophil and monocyte function
TGF-β	TGF	Macrophages, T cells	Anti-inflammation, inhibition of pro-inflammatory cytokine production

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Chen 2018

What's in the mix?

Other Inflammatory Markers

- Antioxidative defense systems.
  - Reduce oxidative stress products that could trigger and growth, gene expression, and increased inflammatory cytokines.

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Chen 2018

What's in the mix?

- Inflammatory Proteins and Enzymes
  - C Reactive Protein
  - Haptoglobin, serum amyloid A, Fibrinogen, Alpha 1-acid glycoprotein.
- Help restore homeostasis and reduce microbial growth independent of antibodies.

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Chen 2018

61

61

Defining Pain.

"An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage,"

IASP

- Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors.
- Pain and nociception are different phenomena. Pain cannot be inferred solely from activity in sensory neurons.
- Through their life experiences, individuals learn the concept of pain.
- A person's report of an experience as pain should be respected.
- Although pain usually serves an adaptive role, it may have adverse effects on function and social and psychological well-being.
- Verbal description is only one of several behaviors to express pain; inability to communicate does not negate the possibility that a human or a nonhuman animal experiences pain.

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62

62

Defining Sensitization.

IASP

Sensitization
- Increased responsiveness of nociceptive neurons to their normal input, and/or recruitment of a response to normally subthreshold inputs.

Peripheral Sensitization
- Increased responsiveness and reduced threshold of nociceptive neurons in the periphery to the stimulation of their receptive fields.

Central Sensitization.
- Increased responsiveness of nociceptive neurons in the central nervous system to their normal or subthreshold afferent input.

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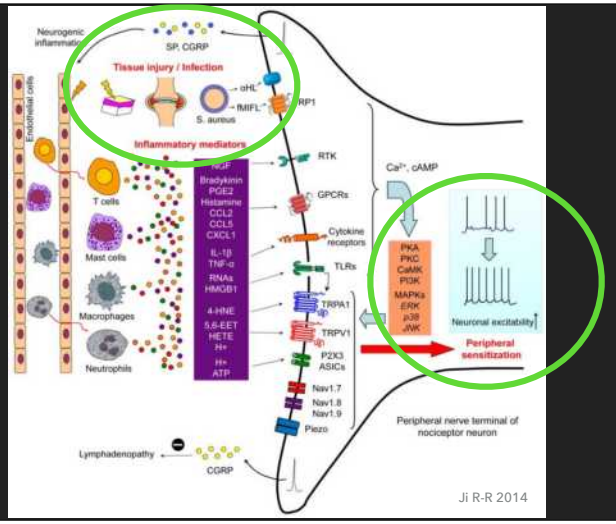

64

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Personal Thought Summary.

Nociception = increased neuronal excitability. There are peripheral and central mechanisms.

Pain = How your brain interprets that information as a threat.

Inflammation and Exercise Induced Muscle Damage

- Local
  - Pro inflammatory cytokines IL-6 and TNF
    - First 24 hours with a second wave several days into recovery.

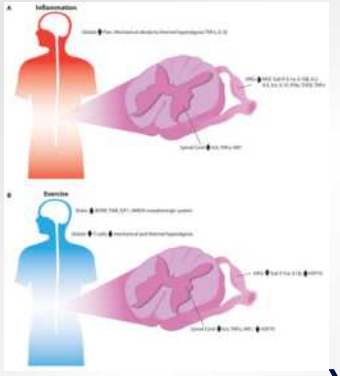
- Systemic
  - Leukocytes elevated not only in the exercised muscle but also in the circulation. This suggests a systemic response from EIMD (Fatouros 2016).

NRT Fatouros, 2016. PMID: 27799809

Inflammatory Effects of Exercise.

"A prominent benefit of both endurance and resistance exercise programs is their reduction of pro-inflammatory cytokines and their increase in anti-inflammatory markers as displayed in Figure 2"

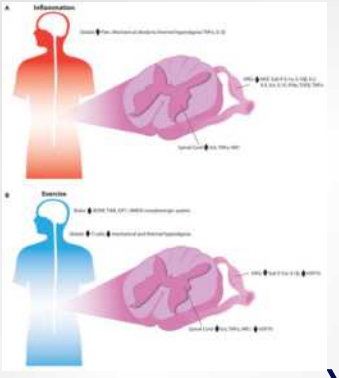
- IL-6 triggers anti-inflammatory response IL-10 anti-inflammation.



NRT Cooper, 2016. PMID: 27601974

Inflammatory Effects of Exercise.

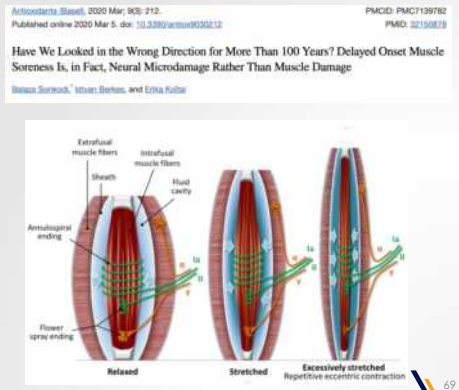
"The pro-inflammatory acute affects of exercise are proposed to cause a subsequent spike in anti-inflammatory cytokines that are long-lasting after completion of the exercise bout."



NRT Cooper, 2016. PMID: 27601974

Inflammation and DOMS

"According to our hypothesis, delayed onset muscle soreness (DOMS) is an acute compression axonopathy of the nerve endings in the muscle spindle. It is caused by the superposition of compression when repetitive eccentric contractions are executed under cognitive demand. The acute compression axonopathy could coincide with microinjury of the surrounding tissues and is enhanced by immune-mediated inflammation"



Have We Looked in the Wrong Direction for More Than 100 Years? Delayed Onset Muscle Soreness Is, in Fact, Neural Microdamage Rather Than Muscle Damage

Balazs Sonkodi, Istvan Berkes, and Erika Koltai

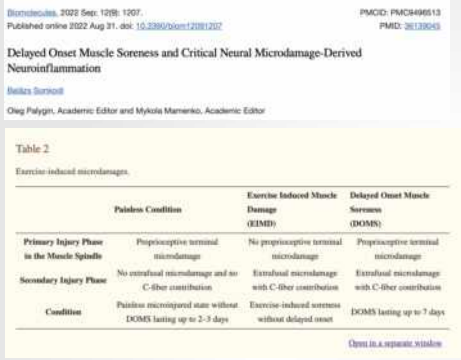
PMCID: PMC7139782 PMID: 32150878

NRT Sonkodi, 2020. PMID: 32150878

69

Inflammation and DOMS

Unaccustomed or strenuous eccentric based exercises leads to hyper excitation of Type 1A afferents. This induces Reactive oxidative stress and the production of neuroinflammation/ cytokines in the spinal cord in adding to muscle.



Delayed Onset Muscle Soreness and Critical Neural Microdamage-Derived Neuroinflammation

Balazs Sonkodi

Oleg Palygin, Academic Editor and Mykola Mamenko, Academic Editor

PMCID: PMC8496513 PMID: 36139045

Table 2

Exercise-induced microdamages.

	Painless Condition	Exercise Induced Muscle Damage (EIMD)	Delayed Onset Muscle Soreness (DOMS)
Primary Injury Phase in the Muscle Spindle	Proprioceptive terminal microdamage	No proprioceptive terminal microdamage	Proprioceptive terminal microdamage
Secondary Injury Phase	No extrafusal microdamage and no C-fiber contribution	Extrafusal microdamage with C-fiber contribution	Extrafusal microdamage with C-fiber contribution
Condition	Painless microinjured state without DOMS lasting up to 2–3 days	Exercise-induced soreness without delayed onset	DOMS lasting up to 7 days

Open in a separate window

NRT Sonkodi, 2022. PMID: 36139045

70

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Inflammation and DOMS

Mouse Study. They swam for 2H to induce DOMS

DOMS induced spinal cord astrocyte and microglial activation in the dorsal horn peaked at 24 hours after exercise.

This initiates a neuroimmune reaction with cytosine and oxidative stress sensitizing nociceptors.

> Front Pharmacol. 2022 Jan 7;12:734091. doi: 10.3389/fphar.2021.734091. eCollection 2021.

Intense Acute Swimming Induces Delayed-Onset Muscle Soreness Dependent on Spinal Cord Neuroinflammation

Sergio M Borghi, Sylvia K D Bussulo, Felipe A Pinho-Ribeiro, Victor Fattori, Thacyana T Carvalho, Fernanda S Rasquel-Oliveira, Tiago H Zaninelli, Camila R Ferraz, Antônio M B Casella, Fernando Q Cunha, Thiago M Cunha, Rubia Casagrande, Waldiceu A Verri Jr

Affiliations + expand

PMID: 35069187 PMCID: PMC8776654 DOI: 10.3389/fphar.2021.734091

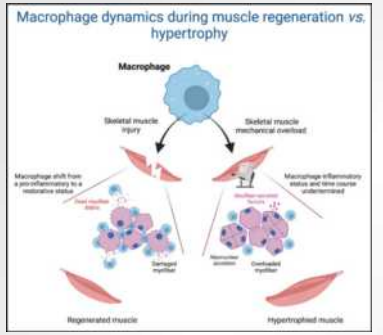
Free PMC article

NRT Borghi, 2022. PMID: 35069187

71

Inflammation and Exercise Induced Muscle Damage

- "Rather than blunting the pro-inflammatory phase, promoting the active resolution of inflammation to establish the regenerative inflammation appears a good strategy to improve/accelerate muscle regeneration as well as to promote muscle growth."



NRT Bernard, 2022. PMID: 36200266

72

71 72

Inflammation and Exercise Induced Muscle Damage

DOMS Summary

- Probably requires unaccustomed exercise, cognitive demand, or significant eccentric contractions.
- Peripheral and central nervous system effects
- Exercise induced muscle damage creates increased local and systemic inflammatory markers.
- Should dosing exercise be a lot like dosing needling? How often do we consider the neural effects of exercise?

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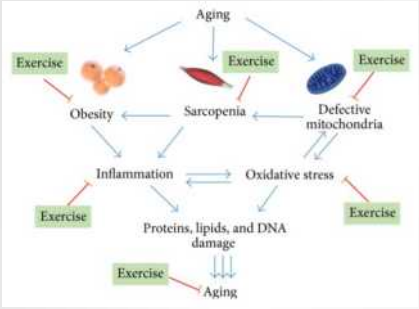
Inflammatory Effects of Exercise on oxidative stress in aging.

"Exercise exerts antioxidant effects by suppressing inflammatory pathways and therefore inhibiting prominent sources of RONS generation.."

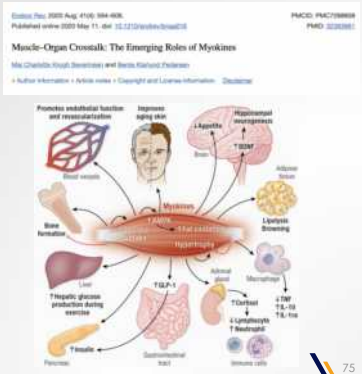


NRT Sallam, 2015. PMID: 26823952

Muscle and Organ Crosstalk

Essential Points

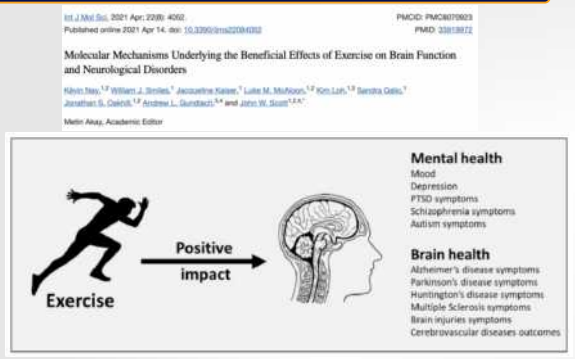
- Myokines are defined as cytokines and other peptides that are produced, expressed and released by muscle fibers and exert either autocrine, paracrine, or endocrine effects
- Myokines mediate communication between muscle and other organs, including brain, adipose tissue, bone, liver, gut, pancreas, vascular bed, and skin, as well as within the muscle itself
- Myokines exert their effects on, for example, cognition, lipid and glucose metabolism, browning of white fat, bone formation, endothelial cell function, hypertrophy, skin structure, and tumor growth
- The myokine IL-6 mediates the exercise-associated anti-inflammatory effects both acutely with each bout of exercise and as a consequence of training adaptation, including reduction in abdominal adiposity.
- The identification of new myokines and their specific roles may lead to novel therapeutic targets
- Myokines can be useful biomarkers for monitoring the type and amount of exercise that are required for the prescription of exercise for people with, for example, cancer, diabetes, or neurodegenerative diseases



NRT Severinsen, 2020. PMID: 32393961

Central effects of exercise.

- Positive effects but exact mechanisms poorly understood.
  - BDNF
  - Myokines
  - Liver and IGF-1
  - Gut Microbiome and Vagus nerve
  - Iron



Nay, 2021. PMID: 33919972

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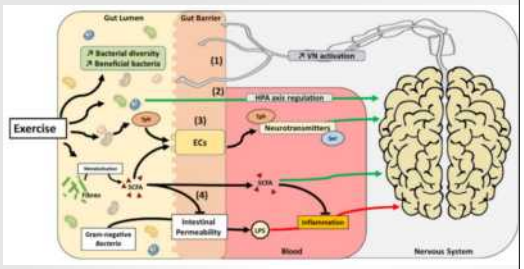
Exercise the Brain and the Gut Microbiome

1. Activation of the vagus n.
   - Depressive changes
2. Activation of HPA Axis
   - Pituitary and pineal gland
3. Modulate neurotransmitters
   - Serotonin and tryptophan
4. Reduce systemic inflammation by managing short chain fatty acids and intestinal permeability.



Nay, 2021. PMID: 33919972

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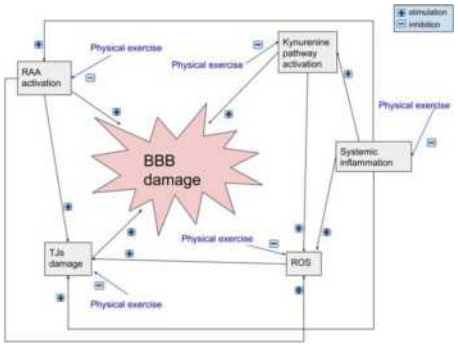
Inflammation the Brain and Exercise

- There is a body of evidence that regular physical exercise diminishes BBB permeability as it reinforces antioxidative capacity, reduces oxidative stress and has anti-inflammatory effects



(Małkiewicz 2019 PMID: 30678702)

78

Summary

Exercise can have a pro and anti-inflammatory effect on inflammation.

There are both local, systemic, and central effects of inflammation and exercise.

There's most likely a metabolic component, a gut component, and central components all at play in how someone reacts to exercise

79

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What kinds of things are you using to address chemical/inflammatory factors of pain and fatigue?

80

Discussion:

Questions?

- **What are you currently doing for local vs. systemic inflammation?**
- **Is anyone having nutrition, stress, or sleep discussions with clients?**
  - **What have you found success with?**
- **What are some strategies you could anticipate adding in to someone who is having trouble with multiple problem areas or dealing with systemic inflammation stress.**

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Understanding Exercise and Inflammation

Lecture 2: Assessing and determining needling dosage for systemic stress, overtraining, and recovery in the active adult and exercise.

Nick Sanders PT, DPT, CSCS, CIDN

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What about needling and inflammation

1. **What is Dry Needling.**
2. **Local effects at the muscle.**
3. **Systemic peripheral effects of exercise.**
4. **Central nervous system effects**

84

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What is Dry Needling

DN is a skilled intervention using a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points and muscula and connective tissues for the management of neuromusculoskeletal pain and movement impairments.

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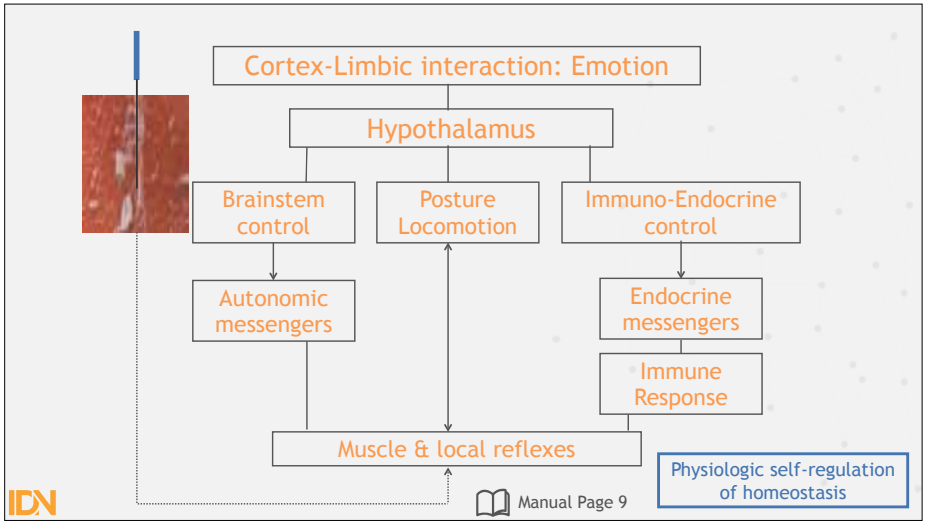


86

Summary of Characteristics of Dry Needling Therapy

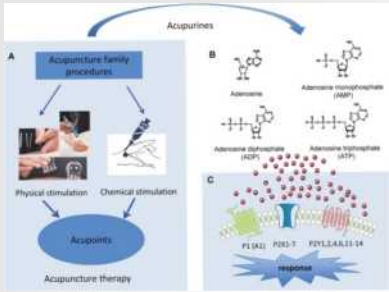
1. Non-specific physiological normalization of soft tissue dysfunction
2. Restoration of homeostasis
3. Promotion of self-healing
4. No interference with natural pathologic processes (Pain, inflammation, fever)

87

What Possibly Happens When We Put a Needle In?

ATP Cell Production

Purinergic signaling peripheral and central analgesic effects.



Tang, 2019. PMID: 30458249

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88

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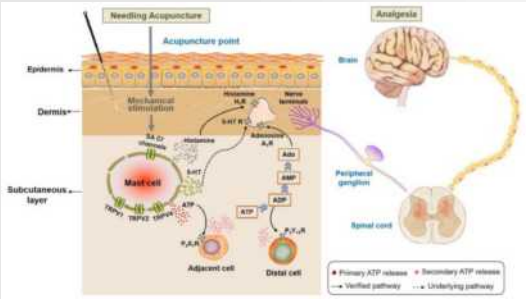
What Possibly Happens When We Put a Needle In?

Mast Cell Production

Mechanical stimulation leading to mast cell stimulation and ATP production at distal cells and dorsal root ganglion.

Mast cells can release histamine, cytokines, and other immune players.



Wang, 2022. PMID: 35269431

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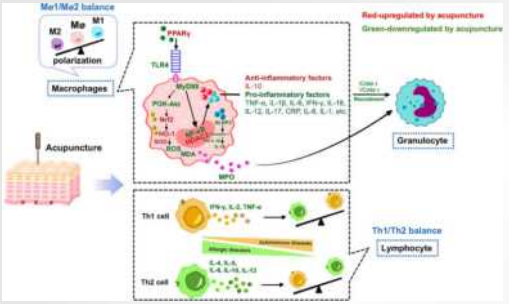
What Possibly Happens When We Put a Needle In?

Anti-Inflammatory Effects



Li N, 2021. PMID: 34992414

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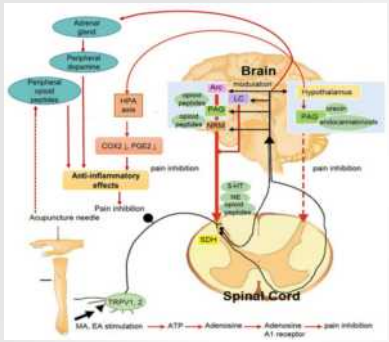
What Possibly Happens When We Put a Needle In?

Endogenous Opiod Release

Peripheral and Central



Wang, 2022. PMID: 35269431

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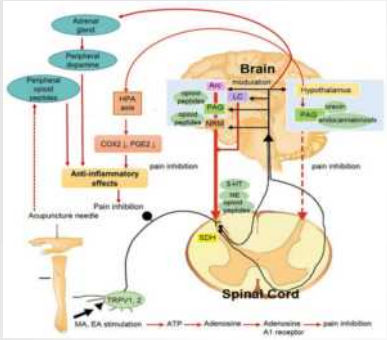
What Possibly Happens When We Put a Needle In?

Summary of Potential Neurophysiolgical mechanisms

1. Mechanical stimulation ATP
2. Mast cell and immune response
3. Peripheral and central opiod release



Lin, 2022. PMID: 35422904

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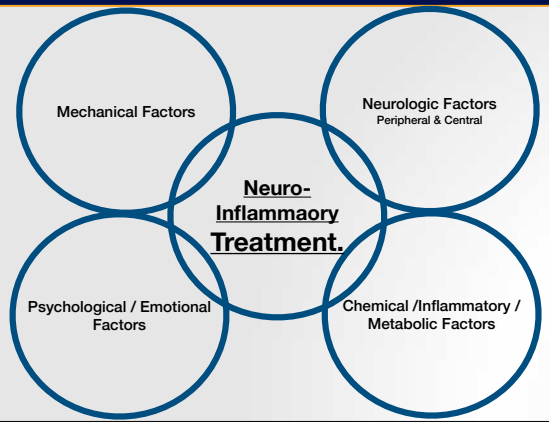
A Neuro-Inflammatory Approach.



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93

Goals of Dry Needling Treatment.

Reduce pain, restore movement, and improve functional activities.

Reduce Tissue Tension | Improve (micro) circulation | Normalize physiological processes

- **The effects of the 720o neurological approach can be:**
  - Local
  - Segmental
  - Systemic

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94

94

What other questions do you have about the physiological effects of dry needling?

95

Local

What's happening with mechanical simulation to the tissue?

Do you get that ache sensation?

Location in proximity to neuromuscular bundle?

- Local Endogenous Opioid Release
- Local Mast Cell Production
- Local ATP at the Cell.

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96

Local

Examples of local needling.

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Local

Examples of local needling.

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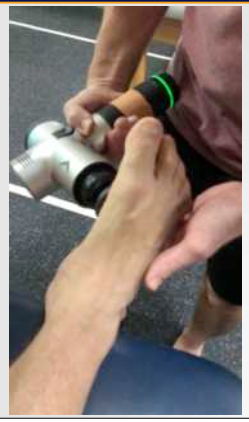
98

98

Other Examples.



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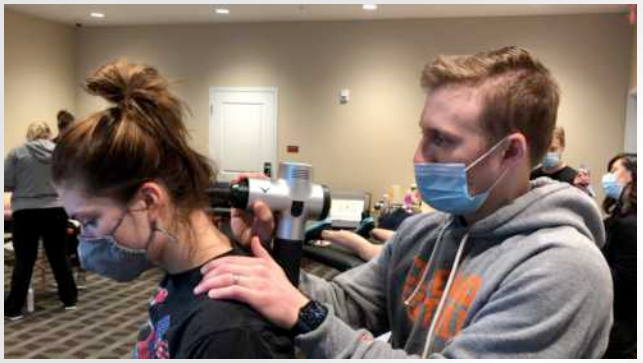
Upper Neck: Weight Bearing with AROM



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Segmental

What's happening at the dorsal root ganglion with nerve stimulation?

Are you treating the area consistent with symptoms dermatomes / myotomes?

- DRG Endogenous Opioid Release
- Secondary ATP production

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101

Segmental

Examples of segmental needling

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102

102

Segmental Cervical

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103

103

Segmental Low Back

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104

104

Triathlete with Plantar Fasciitis

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105

105

Sciatic Nerve

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106

106

Systemic

Central Level + Endocrine (pituitary/pineal gland) + Emotional

- Endogenous Opioid Release
- Pain Processing Centers
- Hypothalmus

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107

107

Systemic

Example of systemic or higher central effect needling.

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108

Systemic

Example of systemic or higher central effect needling.

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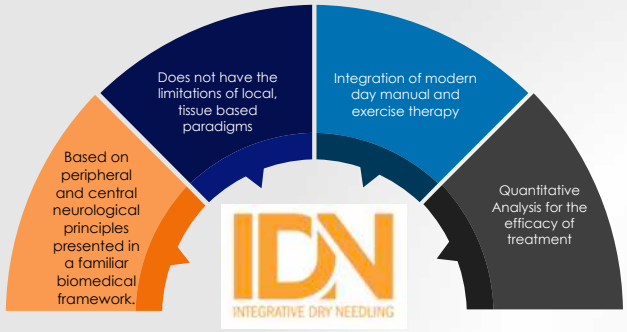
109

IDN: A 720⁰ Integrative Approach



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Discussion:

Questions?

- **For those of you currently doing some needling what have you found with local, segmental, or systemic needling.**
- **Have you noticed any of these similar patterns or ideas in other manual therapies.**
- **Any examples that you have a treating proximal or distal working better than treating local ?**

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Everybody do this…..

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Understanding Exercise and Inflammation

Lecture 2: Assessing and determining needling dosage for systemic stress, overtraining, and recovery in the active adult and exercise.

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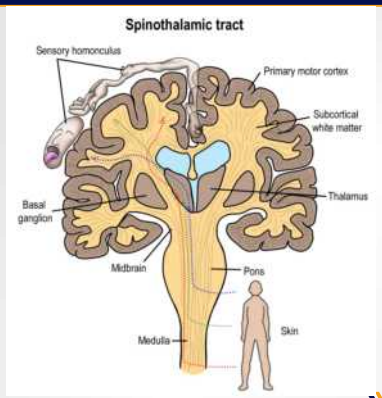
What is Pain

The Brains interpretation of a signal that could cause harm.

- Danger (injury)
- Stranger (intruder)



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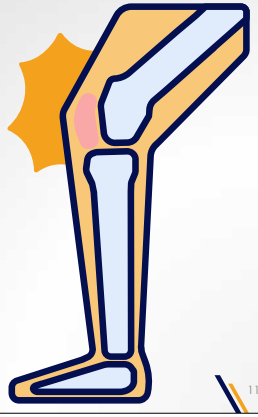
Danger Signal: Actual Tissue Damage

- Tissue Damage will result in an inflammatory response
  - This is good its how we heal
- Our goal is try to provide a safe environment for healing
- Desensitize
- Prevent transmission to chronic pain.



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Treatment Considerations: Actual Damage

Manual therapy and the sensory experience

Acute	Sub-Acute	Chronic
Focus on lymphatics and desensitization techniques.	• Stress to the tissue, sensory nerve feedback • Prevent transition from acute to chronic pain • Neurogenic inflammation	• Central sensitization

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116

116

Treatment Considerations: Actual Damage

Treatment examples Acute

117

117

Acute Proximal Bicep Pain.

Visit 1 / Week 1

Visit 2 / Week 2

Visit 3 / Week 3

118

118

Treatment Considerations: Actual Damage

Treatment examples Sub Acute

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119

119

Treatment Considerations: Actual Damage

Treatment examples Sub Acute

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120

120

Treatment Considerations: Actual Damage

Treatment examples Chronic

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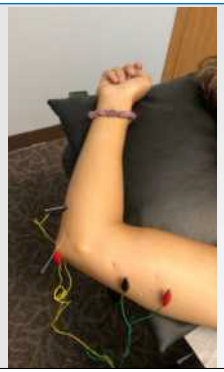
121

121

Treatment Considerations: Actual Damage

Treatment examples Chronic



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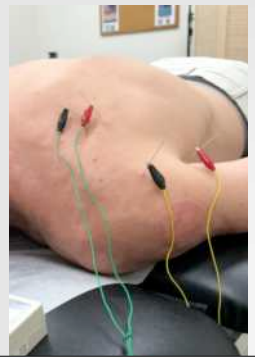
Treatment Considerations: Actual Damage

Treatment examples Chronic



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Treatment Considerations: Actual Damage

Treatment examples Chronic

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124

124

Treatment Considerations: Actual Damage

Treatment examples Chronic

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125

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Treatment Considerations: Actual Damage

Treatment examples Chronic

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126

126

Danger Signal: Potential Tissue Damage

- Positional or Postural Stress that can create pain without true tissue damage.
- Muscle Guarding, tone, etc.
- Increase in nerve sensitivity secondary to
  - Changes in local blood chemistry
  - pH
  - Inflammatory markers
  - Oxygenation levels

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127

Treatment Considerations: Potential Damage

Manual therapy and the sensory experience

Local

- Focus on increasing blood flow in the involved area.
- Decrease nerve hypersensitivity

Regional

- What's causing increased tone.
- Postural Assessments.
- Tolerance to stretch or tension.

Central

- Is there a fear or cognitive protective mechanism.
- Increased sympathetic activity

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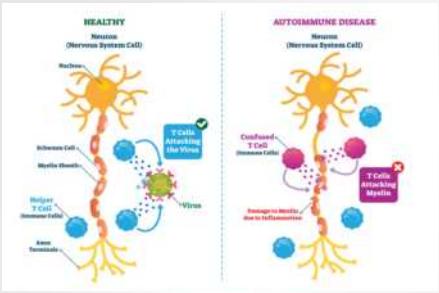
128

Stranger Signals. Real or "Perceived"

- Foreign intruders that cause threat.
  - Bacterias, viruses, allergens, implants, Food?
- "Perceived"
  - Auto-Immune
    - Immune system unnecessarily attacking itself.



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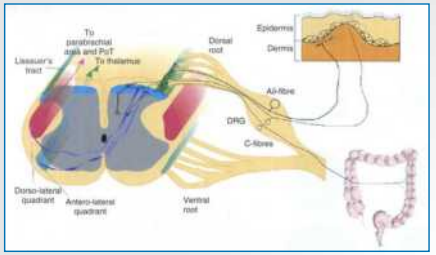
Visceral Pain: Referred Pain



Visceral pain can be referred to a single musculoskeletal structure or to a region of the body.

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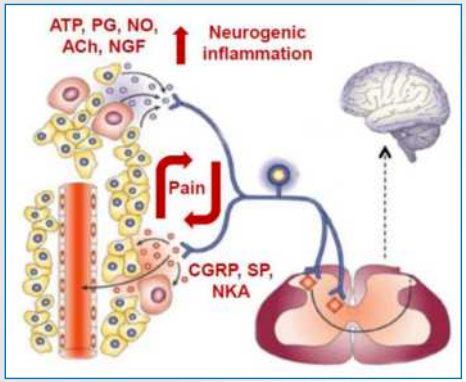
130

Neurogenic Inflammation and The Viscera



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131

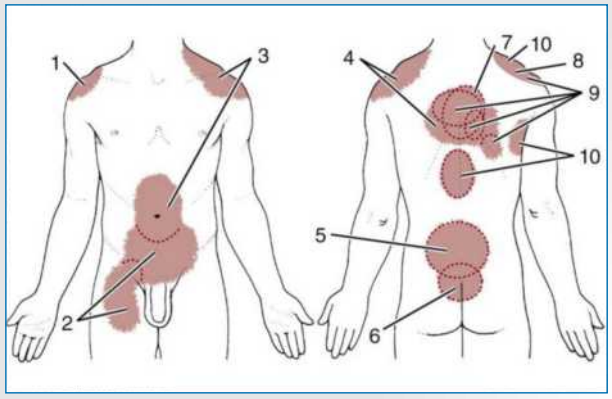

Fig. 8-19
Full-figure referred pain patterns.

1,Liver/gallbladder/ common bile duct;
2, appendix;
3, pancreas;
4, pancreas;
5, small intestine;
6, colon;
7, esophagus;
8, stomach/duodenum;
9,liver/gallbladder/common bile duct; and
10, stomach/duodenum.

Goodman, C 2013

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132

132

Consideration Points

- GI disorders can refer pain to the sternum, neck, shoulder, scapula, low back, sacrum, groin, and hip.
- When evaluated during early onset of referred pain, there is usually full and painless range of motion, but as time goes on, muscle splinting and guarding secondary to pain or as a component of motor nerve involvement will produce altered movements as well.

Differential Diagnosis for Physical Therapists: Goodman 2013

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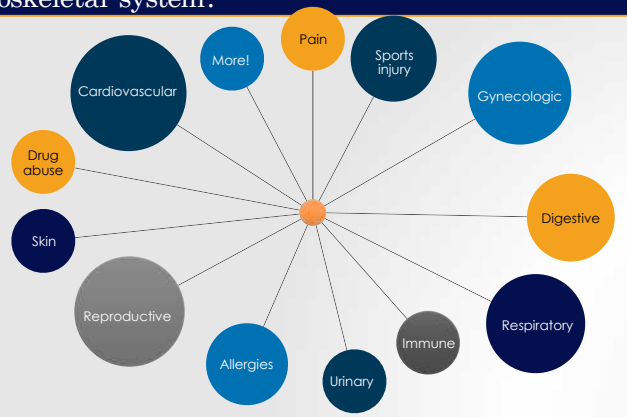
133

133

All pathologic conditions affect soft tissues/ musculoskeletal system.



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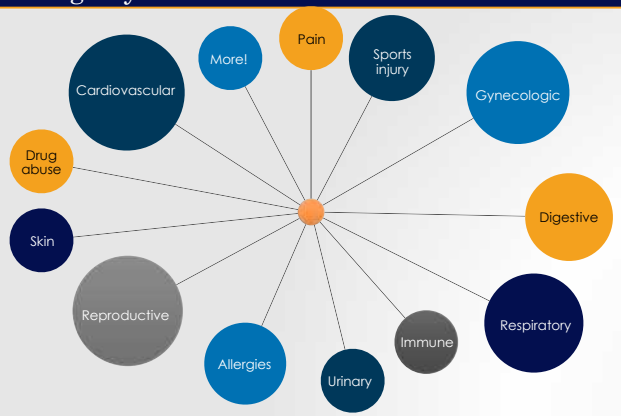
134

134

All musculoskeletal system disorders can affect visceral organs through systemic circulation.



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135

135

Treatment Considerations: Stranger Signals

***** Refer out when appropriate*****

Local

- Focus on increasing blood flow in the involved area.
- Decrease nerve hypersensitivity

Regional

- May require a referral to make sure there is nothing medically wrong.

Central

- Lymphatic flow
- Increased sympathetic activity
  - Relaxation techniques.

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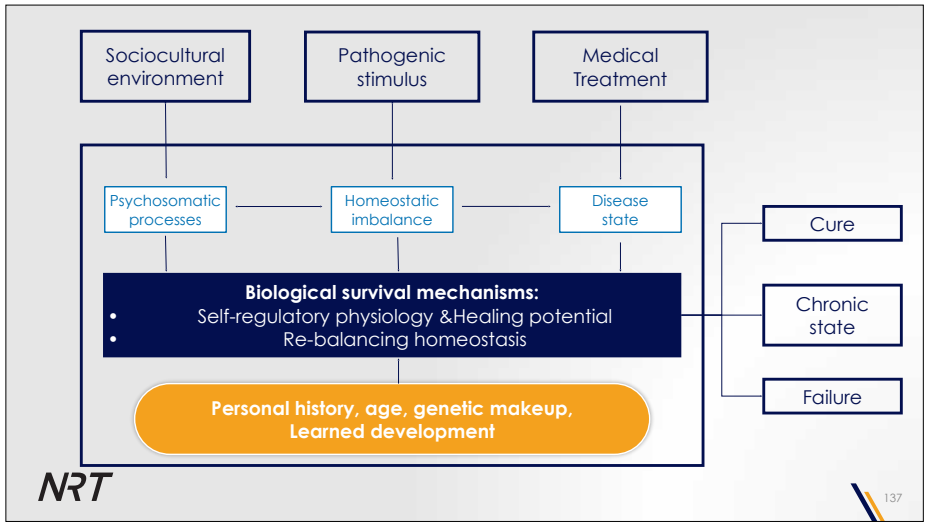
136

136



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Discussion:

Questions?

- **Ever had someone get sick and then notice their old back/neck/whatever problem increases? What do you think that mechanism is?**
- **How would you structure your exercise programs to mimic manual therapy under this neuroinflammatory style?**

138

139

Central Sensitization

"Increased responsiveness of nociceptive neurons in the central nervous system to their normal or subthreshold afferent input.

Note: See note for sensitization and nociceptive neuron above. This may include increased responsiveness due to dysfunction of endogenous pain control systems. Peripheral neurons are functioning normally; changes in function occur in central neurons only."

https://www.iasp-pain.org/resources/terminology/

IASP

140

140

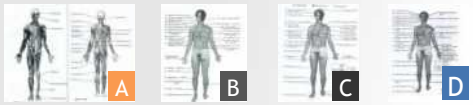
Neuronal Plasticity in Central Nervous System.

Visceral Pathology

Peripheral Sensitized Neuro-Trigger Points.

Central Sensitization - Brain and Spinal Cord.

Self Healing Potential



28% 34% 30% 8%

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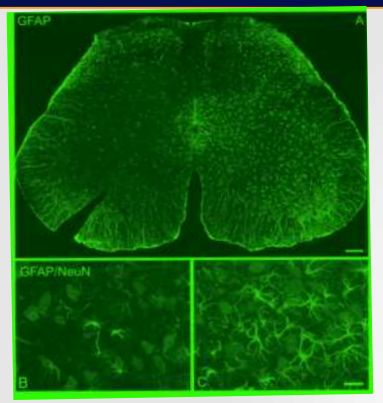
Central Sensitization



Mense, S. 2003
Current Pain and
Headache Reports
Vol. 7 Issue 6

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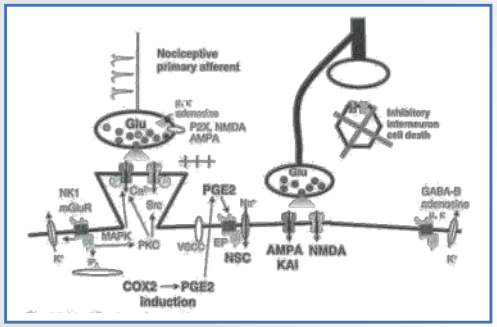
142

142

Central Sensitization of CNS

Modulation or modification of function, chemical profile, and structure.



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143

143

Systemic and Central Considerations in Sport

Nervous System Sensitization in Persistent tendinopathies.

- **"Lowered pressure pain threshold was observed across different tendinopathies at the site of tendinopathy, as well as at other sites, the latter being suggestive of central sensitization." Plinsinga 2015. PMID 26390275**


Evidence of Nervous System Sensitization in Commonly Presenting and Persistent Painful Tendinopathies: A Systematic Review

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144

144

Systemic and Central Considerations in Sport

Chronic patellofemoral pain syndrome

- **Altered pressure pain thresholds.**
- **"Clinicians should incorporate quantitative sensory tests into the examination process to track improvement over time" Sigmund 2021**


JAT JOURNAL OF ATHLETIC TRAINING

Exploring the Pain in Patellofemoral Pain: A Systematic Review and Meta-Analysis Examining Signs of Central Sensitization

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Systemic and Central Considerations in Sport

Chronic Tendinopathy

- **Nearly half of patients presented here with tendinopathy conditions or plantar fasciitis scored highly enough on Self-Administered Leeds Assessment of Neuropathic Symptoms and Signs (S-LANSS)" Wheeler 2022**


Nearly half of patients with chronic tendinopathy may have a neuropathic pain component, with significant differences seen between different tendon sites: a prospective cohort of more than 300 patients

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Systemic and Central Considerations in Sport

DOMS

- **Local and Systemic Effects.**


IJSPT INTERNATIONAL JOURNAL OF SPORTS PHYSICAL THERAPY

BILATERAL SENSORY DEFICITS AND WIDESPREAD HYPERALGESIA OCCUR FOLLOWING INDUCED DELAYED ONSET MUSCLE SORENESS OF THE QUADRICEPS

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Any questions on central sensitization or sensitization in athletes ?

Psychophysical Assessments

The most widely used paradigm to assess central hypersensitivity consists of the application of a standardized stimulus to a peripheral tissue and the recording of a subject's response.

Curatolo 15' , Uddin 16'

- The paradigm relies on the assumption that a non-painful stimulus, when applied to a non-injured tissue (passive NTrP), can evoke pain only if central nociceptive pathways are hypersensitive.
- It is difficult for the clinician to determine if the hypersensitivity is caused by a peripheral mechanism, central mechanisms, or a combination of the two.

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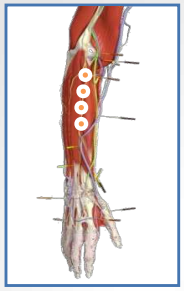
149

Quantitative Sensory Testing.

- Original work based on 110 points
- Original evaluation was based on evaluating all 110 points
- The Quantitative Evaluation was modified by Dr. Ma to assess only 16 points.

Technique: Apply sufficient pressure that compresses the soft tissue overlying the involved nerve until a firm end feel is reached.

Firm end feel defined as a sensation of a firm yet elastic response.



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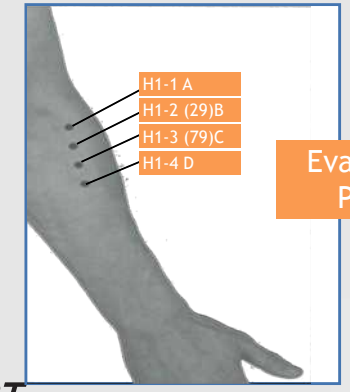
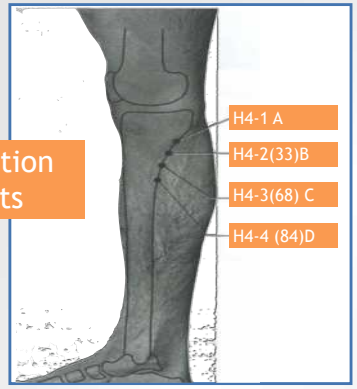
1. Radial Nerve



Evaluation Points

4. Saphenous Nerve



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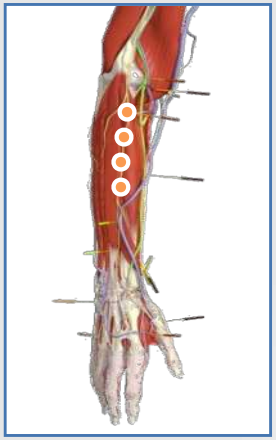

Radial nerve

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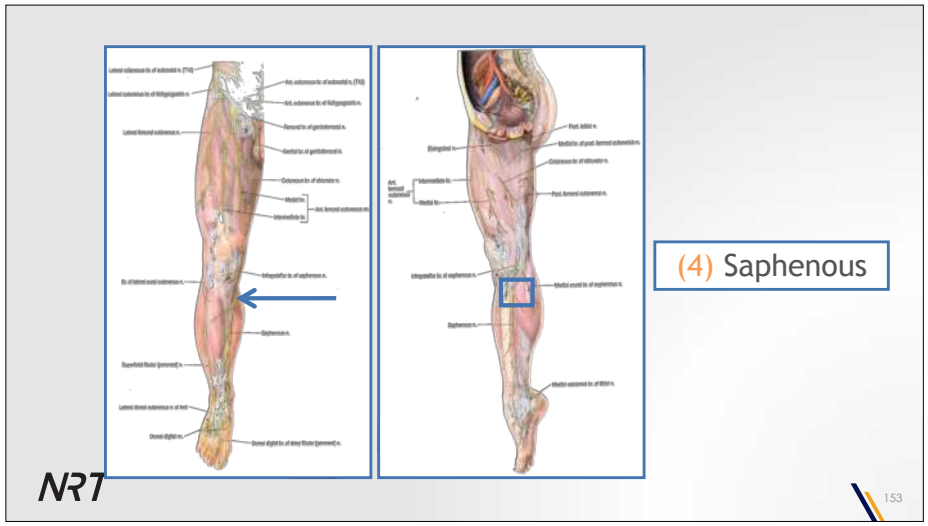
152



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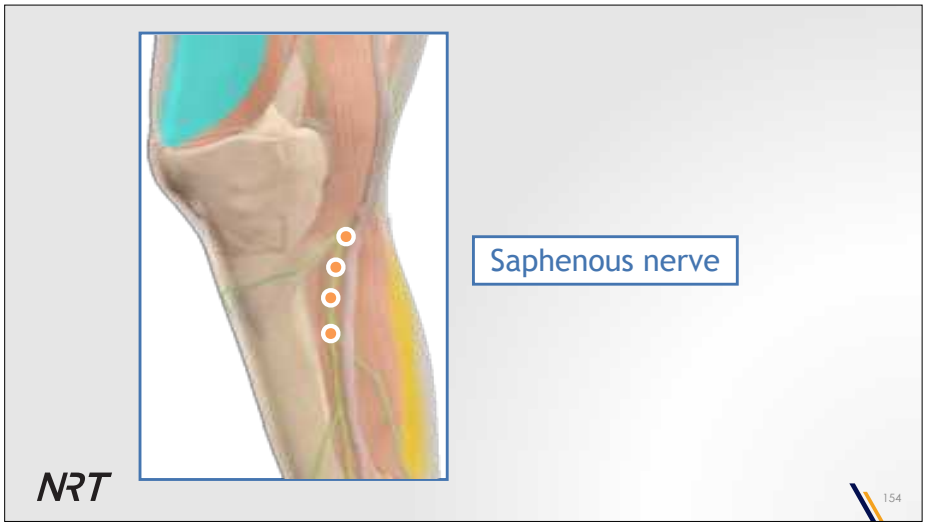

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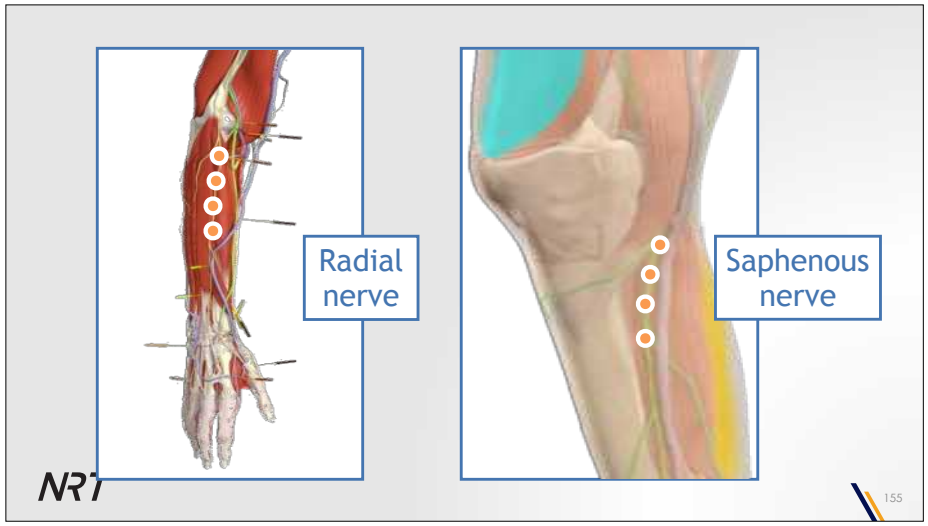

155

QST Instructional Video

Previously recorded and available in NRT Online Course

156

Other Considerations for systemic stress in sport

Markers and tools potentially diagnostic of OTS

EROS-CLINICAL score	EROS-SIMPLIFIED score	EROS-COMPLETE score	OTHERS
- Eating patterns - POMS subscales	- Eating patterns - POMS subscales - Basal hormones	- Eating patterns - POMS subscales - Basal hormones - Hormonal responses to ITT - Body composition	- HRV - Metabolites - TBE and CPX - Neurotransmitters - Immunological and redox parameters - Telomere length - EEG - Psy. questionnaires

If inconclusive result, move to the next score →

Carrard, 2022. PMID: 34496702

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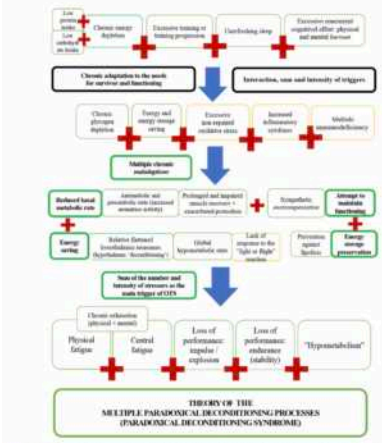

Figure 4 Triggers, pathophysiology and consequences of overtraining syndrome (OTS).

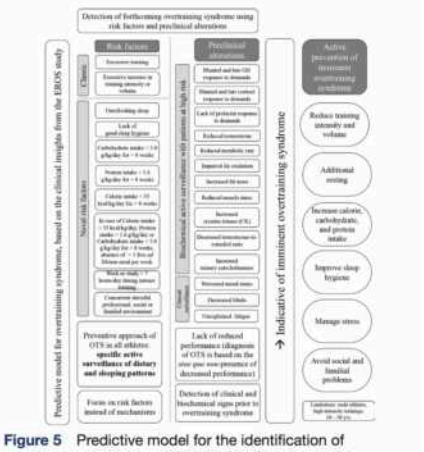

Figure 5 Predictive model for the identification of overtraining syndrome (OTS). EROS, Endocrine and Metabolic Responses on Overtraining Syndrome; GH, growth

https://bmjopensem.bmj.com/content/bmjosem/5/1/e000542.full.pdf

158

How can you use your QST to help determine needling dosage and prognosis?

159

Determining Needling Dosage

How Much Actual Mechanical Stress Do You Need to Create?

- Nerve "tricks" vs. chemical/immune stimulation.
- How much mechanical stimulation do they need?
- What stage of pain is the person in?
- Based off of their QST score can they handle more inflammation?

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Deciding Which Tool to Use: General Guidelines.

Work Superficial to Deep with needling. What it the minimum depth to create an effect?

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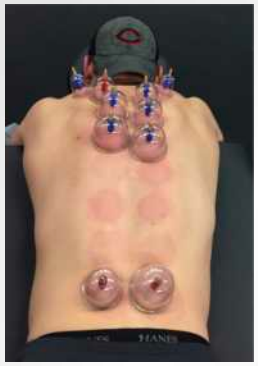
161

Deciding Which Tool to Use: General Guidelines.

Systemic Issues

- Cupping for lymphatic and vascular effects.
- Vibration for central sensory effects
- Combine them???



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162

162

Deciding Which Tool to Use: General Guidelines.

Understand the Neurology.
– Work Distal or Proximal

- For exceptionally tender areas.
- Treat the nerve distribution proximally or distally first, gauge the results.
- Then finish with local treatment as necessary.

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163

163

How can you use your QST to help determine needling dosage and prognosis?

Summary

- Increased central effects can be found in chronic pain including tendinopathy.
- Systemic inflammatory effects in DOMS
- Manage mechanical stress added for someone who is already dealing with high stress.
- What techniques can you use to improve lymphatic flow and decrease sensitization?
- Can you use techniques that have higher sensory value and central activation?

164

164

Discussion:

Questions?

- **In what ways are you adding central sensitization testing to your current practice?**
- **Thoughts on using it with athletes?**
- **For those of you who have taken the Foundation Course have you started using the QST test on any of your patients? Any significant findings?**

165

Everybody do this…..

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166

166

Understanding Exercise and Inflammation

Lecture 3. Integrating Dry Needling into other manual therapies and exercise for the active adult and athlete. + Case Application

Nick Sanders PT, DPT, CSCS, CIDN

167

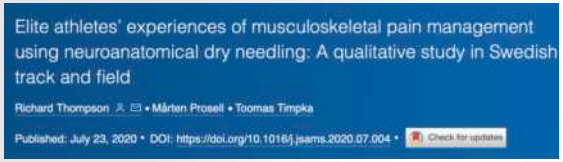
Dry Needling For Sport and Performance

168

168

Treatment Considerations: Performance.

"The elite athletes appreciated the fast-acting effects of the naDN treatment provided at the study clinic as it facilitated rapid return-to-play (RTP)"


Elite athletes' experiences of musculoskeletal pain management using neuroanatomical dry needling: A qualitative study in Swedish track and field

Richard Thompson • Mårten Prosell • Toomas Timpka

Published: July 23, 2020 • DOI: https://doi.org/10.1016/j.jsams.2020.07.004 • Check for updates

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Treatment Considerations Range of Motion

- Multiple Studies show improvement with range in the presence of pain.
- Dry Needling Compared to static stretching. (Alaei 2020). *Access to abstract only.*
  - 40 healthy subjects
  - Dry needling demonstrated greater improvements compared to SS.
    - Single session, 60 seconds of needling on 3 points in hamstring.
    - Static Stretching. 3 x 30 seconds.
    - DN significant improvements at 15 minutes post


Randomized Controlled Trial. > J Sport Rehabil. 2020 Oct 7;30(3):462-467. doi: 10.1123/jsr.2020-0111.

Dry Needling for Hamstring Flexibility: A Single-Blind Randomized Controlled Trial

Parisa Alaei, Noureddin Nakhostin Ansari, Soofia Naghdi, Zahra Fakhari, Shiva Kamesh, Jan Dommerholt

PMID: 33027765 DOI: 10.1123/jsr.2020-0111

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Treatment Considerations Strength / Power

- Multiple Studies show improvement with strength in the presence of pain.
- Dry Needling Compared to sham (Bandy 2017).
  - 35 healthy subjects
  - Dry needling to 4 sights on the gastrocnemius
  - Sham had guide tube pressed only
    - Vertical jump was tested. (Chalk on wall)
    - Received DN or Sham
    - Vertical Jump Retested (average of 10 minutes between jumps.
    - DN group on average improved 1.2 inches


IJSPT INTERNATIONAL JOURNAL OF SPORTS PHYSICAL THERAPY

Int J Sports Phys Ther. 2017 Oct; 12(5): 747–751. PMCID: PMC5685413 PMID: 29181252

COMPARISON OF DRY NEEDLING VS. SHAM ON THE PERFORMANCE OF VERTICAL JUMP

William D Bandy, PT, PhD, SCS,[a] Russell Nelson, PT, PhD, SCS, ATC,[7] and Lisa Bearmer, PT, DPT[2]

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Dry Needling Timing For Sport

Personal opinion.

1. Best case is get to know your athlete and how they respond to DN treatment. Make your adjustments appropriately.
2. Be careful with aggressive needling followed by full intensity efforts within a 24-48 hour window.
3. Sympathetic boosts or range improvement prior to events? Don't fatigue then out or make them sore prior.
4. For recovery I have had best luck needling within a 24 hour post workout window.
   - Doing all of the homeostatic points has worked better than anything else I have tried.
   - Adding cupping and vibration seems to help as well.
   - I have not personally tried ENS for general recovery but given some of the central mechanisms that might be at play that could be worth experimenting with.

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Dry Needling For Delayed Onset Muscle Soreness

Treatment Considerations DOMS

Acupuncture and DOMS

- Huang 2020
  - Six RCT's qualified.
  - Reduced muscle soreness rating
  - Reduced serum creatine kinase
  - Improved muscle strength
  - Effects lasted 24-72 hours.


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Does Acupuncture Benefit Delayed-Onset Muscle Soreness After Strenuous Exercise? A Systematic Review and Meta-Analysis

NRT Huang, 2020. PMID:32765287

Treatment Considerations DOMS

Acupuncture and DOMS

- Chang 2020
  - 15 RCT's included.
  - Acupuncture better on day 1.
  - Lack of follow up reporting is minimal in majority of studies.


Effects of Acupuncture on Delayed-Onset Muscle Soreness: A Systematic Review and Meta-Analysis

NRT Chang, 2020. PMID:32714410

Treatment Considerations DOMS

Vibration and DOMS

"DOMS is caused by unaccustomed exercise, mainly after high-intensity centrifugal exercise, and results in skeletal muscle injury and ultrastructural changes which manifest as muscle soreness, stiffness, swelling, decreased strength, and elevated serum CK concentrations.[3,19,42] Of the many published DOMS mechanisms, the most generally accepted favors the mechanical injury theory, the inflammation theory, and other factors acting together to cause DOMS.[1,43–45] Following high-intensity centrifugal exercise, muscle contractile structures within skeletal muscle are at their least stable, and myofilaments within muscle fibers fail to coordinate movement effectively. This results in excessive stress on single or weaker muscle fibers, overstretching to the point of tearing, and damage to the muscle membrane, leading to increased intracellular Ca2+ concentrations, calcium overload phenomena activating calpain, the destruction of protein structure, protein degradation, autophagy, and inflammatory responses"

Yin, 2022. PMID:362281110


Medicine

The effect of vibration training on delayed muscle soreness: A meta-analysis

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Treatment Considerations DOMS

Vibration and DOMS

- Yin 2022
  - Whole Body Vibration
  - Sixteens studies included.
  - Primary evaluated VAS, PPT, serum creatine kinase.
  - Results suggested improvements in these in all variables including muscle repair
  - Limitations suggesting follow up and best type and duration of VT.

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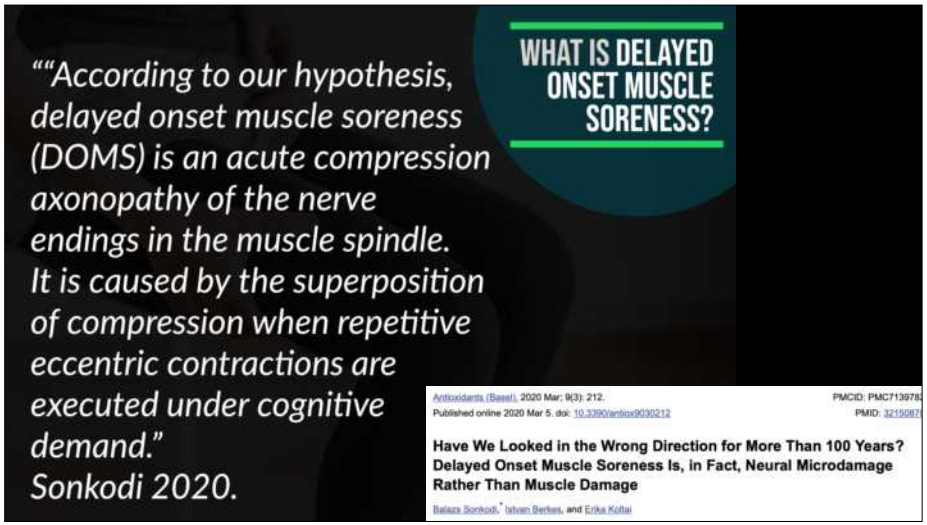
Yin, 2022. PMID:362281110

177



178

Treatment Considerations DOMS

DOMS and the sympathetic nervous system.

- Fleckenstein 2021
  - Suggest inflammation and ANS are linked
  - Applied Stellate ganglion block after eccentric bicep exercise.
  - SGB showed an effect on ANS
  - Effect on DOMS was positive but small.

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179

Treatment Considerations DOMS

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180

Treatment Considerations DOMS

DOMS Summary

- Mixed results but generally positive.
- Do we need to include more of a central component to effect ANS?
- In situ 18 minutes?
- Add needle rotations?
- Add ENS
- Does vibration effect lymphatic flow or sympathetic nerve activity?

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181

181

Treatment Considerations Swelling

Could needling be used to help manage swelling? (Personal experience)

- Normalize ANS response.
- Local tissue guarding that may effect lymphatics or venous return?

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182

182

Dry Needling For Tendinopathy

183

183

Treatment Considerations Tendinopathy: Acute – Sub-Acute

Promote transition from Pro-Inflammatory to Anti-Inflammatory / Regenerative Processes in the Immune Response.

Personal Thoughts:

-Add mechanical Stress

-Manage sympathetic up regulation / emotional response as best as possible.

-Continue to promote microcirculation

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184

184

Treatment Considerations Tendinopathy: Chronic

Chronic tendinpothy

- May show signs of chronic inflammatory processes
  - Achilles Dakin 2018 PMID: 29118051
- Central sensitization (Plinsinga 2015) PMID 26390275
- Increased and persistent stroll fibroblast activity in diseased vs healthy tendon. (Dakin 2017 PMID 28122639)

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185

Does low grade, chronic inflammation effect tendon healing?

- The type of macrophages present and the level of pro-inflammatory inflammation may be effected in the first 3-7 days in the presence of low grade inflammation.
- May effect the transition from a pro-inflammatory response (M1 macrophages) to a reparative response (M2 Macrophages).
- "Active control of the immune system is a very plausible therapeutic strategy to induce tissue regeneration. However, one of the main challenges is to target the right immune cell populations and pathways for the tissue that need to be regenerated."

Rehak 2021 PMID: 34863223

186

Treatment Considerations Tendinopathy: Chronic

Chronic tendinopathy

- May show signs of chronic inflammatory processes
  - Achilles Dakin 2018 PMID: 29118051
- Central sensitization (Plinsinga 2015) PMID 26390275
- Increased and persistent stromal fibroblast activity in diseased vs healthy tendon. (Dakin 2017 PMID 28122639)

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187

Tendinopathy

Dry Needling

- Most studies involve local needling
  - Positive outcomes for hip trochanteric bursitis, lateral epicondylitis, patellar, achilles. etc. Stoychev 2020. PMID: 31942676
  - If we wanted to include central effects.
    - Add ENS
    - Add needle rotation.
      - Uygur 2017 PMID 28828509
      - Needling for lateral Epicondylitis compared to ibuprofen and brace.
      - 5 needles in most painful area of lateral epicondyle. Rotated 3-4 times. In situ 10 min.

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188

188

The use of dry needling vs.corticosteroid injection to treat lateral epicondylitis (LE): a prospective, randomized, controlled study. Uygur, Aktas 2021

Design: 101 subjects with LE had first line treatment of NSAID's/forearm brace if no change at 3 weeks then randomly assigned to 1 of 2 groups. Outcome variable was the Patient-Rated Tennis Elbow Evaluation (PRTEE).

Group 1: 5 sessions of dry needling (DN) {N=49}
- 15- 25 mm needles inserted down to the bone, 3-4 rotations, and left in 10 minutes at the lateral epicondyle and down the extensor muscle bulk.

Group 2: 1 single Cortisone Injection (CS) {N=52}
- 2 mL methylprednisolone acetate, Depo-Medrol 40 gm/ML single dose injection followed by 20-30 peppering lesions using a 22 gauge needle.

Results: PRTEE Scores revealed patients treated with DN had greater improvement than CS patients at both 20 days and 6 month follow up. Minor skin complications in the CS group (N=4)

Page 70 in manual

189

Golfer's Elbow Case Report

Patient was 40yo, male. 2 year pain. Multiple other treatment techniques.
- Tendinopathy identified on US/ doppler.
- 10 needles left in situ for 20 minutes
- \Patient reported decreased pain and disability at 2 days

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190

190

Dry Needling vs. Corticosteroid.

Chiropr Man Therap. 2021; 29: 49. PMCID: PMC8638538
Published online 2021 Dec 2. doi: 10.1186/s12998-021-00408-y PMID: 34857021

Corticosteroid injection or dry needling for musculoskeletal pain and disability? A systematic review and GRADE evidence synthesis

Luis Fernando Sousa Filho, Marta Maria Barbosa Santos, Gabriel Henrique Freire dos Santos, and Walderi Monteiro da Silva Júnior

Author information · Article notes · Copyright and License information Disclaimer

- "In conclusion, there is very low quality of evidence that there is no significant difference between CSI or DN for pain or disability at short-, medium- or long-term follow-up in people with myofascial pain and greater trochanteric pain syndrome."
- Sousa 2021 PMID: 34857021

191

Dry Needling Tendinopathy

Discussion Points.

- Thoughts on Tendinopathy and inflammation?
- Theories of eccentric exercise?
- Combining Dry Needling with Isometrics or Eccentrics.
- Dry needling plus cross friction massage.
- Dry Needling Plus IASTM / Cupping

192

Dry Needling Tendinopathy

Discussion Points.

193

Dry Needling For Osgood-Schlatter disease / osteochondritis

194

194

Osgood-Schlatter disease / osteochondritis

Healthcare (Basel). 2022 Jun; 10(6): 1011. PMCID: PMC9222654
Published online 2022 May 30. doi: 10.3390/healthcare10061011 PMID: 35742062

Osgood-Schlatter Disease: Appearance, Diagnosis and Treatment: A Narrative Review

Francisco Corbi,[1] Sergi Matas,[1] Jesús Álvarez-Herms,[2] Sebastian Sitko,[3] Ernest Baiget,[4] Joaquim Reverter-Masia,[5] and Isaac López-Laval[3,*]

Maria Chiara Gallotta, Academic Editor

No consensus on etiology / pathogenesis.

- Training factors and force may be involved.
- One studied looked at vitamin D deficiency.
- Did not look at inflammatory markers.
- Shape of patella etc. did not play a roll

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195

195

Osgood-Schlatter disease / osteochondritis

Personal Experience / Opinion

- In my experience I have good results with different osteochondritis conditions.
  - With children in general
    - Smaller gauge needles and less of them
    - Goal is a normal immune response
      - How much stimulus do you need?
    - Use a desensitization technique first
      - Cupping, vibration, IASTM
      - Taping after?

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196

196

Dry Needling For Muscle Strains

197

197

Treatment Considerations Muscle Strain

Looking at myotendinous junction.

- Author suggests mechanism not fully understood
- Strain may require simultaneous stretch + forceful muscle contraction
- High number of adipocytes at the MTJ.
  - Adipodcytes can produce cytokines
  - May be responsible for the remodeling process that needs to repeatedly happen at the MTJ.
- Mechanisms pro-inflammatory response (M1 macrophages which release pro-inflammatory cytokines) to a reparative response (M2 Macrophages anti-inflammatory cytokines).


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The Myotendinous Junction—A Vulnerable Companion in Sports. A Narrative Review

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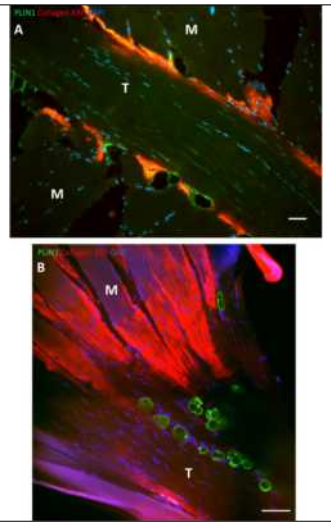
198

198

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The Myotendinous Junction—A Vulnerable Companion in Sports. A Narrative Review

A is human semitendinosis.
B is mouse soles

M = muscle
T = Tendon.
Green = adipocytes

199

199

Dry Needling For Sprains

200

200

Treatment Considerations Sprain: Acute

Personal Experience / Opinion

- In my experience with acute sprains.
  - Manage swelling
  - Normalize Pain.
  - Combine With Other Treatment Options



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201

201

Treatment Considerations Sprain: Chronic

DN for Chronic Ankle Instability

- 32 patients with CAI
  - 16 received DN to Peroneus Longus and anterior tibialis. The most painful trigger point was identified. Poisoning manipulation with 1 puncture/sec for 30 seconds.
  - 16 placebo DN, with set technique that did not puncture skin.
- PL and TA activation improved. Single leg balance and sway improved in the DN group only. Maintained out to 1 month.


Effects of Dry Needling on Neuromuscular Control of Ankle Stabilizer Muscles and Center of Pressure Displacement in Basketball Players with Chronic Ankle Instability: A Single-Blinded Randomized Controlled Trial

NRT Lopez- Gonzales, 2021. PMID:33669979

202

202

Knee Pain Case Scenario.

- What Nerve Level is involved>Working Superficial To Deep
- Passive to Active.


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203

203

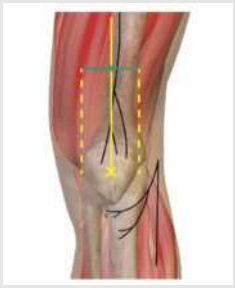
Passive.

Superficial → Deep


204

204

Patellar Mobility + Anterior Femoral Cutaneous n.



Dasa V, et al. Percutaneous freezing of sensory nerves prior to total knee arthroplasty. Knee (2016). http://dx.doi.org/10.1016/j.knee.2016.01.011

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205

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Deep Treatment Of the Nerve Distribution.

206

206

Dry Needling With Vibration.

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207

207

Active

208

208

Active

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209

209

Segmental L2-L4

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210

210

Segmental L2-4

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211

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Regional

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212

212

Home Exercise Program.

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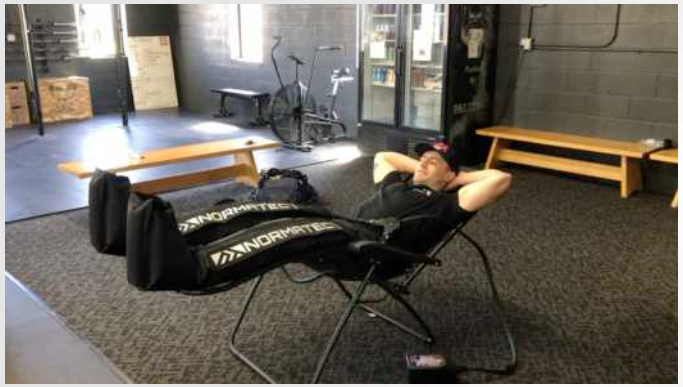
213

213

Lymphatics.



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214

214

Any Other pathologies / situations you want us to specifically talk about?

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215

Any other questions on needling application or ideas on combining with other tools?

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216

Case Study Review

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217

Case 1. General

- 25 year old female, Active, Crossfit 2-3x/ week, but works in office setting.
- History of chronic headaches (multiple times per week), jaw pain, thoracic pain and lumbar pain. No significant medical/ health history.
- Woke up in the morning yesterday with acute neck pain, radiating down the left scapular girdle, making it difficulty to turn her head left.
- QST 14/16

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218

218

Case 2. Lower Extremity

Anterior Knee Pain.

- A 13 year old female basketball player has a new onset of anterior knee pain you suspect Osgood-Schlatter disease.
- Normal patellar tendon reflex. Paresthesias and a numbness sensation reported in the medial knee and medial right calf.
- She is in week 3 of the season
- Quantitative Analysis score of 15/16

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219

Case 3. Upper Extremity

Shoulder pain and weakness of the arm

- A 16-year old, male, high school pitcher is experiencing a painful sensation in his right shoulder after pitching.
- He denies numbness or tingling, denies neck or elbow pain, states it only hurts after he throws.
- Has noticed he has been less consistent with velocity and ability to throw strikes.
- Weak shoulder external rotation, and biceps with reduced right biceps reflex.
- Quantitative Analysis score of 2/16

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220

220

Case 4. Lower Extremity

Achilles Tendonitis

- A 22-year old female is a long jumper that was injured at a competition 2 weeks ago. She reported a sharp pain upon pushing off with the left foot.
- She reports pain, cramping and paresthesias in the posterior left calf down into the lateral foot with walking. Neuro examination is negative. Strength is pain limited. Quantitative Analysis score of 12/16
- She has not had an MRI.

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221

221

Case 5. Lower Extremity

Hamstring Pain and Buttock Pain.

- A 24-year old triathlete experienced a sharp pain in the left posterior thigh down to the posterior calf during a run 2 days ago that stopped her from running.
- She experienced weakness to resisted knee flexion and a reduced hamstring reflex but a normal Achilles reflex. Quantitative Analysis score of 6/16
- Low lumbar pain began the next day; she has not had imaging done but does have moderate bruising present.

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222

222

Case 6. Upper Extremity

Lateral Elbow Pain

- A 45-year old male tennis player and pipe fitter has had a 5 year history of lateral elbow pain.
- History of ulnar reposition 8 years ago.
- He gets sharp pain with gripping, shaking hands, and playing tennis.
- General neck soreness and will occasionally feel an achy type pain down the back of his forearm.
- QST score 8/16.

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223

223