

Integrative Dry Needling for the Upper Extremity & Hand



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Course Agenda

Time	Topic
	Friday – Day One
7:30-8:00	Registration/sign in.
8:00 - 9:00	Lecture 1: Introduction of concept, physiological mechanisms of dry needling, peripheral and central mechanisms, specific and non-specific mechanisms.
9:00 -9:45	Safety Lecture (Adverse Reactions, OSHA guidelines, BBP, Precautions)
9:45–10:45	Needling insertion techniques using ½”- 1” needle. Lab practice
10:45-11:15	Lecture 2: Neuroanatomy of neuro-trigger points and development of Homeostatic neuro-trigger points.
11:15 – 12:30	Lab: Surface anatomy of neuro-trigger points in the upper quadrant
12:30 – 1:30	Lunch
1:30 – 2:30	The IDN Bedside Quantitative Sensory Testing
2:30 – 4:00	Needling Lab-1”: Deep Radial (1), Superficial Radial (12), Lateral Antebrachial Cutaneous (9).
4:00-4:30	Electrical Needling Stimulation [ENS] (Lecture)
4:30-6:00	Scar tissue considerations and techniques (Lab)
	Saturday- Day two
8:00 – 10:00	Mid-Lower Cervical Needling Lecture and Lab- Cervical Paravertebrals, and Upper Trapezius, Dorsal Scapular nerve
10:00 –12:30	Shoulder: Supraspinatus, Infraspinatus, Subscapularis, Latissimus Dorsi, Pectoralis Major
12:30 - 1:30	Lunch
1:30 – 3:30	Major neuromuscular points of the upper limbs: Axillary/Radial N. (Lab) to include Supinator Syndrome, Lateral Epicondylalgia, and other neuro-entrapments with ENS
3:30 – 4:30	Major neuromuscular points of the upper limbs: Musculocutaneous N. (Lab) to include Coracobrachialis entrapment and Bicipital involvement with ENS
4:30 – 6:00	Major neuromuscular points of the upper limbs: Median N. (Lab) to include Pronator Syndrome, Carpal Tunnel and other neuro-entrapments and ENS.
	Sunday - Day Three
8:00 – 9:30	Major neuromuscular points of the upper limbs: Ulnar N. (Lab) to include Cubital Tunnel, Medial Epicondylalgia, Guyon’s Canal, and other neuro-entrapments and ENS.
9:30 – 12:30	Hand: CMC OA considerations / DeQuervains Tenosynovitis / Hand Intrinsic / Trigger Finger (Lab) Case study
12:30 – 1:30	Working Lunch- Discussion on administrative / clinical practice /marketing / legal / billing and any other practice issues.
1:30 – 2:00	Neurologic Dry Needling in the treatment of spasticity.
2:00-5:00	Written and Practical Examinations based on case studies
End	Course evaluation

Course Description

This specialty course is designed for licensed healthcare professionals who treat neuromusculoskeletal conditions in the upper extremity and hand. The participant will learn IDN's neurologic model of dry needling and how to integrate this physical agent modality with hand therapy, manual therapy, neurologic rehabilitation, electrical nerve stimulation and functional re-training. This lab-based course is focused on using dry needling as a tool to manage pain, restore function and to maximize soft tissue healing and elasticity. IDN's peripheral nerve mapping model provides the framework for the clinician to address common neuromusculoskeletal conditions encountered in daily practice such as: tendinopathy, epicondylalgia, tenosynovitis, intrinsic and extrinsic tightness, shoulder rotator cuff/impingement syndromes, nerve entrapments, radicular pain, and OA. The course is designed for clinicians with and without prior dry needling training or experience to attend. The main focus is for the clinician to obtain safe and effective dry needling skills using sound clinical decision-making.

Learning Objectives

1. Independently identify a minimum of three peripheral neuro-trigger points in the upper extremity for a given case study.
2. Independently evaluate peripheral nerve (soft tissue) dysfunctions relating to a given upper extremity musculoskeletal condition and pain.
3. Explain the strategy for the prevention and management of an adverse response to dry needling during a case study.
4. Independently choose the correct neuro-trigger point treatment sites for safe application of dry needling treatment during lab sessions and practical examination.
5. Correctly defend the IDN system for treatment of musculoskeletal pain based on the unique neurology and physiology of neuro-trigger points.
6. Explain the relative and absolute contraindications to performing dry needling treatment on a patient with an upper extremity musculoskeletal dysfunction.
7. Design a plan of care using dry needling to prepare and optimize tissue healing for exercise and functional activities for a given case study.
8. Participants will develop a treatment plan based on a given case study that will utilize DN to facilitate the progression to ADLs.

Why Modern Dry Needling is not Traditional Chinese Acupuncture.

Dr. Yun-Tao Ma.

Modern dry needling (DN) is not traditional Chinese acupuncture (TCA) because DN practice is based on the laws of modern medicine, while TCA is based on the laws of Traditional Chinese Medicine (TCM).

Modern DN has developed on the foundation of modern Western medicine, which consists of biology, chemistry and physics. Each scientific field may offer DN the information from many sub-fields, such as molecular biology, physiology, pathology, anatomy, kinesiology, and more.

Medicine is an applied biology and obeys the laws of chemistry and physics. Science advances when new information obtained is different from the old, the law of science may change, so the laws of modern medicine may change; DN is advancing with science and the new laws of medicine. Thus, DN is dynamically advancing and will not stagnate in its evolution.

Traditional Chinese acupuncture was developed at least 2,500 years ago in ancient agricultural Chinese society. Ancient Chinese believed that there were universal laws that govern the universe, nature, social structure (from family to politics), human body and human medicine and diseases. These laws are in fact a product of the Chinese agricultural civilization and philosophy. The first law of traditional Chinese medicine (TCM) is the Yin-Yang. The second law is the interrelation of five elements. Then there are numerous minor laws that govern the TCM and TCA. The third law is the Qi (vitality, energy) that exists in every entity. If the new information contradicts with those universal laws, the information must be modified to fit into the universal laws. The TCA community believes that Chinese medicine is different from modern medicine and it does not obey modern scientific laws, and the scientific method cannot be applied to TCA. However, the “laws” of Chinese medicine are just human-formed historical concepts, not natural laws. Thus, acupuncture theories, like the central concept of meridians, have been regarded as fact, not theory, and have been humanly kept in its antique form for thousands of years.

DN techniques are based on the laws of modern medicine. Those laws are rules nature must live by. The “laws” that format TCM and TCA are human-created concepts representing ancient human thoughts and bias. This is the fundamental difference between modern DN and TCA though both DN and TCA are clinically effective.

Current research and clinical data has modified the hypothesis and clinical techniques of modern DN. The result: Neurologic Dry Needling (NDN).

Research demonstrates the clinical outcomes of needling “official” acupoints and non-acupoints are equally effective. This falsifies the uniqueness of meridians and acupoints

Trigger point hypothesis: Trigger points cause myofascial pain. Based on this hypothesis it is important to identify and deactivate the trigger points. This approach can be clinically effective. However, a non- trigger point approach, such as superficial needling or needling of distant points can also reduce or heal myofascial pain even though the trigger points were untouched during treatment. *Note: Various research sources cite an overlap of the named trigger points and acupoints, ranging from 80% to 100%, claiming they are the same points. Thus, the same scientific discovery in (1) can be applied to the trigger point hypothesis.

The clinical evidence demonstrates that healing can be achieved by using both local symptomatic points and distant points.

Based on research and clinical data since the 1960's, we have falsified the meridian theory, and now we are improving the trigger point hypothesis. The results: IDN / NDN are developed by synthesizing all the DN scientific and empirical data.

Analysis of Competencies for Dry Needling by Physical Therapists (Final Report 2015)

Dry needling is a skilled technique performed by a physical therapist using filiform needles to penetrate the skin and/or underlying tissues to affect change in body structures and functions for the evaluation and management of neuromusculoskeletal conditions, pain, movement impairments, and disability.

AOTA Dry Needling Position

The inclusion of dry needling within the category of treatment modalities under PAMs that may be used as a preparatory method to reduce or modulate pain, reduce inflammation, increase tissue extensibility and ROM, promote circulation, decrease edema, facilitate healing, stimulate muscle activity, and facilitate occupational performance.

What is Dry Needling Therapy?

Dry needling is a minimally invasive procedure using a fine monofilament needle to penetrate symptomatic soft tissue to reduce pain and disability for many myofascial pain disorders (MPD). (Kalichman, 2010) The hypothesized mechanisms of a needle insertion, with or without injection, includes various peripheral and central nervous system effects associated with pain modulation. (Cagnie 2013; Fernandez-de-las Penas, 2019; Dommerholt, 2011) Needling improves microcirculation (Minn, 2015) by altering biochemical (Shah, 2005, 2008) and neuroinflammatory mediators, (Kavoussi, 2007) and inducing mechanical disruption of connective tissue. (Langevin, 2007) Although historically, DN could be used to target myofascial trigger points (MTrP), (Gattie,

Dry Needling

An invasive procedure that utilizes a solid monofilament needle inserted into symptomatic soft tissue to:

- Reduce tissue tension
- Improve (micro) circulation
- Normalize physiological processes

The effects of Dry Needling can be:

- Local/Symptomatic
- Segmental
- Systemic



2017) the application of the therapy has evolved into physiologically impacting other structures including perineural, (Griswold, 2019) joint structures & periosteum, (Pai, 2018; Dunning, 2018) sensory nerves, (Griswold, 2019) and tendons. (Stoychev, 2020)

Effects of Neuro-Trigger Points (Passive and Active)

- Pain via sensitized peripheral nerves (Shah et al.)
- Loss of ROM (Travel/Simons)
- Reduced circulation in MSK pain (Lee et al.)
- Reduced ability to generate and attenuate force
- Increased electrical activity at rest (SEA). (Ge et al.)
- Accelerated fatiguability
- Reduced efficiency of reciprocal inhibition, which may contribute to disordered fine movement and imbalanced muscle activation (Lucas; Lbarra et al.)

Local effects of needling

Dry needling lesions in the soft tissue is a therapeutic modality for soft tissue dysfunction. Soft tissue dysfunction involves soft tissue injuries including tissue inflammation, sensitized nerve tissue, scar tissue formation, tissue adhesion, and deficiency of blood and lymphatic circulation. The process of inserting a needle starts with puncturing the skin, and then involves physical stretching the tissues (down and up, and/or rotation movement of needle shaft), which creates lesions in the soft tissue. When the needle is removed, the lesions remain for a few days. Needling process thus provides both physical (tissue stretching) and biochemical (lesions) stimuli. This lesion-induced process activates physiological mechanisms of remodeling of injured and inflamed soft tissues in and around the needling site. The tissue remodeling process includes (1) local physical stress reduction (tissue tension) and (2) normalizing local inflammation, and (3) replacement of injured tissues with fresh tissues of the same type.

Systemic effects of needling

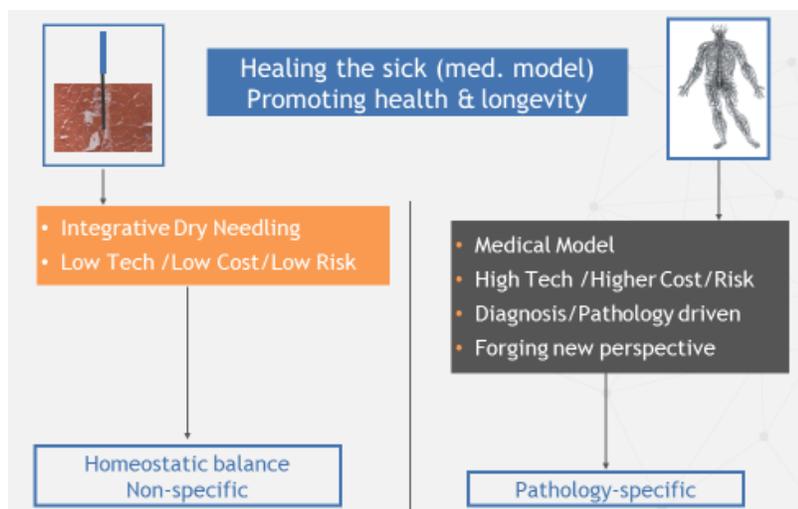
Each needling process is invasive and creates both local and systemic effects – the restoration of both local tissue homeostasis* (tissue remodeling of injured tissues) and systemic homeostasis. Restoration of systemic homeostasis involves reducing both physical and physiological stress. Physical stress means muscular, which creates biomechanical imbalance such as joint and posture imbalance. Physiological stress may include local physiological dysfunction (inflammation, tissue ischemia, etc.) and all body systems like immune, cardiovascular, endocrine, and all others. Simple insertion of an invasive needle creates both local and systemic therapeutic effects.

Non-specific pathophysiologic features of needling

It is important to understand that needling itself does not treat any specific disease, but may restore tissue homeostasis, during which the process of biological self-healing and self-repair physiology-mechanisms are activated. After needling many pathological conditions can be improved, including joint biomechanics. Thus, needling is a non-specific therapy.

*Homeostasis:

The property of a system that regulates its internal environment and tends to maintain a stable, relatively constant condition of properties. In simple terms, it is a process in which the body's internal environment is kept stable, despite changes in external conditions.

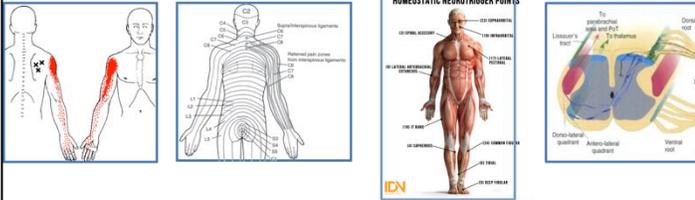


The Evolution of Dry Needling Models

Empirical Model type	Physiologic features of the model	Weakness of the model	Historical notes
Traditional model	The model reveals systemic and non-specific effects of needling physiology. A system of accumulation of ancient and modern clinical data.	Model development is disadvantages by its philosophy. Modern medical understanding is irrelevant (some improvement in modern versions). Complicated out of date theories and unnecessary clinical procedures.	Empirical development: Chinese agricultural civilization at least 2,500 years ago.
Trigger point model 1 st generation of dry needling	Local muscle patho-histology and patho-physiology of trigger points are emphasized. Local gross anatomy is emphasized.	Systemic physiology of needling effect is ignored. Pain physiology of sensory nerve is underestimated. Anti-inflammatory physiology of needling is neglected.	Empirical development: 1930s: J Kellgren 1940s: J Travell 1970-2010: J Travell & D Simon
Gunn approach 2 nd generation of dry needling	Spinal segmental physiology of needling stimulation is emphasized. Concept of soft tissue dysfunction is considered.	Non-segmental physiology of needling effect is ignored.	Empirical development: 1970s: Dr CC Gunn
Neurologic Dry Needling 3 rd generation of dry needling	Integration of all known models. Systemic, segmental, and symptomatic needling is emphasized. Pain physiology of nervous system and soft tissue dysfunction are inter-connected. Pain of neurogenic origin is emphasized. Clinical procedure is comprehensive but simple. Preventive effect of needling is emphasized. Quantitative analysis as a prognostic is used.		Empirical development: 1970s: HC Dung 1990s: HC Dung & YT Ma 2000s: YT Ma 24 Homeostatic points.

The Evolution of Dry Needling Models

- 1st generation: Dr. Janet Travell- Myofascial Trigger Points
- 2nd generation: Dr. CC Gun-Intramuscular Segmental Stimulation
- 3rd generation: Dr. Ma - Systemic Needling
- 4th generation: IDN- Integrative Dry Needling

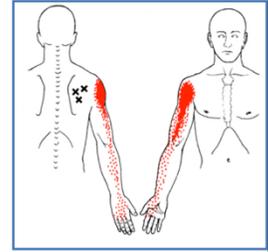


Trigger Point Approach-Dr. Janet Travell

1st Generation of Dry Needling

“ A hyper-irritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in the taut band. The spot is tender when pressed, and can give characteristic referred pain, motor dysfunction, and ”

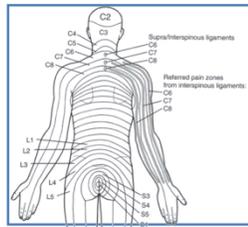
Travell



Gunn Approach-Intra-Muscular Stimulation (IMS)

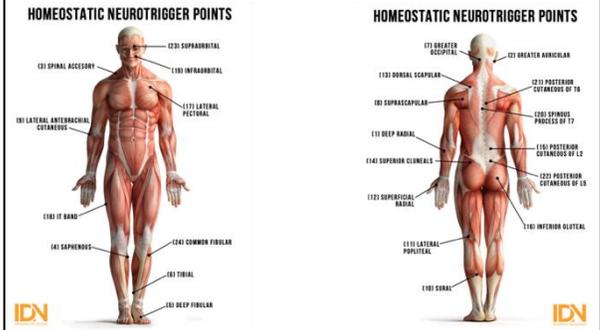
2nd Generation of Dry Needling -

“ **Radiculopathy Model:** When the flow of nerve impulses is restricted, all innervated structures, skeletal muscle, smooth muscle, spinal neurons, sympathetic ganglions, brain cells, glands, become atrophic, highly irritable, and supersensitive. ”

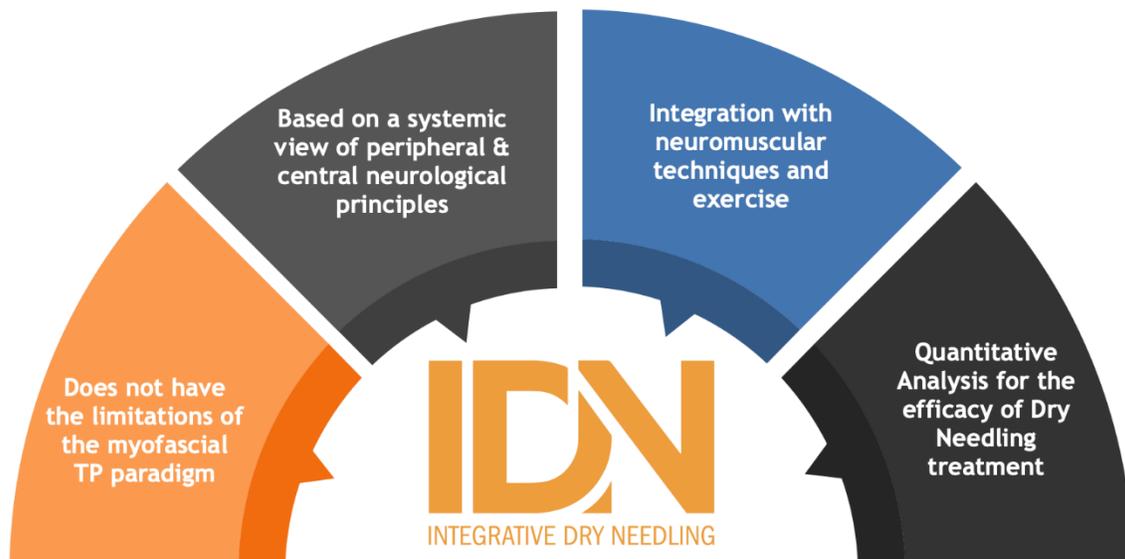


Dr. Ma's Systemic Dry Needling

3rd Generation of Dry Needling -



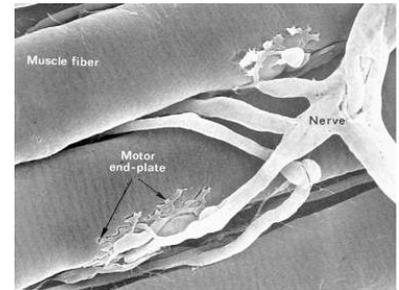
Integrative Dry Needling (IDN) 4th generation of dry needling



Limitations to the current diagnostic model of trigger point dry needling

Integrated hypothesis of MTrP (Simons, 2004)

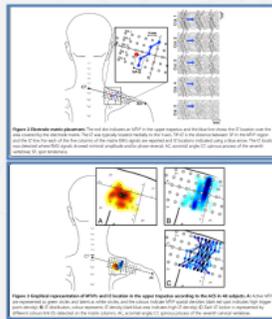
Excessive ACH release into the neuromuscular junction produces sarcomere shortening or the “taut band” that clinicians may palpate. This may create an “energy crisis” with an increase of sensitizing substances (Shah et al., 2008) in the area that may sensitize peripheral nerves and may be responsible for the spontaneous electrical activity (SEA) stated to be present as a result of the MTrP. (Quintner et al., 2015)



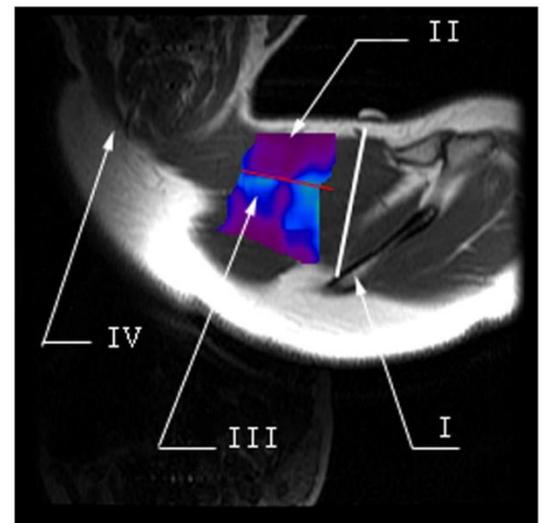
Barbero et al., 2013: Described innervation zones (IZ), which are anatomically the same as the motor end-plate (where the α -motor neuron divides into a number of branches and synapses onto target muscle fibers). It is in these IZ that the peripheral nerve will release the inflammatory mediators that Shah discovered in his research.

Trigger Points and their Relationship to the Motor Endplate

- Barbero et al. 2013
- MTrP were located in well-defined areas of the upper trapezius; proximal to the innervation zone (IZ) but did not overlap. The distance between the IZ and the MTrP was about 10 mm.
- The close relationship between the location of the MTrP and IZ may be useful to guide treatments targeting the IZ.

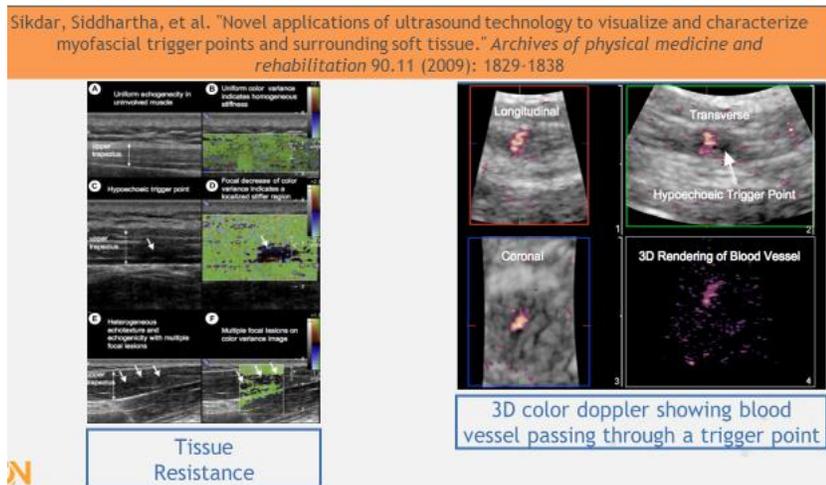


Chen et al., 2008: Utilized magnetic Resonance Elastography (MRE) to demonstrate that the region of the MTrP is associated with an increased stiffness relative to the surrounding muscle tissue. He found the MRE intra- and inter-rater reliability was excellent however, the agreement was poor between the MRE findings and the physician palpation exam for the location of the MTrP.



- I. spine of scapula
- II. taut band region in UT
- III. MTrP identified by the physician palpation
- IV. cervical spine

Sikdar et al.,2009: utilized colored US to show stiffness / nodules (lack of color) in tissue. There were multiple nodules existing along a muscle fiber demonstrating an area of stiff-ness not a point of attention. This may be explained by the other finding of a retrograde blood flow (in diastole) near an active trigger point indicating a highly resistive vascular bed.



What is currently known about Myofascial Pain Syndrome and MTrPs

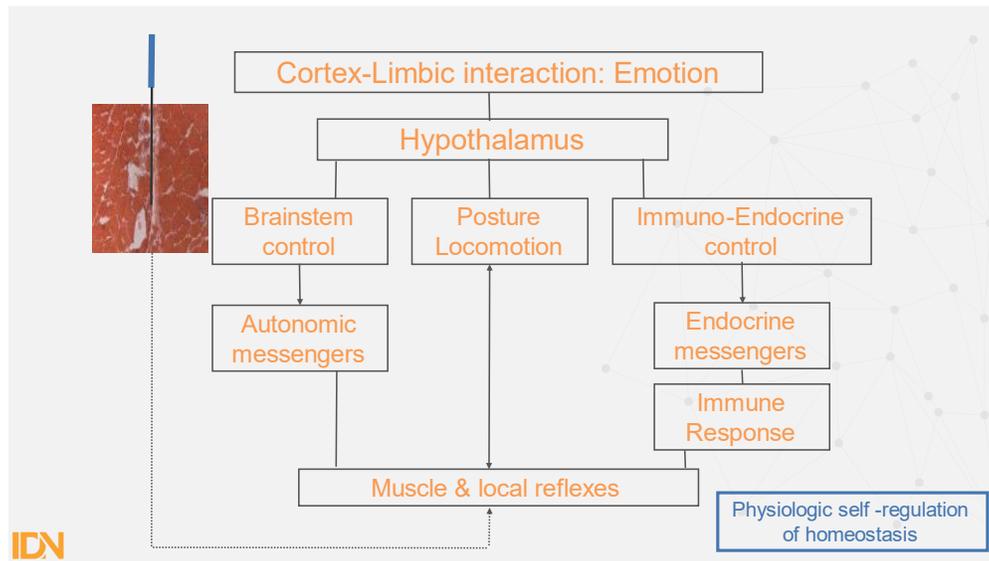
Myofascial pain is complex, and the pathophysiology remains elusive. The original definition of MTrP by Travell, and Simons is outdated based on modern evidence of MPS pathophysiology.(Simons,1990) No diagnostic reference standard for MTrP is currently available to compare the clinical findings of MTrP through palpation. Therefore, it is not possible to truly assess the accuracy of manual palpation, however, reliability data suggests the consistency amongst clinicians for identifying the precise location of a MTrP is inadequate. The most consistent clinical features are “tenderness and pain” (Rathbone,2017) and not the physical nature of the tissue. Tenderness and pain are a result of the chemical changes in blood circulation (Sikdar,2009; Lee,2008) that sensitizes sensory nerve endings lowering their firing threshold. The perpetual presence of inflammatory agents may further sensitize the nervous system segmentally (Borstad,2015) and/or centrally.(Bordstad,2015; Sanchis,2015)

It is well documented that various conditions extending beyond the musculoskeletal system i.e visceral and psychological co-morbidities can generate signs and symptoms of MPS/MTrP due to their known etiologic mechanisms with systemic inflammatory processes. Recent evidence shows patients with MPS exhibit specific local and systemic inflammatory biomarkers. (Duarte,2021) This demonstrates that the development of MPS/MTrP is not a local phenomenon. Moreover, both peripheral and central sensitization of the nervous system may occur through neurogenic inflammatory mechanisms. (Matsuda, 2019) Both widespread inflammation and neuroplastic changes resulting from central sensitization can manifest as secondary hyperalgesia. Clinically, secondary hyperalgesia is important to recognize as it is an important prognostic factor for patients recovering from pain.

Conclusion: Duarte 2021:

MPS is diagnosed using subjective clinical criteria that includes measures of self-reported pain, exclusion of other pathologies, and clinical palpation of MTrP's. No widely accepted objective reference standard exists, impacting negatively the precision of clinical diagnosis, therapeutic management and advancement of high-quality scientific evidence. Therefore, Travell and Simons criteria alone are likely insufficient to reliably and objectively assess MPS.

Physiologic/Neurologic Mechanisms of Dry Needling



Precise selection of points (traditional acupoints or trigger points) is clinically unnecessary.

The traditional view of selecting precise needling points is not supported by clinical evidence (Chae et al., 2013). The ancient view requires precise location of a so-called acupoint. More modern view requires precise location of trigger points. These empirical procedures are clinically effective but not supported by both empirical and evidence-based data (Chae et al., 2013). In general, needling the sensitized and inflamed area will achieve the same clinical efficacy as selecting precise trigger point location. This is because most soft tissue dysfunction involves tissue inflammation and related conditions such as vasoregulation-dependent dysfunction and blood and lymphatic circulation. Trigger point nodules are not the cause of the inflammation in many cases. Inflammation is one of the reasons causing the formation of nodules. Trigger points become “active” due to inflammation. As inflammation is reduced, trigger points become “latent”. Thus, the concepts of trigger points causing pain needs to be re- examined.

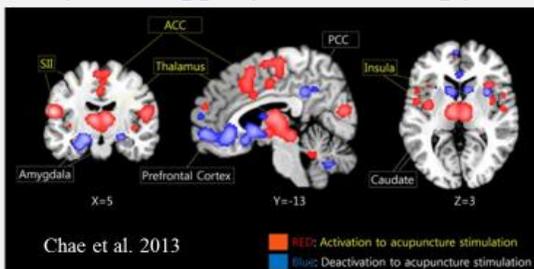


Figure 1. Brain areas associated with acupuncture stimulation that exhibited increased (red) and decreased (blue) activity

- The brain areas activated and deactivated by acupuncture needle stimulation largely overlap with the brain regions that constitute the so-called pain matrix.
- Activation/ deactivation patterns of brain response to needling were consistent regardless of specifically defined points.

Neurogenic Inflammation

Neurogenic Inflammation

Vinay 2023; S.D. Brain 2013

- Nerve endings of sensory fibers contain: Neuropeptides, Substance P, CGRP, and Somatostatin.
- Under pathological conditions (e.g. tissue damage) sensitizing chemicals are released that influences neuronal excitability, local microcirculation and metabolism of the local environment.
- This leads to Neurogenic Inflammation:
 - Fluids/proteins shift from blood vessels to interstitial space leading to further release of sensitizing substances. (Shah 08')
 - Neurogenic inflammation can spread along any collateral branch of the neuron extending a nociceptive field. (Vinay 2023, Greening 2018)

IDN

Neurogenic Inflammation

Vinay 2023; S.D. Brain 2013

- When nociceptors are sensitized -nerve firing threshold (PPT) decreases:
 - Passive NTrP - (low level of sensitizing chemicals) - Only with physical pressure does the nerve to send impulses to the CNS.
"It only hurts when you push it"
 - Active NTrP - Increased level of sensitizing chemical further lowers the firing threshold and may spontaneously send impulses to the CNS (nociception).
"It hurts right here!"

Thus, inflammation within the nerve itself at peripheral nerve terminals and/or around the nerve itself may contribute to abnormal modulation of pain locally and at the spinal cord level.

IDN

What are the functions of a muscle?

- Movement of the body
- Postural Stability
- Compression / Stabilization of the Joint
- Force Generation
- Force Attenuation
- Proprioception
- And....



Protection of a nerve!

IDN

Functional consequences of Neuro-Trigger Points

Functional consequences of Neuro-Trigger Points (NTrP)

- Accumulating evidence supports a close relationship between motor dysfunction and latent (passive) TPs. (Celik 2013, Ge 2011, Lucas, 2004 -08'-11', Ibarra 2011)
- Evidence further consolidates the concept that latent (passive) MTPs are one of the causes of the restricted ROM. (Celik 2013, Grieve 2011, Trampas 2010, Simons 2004.)
- Increased motor unit hyper-excitability at latent (passive) MTPs may constitute one of the physiological mechanisms for the development of muscle cramps. (Celik 2013, Xu 2010, Ge 2008)
- Accelerated muscle fatiguability of MTP's may have adverse effects on movement control strategies. (Celik 2013, Ge 2012, Ge 2011, Ibarra 2011)

Peripheral nerve irritation ⇒ Pain with resultant muscle guarding (NTrp)

IDN

Clinical Relevance

1. Targeted intervention to decrease the mechanical, physical or chemical irritation by normalizing blood flow, and releasing endogenous muscle contraction around the involved nerve(s) would be of benefit in reducing and restoring function.
2. With good knowledge of (neuro) anatomy, clinicians can locate the most relevant sensitized nerve areas, both proximal and distal, to maximize treatment effectiveness and efficiency.

NTrPs are not just contracted muscle fibers, but neuromuscular lesions that form part of the neurological system that affects and is affected by the CNS.

IDN

Dry Needling Therapeutic Lesion



Needling and needling-induced lesion in soft tissues

↓

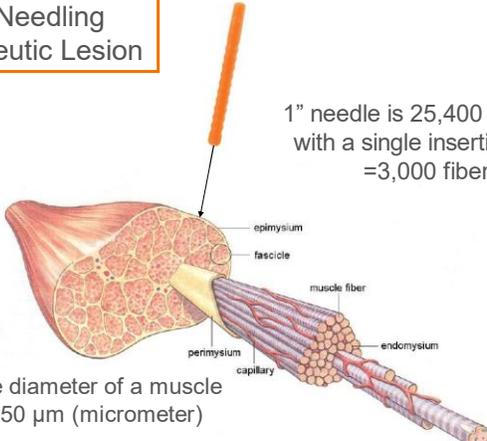
Normalize soft tissue dysfunction.

↓

Dry Needling is Soft Tissue Therapy

IDN

Dry Needling Therapeutic Lesion

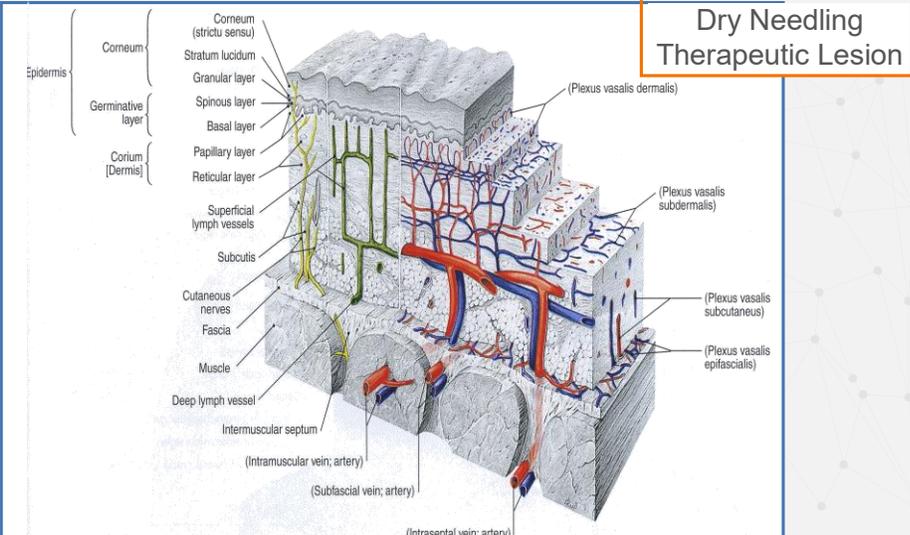


1" needle is 25,400 μm wide (.25mm)
with a single insertion of the needle
=3,000 fibers lesioned

Average diameter of a muscle fiber 50 μm (micrometer)

epimysium
fascicle
muscle fiber
perimysium
capillary
endomysium

Dry Needling Therapeutic Lesion



Epidermis

- Corneum (stricto sensu)
- Stratum lucidum
- Granular layer
- Spinous layer
- Basal layer

Corium [Dermis]

- Papillary layer
- Reticular layer
- Superficial lymph vessels
- Subcutis
- Cutaneous nerves
- Fascia
- Muscle
- Deep lymph vessel
- Intermuscular septum
- (Intramuscular vein; artery)
- (Subfascial vein; artery)
- (Intraseptal vein; artery)

(Plexus vasalis dermalis)

(Plexus vasalis subdermalis)

(Plexus vasalis subcutaneous)

(Plexus vasalis epifascialis)

IDN

Molecular mechanism of dry needling

View this Clinical Relevance YouTube post from Dr Frank Gargano discussing [How Needling effects macrophages in regulating Inflammation.](#)

Needling normalizes inflammation. This needling-induced anti-inflammatory process triggers regulatory mechanisms of blood and fluid circulation in inflamed tissues that includes microcirculatory vessels. The anti-inflammatory process of dry needling involves balancing autonomic nervous system thus balancing between vasodilators such as adenosine and nitric oxide (NO) and vasoconstrictors such as superoxide and many others. We are just at the beginning to understand the needling mechanisms at this level.

Macrophages are key components of innate immune system functioning to balance the macrophage type 1 (M1) and macrophage type 2 (M2) ratio and modulating cytokine levels in the inflammatory environment (Wang et al 2021). Cytokines are small secreted proteins released by cells that have a specific effect on the interactions and communications between cells. Evidence has shown that needling has an anti-inflammatory action that affect multiple body systems, including the immune, locomotory, endocrine, nervous, digestive and respiratory systems, by downregulating pro-inflammatory M1 and upregulating anti-inflammatory M2 macrophages as well as modulating associated cytokine secretion (Wang et al 2021). The therapeutic goal of dry needling is to obtain the optimal balance of M1/M2 ratio which is to reduce the prolonged M1 polarization and enhance the M2 polarization - this could act to prevent an immune overreaction which is an important anti-inflammatory action of needling in all immune disorders.

Chronic inflammation/pain is a combination of neurogenic inflammation (Matsuda 2019) and inflamed microcirculatory vessels that causes tissue hypoxia. Needling creates acute inflammation as a mechanism to reduce chronic inflammation. The micro-physiological effects that occur increase the local levels of NO, O₂, and Adenosine are transient, but continue between 15-60 minutes even after the needle is removed (Cagnie et al., 2012; Takano et al., 2012; Tsuchiya et al., 2007).

Unique features of the systemic approach of the Integrative Dry Needling System

Treatment of soft tissue dysfunction: All modern dry needling models were developed by medical clinicians to treat clinical symptoms, especially soft tissue pain. For this reason, all other dry needling techniques focus on local symptoms or regional symptoms in general. Both doctors and patients will apply these techniques when pain is felt. Unfortunately, in many cases the most effective treatment using dry needling is during pre-pain or pre-symptom stage, not symptom-stage.

Systemic approach: In fact, all local symptoms have systemic effects over all the human systems, including physiologic systems and biomechanical balance of neuromusculoskeletal system as soft tissue pain always affects the biomechanical balance of part or all of the musculoskeletal system. Integrative Dry Needling System (IDNS) connects the local symptoms with the body as a whole, especially the systemic balance of biomechanics of human movement, which is very important in sports medicine. (See the 3 S's and I's paper in the pre-reading)

Prevention of pathologic conditions: Using IDNS, we can prevent soft tissue dysfunction in many cases if applied in pre-symptom stage or symptom-free persons. This is especially important for athletes, musicians, physical therapists and chiropractic doctors as their professional injuries shorten their careers. Unfortunately, both medical professionals and patients ignore the preventative approach.

IDNS for sports medicine: We developed the IDNS for athletes because the techniques will (a) optimize physical performance by reducing biomechanical and physical stress during the pre-

symptom stage, (b) prevent chronic soft tissue injuries and some acute injuries, (c) provide treatments for conditions such as overtraining stress, soft tissue injuries related to the respective professions and rehabilitation after surgeries.

The clinical limitation of needling therapy

DN therapy is a process of physiological adjustment to normalize homeostasis in order to promote self-healing. However, as the severity of pathological condition (stressor) increases, the self-healing potential decreases. If the patient's self-healing potential is severely hindered, their response to DN therapy may be limited.

Dry needling efficacy varies from person to person. The same soft tissue pain symptom can be completely cured in some persons (28%), partially relieved in most persons (64%) and have low or no efficacy in a few patients (8%). DN therapeutic results for soft tissue pain management are reliably predictable and depend on (1) the self-healing potential and (2) the healing potential of the symptom(s) of each patient. The predictability arises from the fact that most soft tissue pains manifest through localized symptoms. For non-soft tissue pain symptoms, DN efficacy is less predictable.

Law of Dry Needling: The reality of dry needling therapy

There are different modalities of DN and this diversity, in fact, promotes the advancement of DN therapy. As science philosopher Karl Popper indicates that disagreement advances science. However, this diversity often confuses both instructors and students of DN. For example, some instructors believe that only their way is correct and other techniques are not supported by scientific data. This creates uncertainty with students trying to understand which technique is correct when facing different DN paradigms. These laws will help explain the diversity of DN and clarify the confusion.

- All needling models clinically work. All models are partially truthful models.
- All theories are tentative and subjective to change as science advances. Differentiation of facts from theories is needed in understanding the therapy.
- If any scientific researches support one model, in fact, support all models.
- If any scientific researches deny/falsify the theory of particular model, they only deny that theory, not the clinical techniques of the model.
- Each model has its unique benefits and unique limitations.
- Physiologically all models do not conflict with each other. Thus, it is possible to integrate all models into a new model with new theories.

Healing Patterns of DN Therapy

Healing patterns are not predictable, especially in C and D groups.

- Immediate: acute condition in healthy patients
- Cumulative: patients feel better after each treatment within 1-2 days.
- Wavering but gradually improving patients may feel alternatively better and worse, but gradually healing becomes faster and more stable.
- No-change-then-better: no improvement at first 2-3 weeks. Stop treatment for one week and patients suddenly or gradually feel better.
- Worse-then-better: mostly in stubborn and severe conditions. Some patients may interpret the needling sensation as "more pain" after treatment.
- Non-responders: most are in the D group.

Evidence-based Research

Research helps to support or falsify/deny our empirical data. As research advances, our concepts and techniques also evolve. However, the interpretation of the research data is challenging in medicine and biology. We need to examine how the research is designed, how the data is collected and how the data is interpreted. Always question the research and never take the conclusion of a research paper as absolutely correct.

Quality of evidence-based research

Today many articles and books bear the title evidence-based. It should be noted that not all evidence is of equal quality. The highest quality of evidence is randomized clinical trials or systematic reviews of randomized trials, which have the lowest likelihood of bias.

Limitations of evidence-based medicine - (Sackett et al., 1996)

Evidence, whether strong or weak, is never sufficient to make clinical decisions. Individual values and preferences must balance this evidence to achieve optimal shared decision-making and highlight that the practice of evidence-based medicine is not “one-size fits all” approach. It has been recognized that providing evidence from clinical research is a necessary but not a sufficient condition to provide optimal care.

Evidence Based (Informed) Practice

Clinical decisions are influenced by a range of sources that include evidence-based research, empirical evidence, law and policy, opinion of colleagues and professionals and what can be thought of as clinical “gut feelings”.

Comparison of different models of needling therapy

It should be emphasized that each needling model has unique benefits and unique limitations. A good practitioner is encouraged to learn different models of needling. Those who believe that only one model is effective will limit the clinical efficacy of the dry needling procedure.

Clinically Important Mechanisms of DN Therapy.

Note:

All the mechanisms listed here help identify the most effective neuro-trigger points/areas for needling.

Local Mechanisms: See soft tissue dysfunction (below)

Systemic Normalization of Pathophysiological Imbalance

Pathological stimulations reach all levels of CNS (spinal cord, brain stem, pons, thalamus, limbic system and cortices). They disturb, interrupt or suppress normal interaction and cause dysregulation of a variety of physiological functions. Dry needling signals also reach these levels and interact with pathological signals. Needling stimulates the release of neural transmitters and bioactive factors from CNS and causes immune and endocrine systems to release immune factors and hormones to regulate physiological and biochemical environments of pathological tissues, thus affecting cells and microenvironment and leading to self-healing.

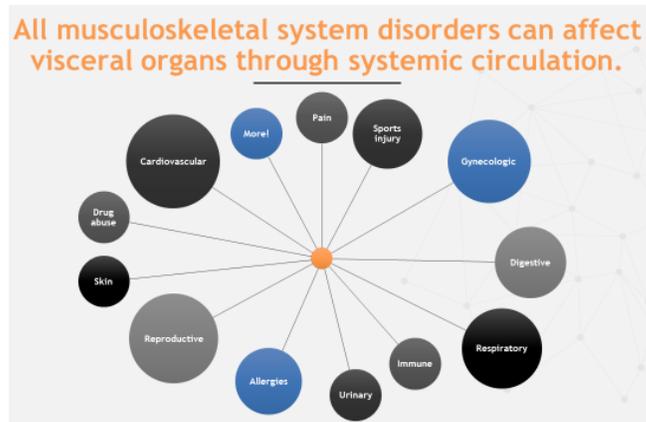
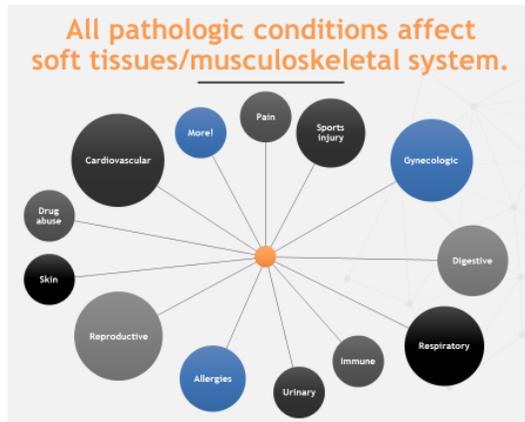
There are somatic and emotional imbalances. Any imbalance or load is a stress to the body. Systemic somatic stresses may include pain, low/high temperature, fever, infection, injuries, surgeries, hypoxia, overwork and repetitive overuse. Emotional stress may include fear, anxiety, depression, worry, hopelessness, helplessness and grief, etc.



Somatic and Visceral Referral

Visceral reflex

If the patient's condition involves internal organ(s), the diseased organ(s) will project the pathological signals to the certain part(s) of the body, which are represented as tender points, soft tissue nodules, skin discoloration, or painful area. Most internal pathological insults affect only part or parts of the body in the beginning and tender Symptomatic Neuro-trigger Points (S's) are formed in the specific area. If the affected area harbors homeostatic NTRPs (H's), these H's are also S's. For example, in patients with a kidney problem, H15 and H14 would be more symptomatic than other H's. If the pathology of the kidneys continues to develop, the whole lumbar area can become tender.



Somatic referral

A part of the body can refer or radiate its pain to another part of the body. For example, inflamed low back muscles and nerves can project their pain to the thigh, leg and foot. Usually H15 and H22 are the centers of the pain and the pain may project to H14 and H16 of the gluteal area, to H18 and its vicinity of the thigh, and H11, H24 and H10 of the leg.

Systemic Pathological Sensitization

Visceral, metabolic and physiological pathology can cause neuro-trigger points to appear systemically. Clinicians need to be cognizant of medical condition, comorbidities, and risk factors that can influence clinical decisions on the appropriateness of using dry needling. Systemic conditions can masquerade as more common musculoskeletal conditions, so clinicians are strongly cautioned against relying solely on palpation findings when choosing dry needling without thorough systems screening and viewing provocative findings within the patient's overall presentation. (Kearns,2021)

Soft tissue dysfunction

DN therapy non-specifically promotes physiological normalization of dysfunctional or injured soft tissues. Self-healing begins after acute or chronic injuries of soft tissues. However, during this self-healing process, inflammation, contracture of soft tissues, adhesion formed between different soft tissues, scar formation within the same and between different soft tissues becomes the pathology of chronic soft tissue dysfunction. These compensatory changes cause the blockage of fluid and blood circulation in the affected soft tissues. Thus, inflammation, contracture, adhesion, scarring and blockage are the major pathologies of chronic soft tissue dysfunction. All human diseases can create some degree of soft tissue dysfunction. Many clinical symptoms are related or produced by the compensatory changes of soft tissues. The efficacy of medical intervention in treating many external injuries and internal dysfunction depends how much we can solve the pathologies of the soft tissue, the inflammation, contracture, adhesion, scarring and blockage of local

microcirculation. Chronic soft tissue syndrome is the pathological conditions caused by the compensatory inflammation, contracture, adhesion, scarring and blockage of circulation in the soft tissues after acute or chronic injuries.

Unique features of the Integrative Dry Needling Systemic Approach

Treatment of soft tissue dysfunction

All modern dry needling models were developed by medical clinicians to treat clinical symptoms, especially soft tissue pain. For this reason, all other dry needling techniques focus on local symptoms or regional symptoms in general. Both doctors and patients will apply these techniques when pain is felt. Unfortunately, in many cases the most effective treatment using dry needling is during pre-pain or pre-symptom stage, not symptom- stage.

Systemic approach

In fact, all local symptoms have systemic effects over all the human systems, including physiologic systems and biomechanical balance of neuromusculoskeletal system as soft tissue pain always affects the biomechanical balance of part or all of the musculoskeletal system. Integrative Dry Needling System (IDN) connects the local symptoms with the body as a whole, especially the systemic balance of biomechanics of human movement, which is very important in sports medicine. (See the 3 S's and I's paper in the pre-reading)

Prevention of pathologic conditions

Using IDN, we can prevent soft tissue dysfunction in many cases if applied in pre-symptom stage or symptom-free persons. This is especially important for athletes, musicians, physical therapists and chiropractic doctors as their professional injuries shorten their careers. Unfortunately, both medical professionals and patients ignore the preventative approach.

Health promotion

IDN is beneficial for prevention of soft tissue dysfunctions, which are a major pathologic condition involved in almost all diseases.

IDN for sports medicine

IDN is effective for athletes because the techniques will (a) optimize physical performance by reducing biomechanical and physical stress during the pre- symptom stage, (b) prevent chronic soft tissue injuries and some acute injuries, (c) provide treatments for conditions such as overtraining stress, soft tissue injuries related to the respective professions and rehabilitation after surgeries.

Features of the IDN Neurologic Approach

Integrative Dry Needling

Our **Structured** neurological model enables achievement of **Reproducible** and **Predictable** clinical outcomes regardless if the clinician has experience or is just a novice in providing dry needling treatment

Structured

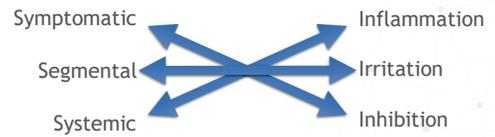
Reproducible

Predictable

Research + clinical evidence
Integrated over the past 40+ years.

IDN

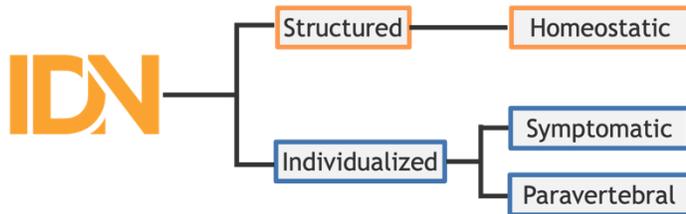
IDN Systemic Approach



Dry Needling is non-specific

“A change anywhere creates a change everywhere”
“You can get to a point but miss the system”

Integrative Assessment & Treatment Approach



IDN

IDN practitioner



4th Generation of
Dry Needling Therapy

“The 3 S’s & 3 I’s” (Symptomatic, Segmental, Systemic & Inflammation, Irritation, Inhibition).

Frank Gargano PT, DPT, CIDN, MCTA, CMP

The 3 I’s describe the “problem” with musculoskeletal pain and dysfunction, **Inflammation**, **Irritation**, and **Inhibition**. The 3 I’s do not occur in isolation; they are coupled with one another in an injury situation. Each of the I’s occur locally (**Symptomatic**), **Segmentally**, and **Systemically**. If pain and dysfunction are treated solely at the site of the symptoms, “you may get to the point but will miss the system,” as we like to say. The human body works as an integrated organism and must be viewed and treated in this way. The human body shares neurology and circulation, and to believe that an injury remains local to the site, absent an effect on the rest of the body, is limiting your treatment effect. This reminds me of the “guru” based treatment models of the 1980s and 90s. Clinicians would utilize a specific manual therapy paradigm and would become cult-like in their treatment approach, and if it failed, the patient was labeled “not-fixable”. Since that time, the PT profession has become more eclectic in viewing the body as greater than the sum of its parts (Gestalt). This eclectic view is in perfect alignment with the IDN system of dry needling. The days of focusing on a point as the source of pain and dysfunction are numbered, and it is time that we begin to move toward a more reliable and global assessment and comprehensive treatment. The global thinking of the 3 I’s and the 3 S’s is the model that sums up both the injury of the system and comprehensive treatment. The dilemma lies in the fact that we do not fully understand the experience of pain, dysfunction, or the physiological mechanisms of dry needling. This is today’s reality, and if we can embrace it, we can continue to move our thinking forward.

The more you read about **Inflammation** the more it becomes apparent it is centered at the root of pain and dysfunction in the human body. This creates **Irritation** of peripheral nerves that can create the sensory experience of pain and the motor effects that drive neuromuscular **Inhibition**. If inflammation could be managed more effectively, we may be better able to mitigate its effect on both pain and motor dysfunction. This is not a revelation but a basic fact of treating most musculoskeletal conditions. Following injury, the inflammation may reside in local tissue acutely, however as time goes on and the body is unable to clear the inflammation, it can become more widespread and involve more of the nervous system such as in chronic conditions. Neurogenic inflammation results from bioactive chemicals activating sensory neurons, which in turn activates the release of sensitizing chemicals from peripheral nerve terminals (Irritation). This bi-directional process from local peripheral tissue to the CNS causes a more widespread inflammatory process. The Inflammation that produces pain and dysfunction can be local, segmental and or systemic, which is what creates the challenge. This may explain why the modern continuing education seminars now focus on assessing and treating the body as a whole with less focus on identifying the specific tissue that is at fault. The tissue-specific diagnoses that aim to identify the “involved” structure are faulty reasoning and should be reconsidered. Sound clinical reasoning is dependent on a multi-factorial construct, which encourages innovative practice. Acknowledging the lack of diagnostic accuracy in clinical testing, palpation, and even patient report makes treatment design challenging to say the least. That may have led some to attempt to create a cookbook style of treatment where it is assumed that a common grouping of signs and symptoms will all respond to a specific treatment regimen. We all know how that worked out and essentially lead back to the “not fixable” conclusions for patients that did not fit or respond favorably to the treatment mold they were placed in.

IDN's 3 S's concept of treatment provides no preconceived notions of the source of the 3 I's instead provides a foundation upon which to build a treatment plan.

Symptomatic (local)

This is undoubtedly the most obvious type of pain and dysfunction to treat as the patient tells you it hurts "here". Symptomatic pain is usually the result of an acute to sub-acute injury, and the area may have edema with a loss of motion.

Segmental

Manual therapy clinicians understand that when treating musculoskeletal pain and dysfunction, the spinal component cannot be ignored. They have been trained to first "clear" the spine to reduce the likelihood of missing a segmental problem based on a peripheral complaint. The segmental effects of needling help to reduce the symptoms of the local (symptomatic) points.

Systemic

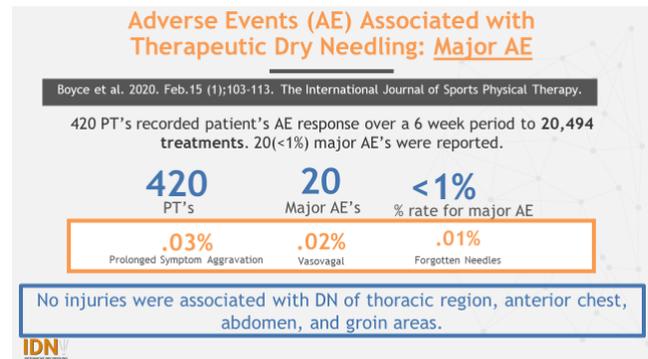
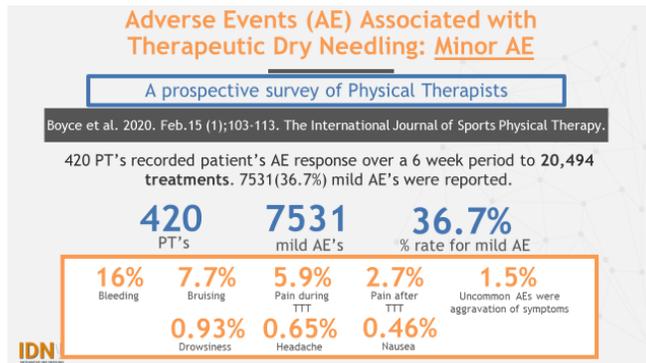
This is where the most confusion and even misunderstanding of the pain mechanisms are experienced. In the human body, there is shared neurology, circulation, and physiology that we cannot separate into pieces or parts. We base our systemic treatment on homeostatic points that are key neurological areas in the body that have stronger therapeutic signaling to the CNS and are present in reproducible locations and patterns. The innervation zones of homeostatic points are extensions of major peripheral nerves that are present in consistent locations around the body based on the predictable anatomy of the peripheral nervous system. This is in stark contrast to locating the highly variable myofascial trigger points.

In patients with acute symptom presentations, treating just symptomatic points (local) may be all that is needed to get the desired effect. As you move from the acute patient to the sub-acute and into the chronic, the need to expand the treatment methods becomes empirically evident by the reduced clinical results. Assessment tools, such as quantitative sensory testing, may be used to identify the possible central mechanism driving the symptoms. We believe it is relevant to address the 3 S's together because clinically, this approach has a better chance to address the 3 I's of pain and dysfunction.

Short Term Reactions to Needling

DN is a medical modality with certain risks. It is very critical for both experienced and beginning practitioners to understand what adverse effects may occur during treatment, how to prevent them and how to manage them.

Boyce, D., Wempe, H., Campbell, C., Fuehne, S., Zylstra, E., Smith, G., Wingard, C., & Jones, R. (2020). Adverse Events Associated With Therapeutic Dry Needling. International Journal of Sports Physical Therapy, 15(1), 103–113.



MacPherson, H., & Thomas, K. (2005). Short Term Reactions to Acupuncture – a Cross-Sectional Survey of Patient Reports. Acupuncture in Medicine, 23(3), 112–120.
<https://doi.org/10.1136/aim.23.3.112>

Table 1: Positive Reactions n=9408

Type of event	Number of reported reactions	%
Relaxed	7436	79.1
Energized	3072	32.7
Other positive	166	1.8
Tiredness	2295	24.4

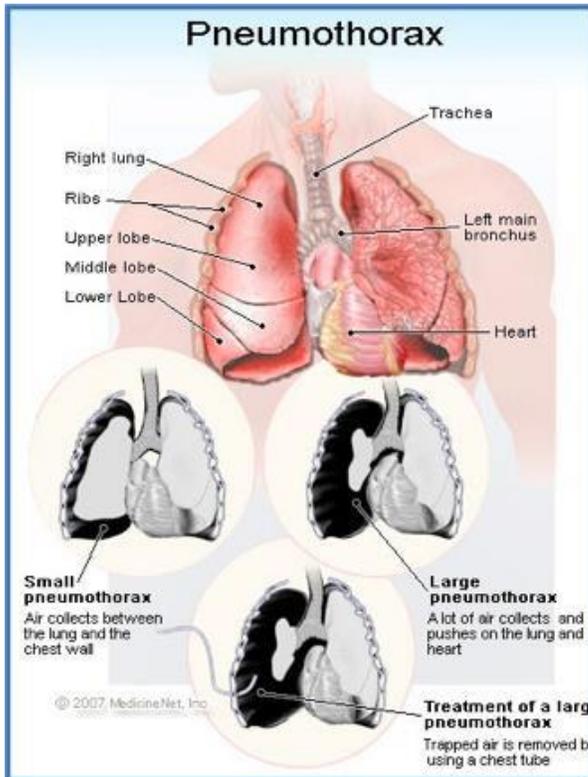
Table 2: Negative Reactions n=9408

Type of event	Number of reported reactions	%
Pain where needle was inserted	1154	12.3
Bruising	378	4.0
Pain other than at site of needling	373	4.0
Faint/dizzy	248	2.6
Worsening of condition	165	1.8
Nauseous	111	1.2
Sweating	79	0.8
Bleeding	66	0.7
Disorientation/anxiety/nervousness/insomnia/emotional	63	0.7
Ache/discomfort other than at needle point	49	0.5
Itching/pins & needles/tingling/ burning sensation	33	0.4
Irritation/ache at needle point	24	0.3

Safety Considerations

No Thoracic needling is performed in this course!

Pneumothorax (Traumatic)



When the chest wall is pierced air is allowed to enter, the pleural space causing an uncoupling of the lung from the chest wall, often called a collapsed lung.

Symptoms:

- Chest pain of sudden onset that can be sharp and lead to feeling of tightness in the chest.
- Coughing, shortness of breath, rapid heart rate, rapid breathing pattern and or fatigue.

Treatment:

- This is a potential life-threatening emergency and the patient needs to be transported to an emergency department immediately.

Considerations to prevent occurrence or complications:

- Always follow the (1:1) rule in the thoracic spine. (One finger width lateral to the spinous process and up to a 1-inch needle.)
- Care must be taken in the supraclavicular region, anterior chest/thorax, between the shoulder blades, and lateral thorax as these are at higher risk areas when performing needling treatment.
- Scoliosis, kyphosis or other rib cage anomaly may alter the position of the lung tissue within the chest cavity creating a greater risk of an adverse event when performing dry needling to the region.

Safety Considerations continued

Syncope and Dry Needling

Syncope will usually occur during first 1-3 sessions however, unpredictable syncope episodes can occur at any time, so care is warranted.

In general, we can usually predict when a patient type is more prone to experience syncope:

- Young, strong 20 +/- year-old male athletes
- Thin female patients with blood pressure at or below 110/70 mmHg.
- Prior needling patients that have not had needling treatment within the last six months.

Patients who should not be treated until they have had time to rest, eat and drink water, include but are not limited to, those reporting:

- being extremely hungry or dehydrated
- feeling very tired or exhausted
- having consumed excessive alcohol

Treatment/Triage of Syncope:

- If a patient begins to show pre-syncope symptoms or experiences an episode, immediately remove all needles, recline the patient to supine and raise the feet higher than the head.
- The patient will recover quickly, and no lasting effects will be felt, of course no further needling is to be performed that day.
- **To reduce the likelihood of an episode, treat patients lying down and use fewer and/or shorter needles initially until their tolerance to needling can be better determined.

Safety Considerations continued

Anticoagulants and Dry Needling

When considering performing dry needling (DN) on patient's taking antithrombotic drugs, clinicians must exercise caution and have the requisite competencies in DN techniques and human anatomy.

There are two classes of antithrombotic drugs that are prescribed each with specific mechanisms of action and side effects, see Munoz et al. 2022 for additional information.

1. Antiplatelet agents with the brand names of Ecotrin (aspirin), Plavix, or Brilinta among others.
2. Anticoagulants with the brand names of Coumadin, Xarelto, Eliquis or Bevyxxa among others.

To date, no DN studies have compared the prevalence of DN adverse events in patients taking antithrombotic medications and those that do not. However, acupuncture studies are available assessing the risk of adverse events in people taking antithrombotic medications.

Lee et al., 2018 assessed 428 in-patients who received acupuncture treatment. A total of 169 patients received anticoagulant or antiplatelet drugs (exposure group) and 259 patients did not receive either drug (non-exposure group). Sixty-five (38.5%) patients in the exposure group and, 115 (44.4%) patients in the non-exposure group had bleeding-related mild adverse events. There was no difference in the risk of bleeding-related adverse events between the two groups per sessions. The findings suggest that anticoagulant and antiplatelet drugs do not increase the incidence of bleeding-related adverse events after acupuncture treatment.

McCulloh et al., 2015 performed a systematic review of 7 studies with methodological quality ratings sufficient to assess acupuncture safety in 384 anticoagulated patients (3974 treatments). This systematic review concluded that acupuncture appears safe in patients taking anticoagulants citing a 0.003% complication rate, assuming adequate needling location and depth.

Anticoagulant Summary

A patient's bleeding response can vary from day to day depending on several factors including their intake of medication, the needle procedure, area being needled, and the characteristics of the needle. The monofilament needles being used for DN do not have a cutting beveled edge like hypodermic needles, thus they will cause less tissue damage, and the likelihood of bleeding is minimized (Halle et al., 2016).

Based on published data, DN is not contraindicated for use in patients taking antithrombotic medications, however, the following recommendations should be considered:

- Initially observe the patients bleeding response on more superficial structures avoiding deep needling until the safety of performing DN has been established.
- Apply prolonged hemostasis (10 seconds) in treated areas
- Use a smaller gauge needle that will provide treatment effect but minimize the tissue trauma, especially in deeper areas where hemostasis cannot be applied.
- Reduce the intensity of DN by avoiding aggressive needling techniques (such as pistoning) especially around vulnerable areas and into deeper structures where hemostasis cannot be applied.

Safety Considerations continued

Pregnancy and the Use of Needling

Pregnancy represents a multifaceted physiological and hormonal state, often accompanied by lumbopelvic pain and headaches. The application of dry needling (DN) or acupuncture during pregnancy remains a subject of scientific debate. Traditional Chinese Medicine (TCM) describes "forbidden points" as areas believed to stimulate uterine contractions resulting in miscarriage or preterm labor in the earlier stages of pregnancy. These points, however, can be considered safe during full-term pregnancy (at 37+ weeks) (Levett, 2019). It is stated that these points maybe used to initiate or facilitate the birthing process at 37+ weeks (Levett, 2019). It is worth noting that the precise locations and classification of these forbidden points vary among different acupuncture schools of thought.

Several systematic reviews, including Carr in 2015 and Park et al. in 2014, have drawn the following conclusions about forbidden points:

Needling of forbidden points does not increase the risk of adverse pregnancy outcome in controlled clinical trials

There is no association with increased rates of adverse pregnancy outcomes in observational studies

Does not induce miscarriage or labor.

Examination of the proposed risks fails to provide any plausible physiological mechanism. (Cummings, 2011)

In contrast, Levett et al. in their 2019 systematic narrative review concluded that the current evidence is insufficient to recommend the use of forbidden points before 37 weeks of pregnancy. They pointed out that the highly selective patient populations used in the studies introduced a risk of bias in study designs and participant withdrawal rates indicated a need for additional high-quality trials.

From a clinical standpoint, it is generally considered prudent to avoid needling any area of the body during the first trimester of pregnancy, when the risk of spontaneous miscarriage is higher (McDowell, 2019). Based on the existing scientific research, needling in the second and third trimester appears to be safe and is indicated for musculoskeletal treatment (McDowell, 2019). However, all needling practitioners should be aware of the classic literature on "forbidden points" and should consider the physiological and systemic effects when treating musculoskeletal pain during pregnancy (McDowell, 2019).

While we do not intend to resolve this controversy, we believe it is important that clinicians understand the historical information related to forbidden points as these areas may overlap with neuromuscular innervation zones used during DN treatment. Judicious use of DN can provide relief for musculoskeletal pain experienced during the later stages of pregnancy and based on the available literature, appears to be safe. The decision to use DN is a clinical one that takes into account all available information, including the patient's medical history, physical condition, and their informed consent.

Safety Considerations continued

Pregnancy and the Use of Needling continued

Forbidden Points described in Traditional Chinese Medicine	
Spleen 6	Located 4 finger widths above the medial malleolus
Bladder 60	Located in the depression between the tip of the lateral malleolus, and the Achilles tendon.
Pericardium 8	Located in the middle of the palm, with a clenched fist, under the tip of the middle finger.
Large Intestine 4	Located on the dorsum of the hand in the web space between the thumb and index finger.
Bladder 27-34	These points are located over and lateral to the sacral foramen (S1-S4).
Bladder 67	Located on the tip of a pinky toe, near the lower outside corner of the toenail.
Gall Bladder 21	Located in the mid-portion of the posterior aspect of the upper trapezius muscle.
Lung 7	Located 2 finger-widths proximal to the anatomical snuffbox on the radius.
Conception Vessel 3-7	These points are located on the midline of the lower abdomen between the umbilicus and the pubic symphysis.

Pregnancy and the use of needling

Clinical Relevance:

- It is generally considered prudent to avoid needling any area of the body during the first trimester of pregnancy. when the risk of spontaneous miscarriage is higher (McDowell, 2019).
- Based on the existing scientific research, needling in the second and third trimester appears to be safe and is indicated for musculoskeletal treatment (Carr 2015; Park 2014)).
- However, all needling practitioners should be aware of the classic literature on “forbidden points” and should consider the physiological and systemic effects when treating musculo - skeletal pain during pregnancy (Levett et.al 2019; McDowell, 2019).
- The decision to use DN is a clinical one that should consider all the available information, including the patient’s medical history, physical condition, and their informed consent.

Dry Needling Precautions and Considerations

Adapted from: APTA Public Policy, Practice, and Professional Affairs Unit.

There are certain precautions to be considered with the use of DN:

1. Patients need to be able to give informed consent for DN treatment.
2. Patients may not be willing to be treated with DN.
3. Patients with a needle aversion or phobia may object to dry needling treatment. With appropriate education, however, these patients may still consider DN.
4. Patients with significant cognitive impairment may have difficulty understanding the treatment parameters of DN intervention.
5. Patients who are unable to communicate directly or via an interpreter may have difficulty understanding the treatment parameters of DN intervention.
6. Local skin lesions must be avoided with DN.
7. Local or systemic infections are generally considered to be contraindicated.
8. Local lymphedema (note: there is no evidence that DN would cause or contribute to increased lymphedema, i.e., post mastectomy, and as such is not a contraindication).
9. Severe hyperalgesia or allodynia may interfere with the application of DN but should not be considered an absolute contraindication.
10. Some patients may be allergic to certain metals in the needle, such as nickel or chromium. This situation can be remedied by using silver or gold-plated needle
11. Patients with an abnormal bleeding tendency, i.e., patients on anticoagulant therapy or with thrombocytopenia, must be needled with caution. DN of deep muscles, such as the lateral pterygoid or psoas major muscle, which cannot be approached with direct pressure to create hemostasis may need to be avoided to prevent excessive bleeding.
12. Patients with a compromised immune system may be more susceptible to local or systemic infections from DN, even though there is no documented increased risk of infection with DN.
13. DN during the first trimester of pregnancy, during which miscarriage is fairly common, must be approached with caution, even though there is no evidence that DN has any potential abortifacient effect.
14. DN should not be used in the presence of vascular disease, including varicose veins.
15. Caution is warranted with DN following surgical procedures where the joint capsule has been opened. Although septic arthritis is a concern, DN may still be performed as long as the needle is not directed toward the joint or implant.

As part of the procedural guidelines for DN, physical therapists must practice consistent with the OSHA Blood Borne Pathogens standard¹¹⁶ (osha.gov), which applies to all occupational exposure to blood or other potentially infectious materials. According to the OSHA Blood Borne Pathogens Standard (BBPS), gloves shall be worn when it can be reasonably anticipated that the employee may have hand contact with blood, other potentially infectious materials, mucous membranes, and non-intact skin. As DN creates “non-intact skin” and recent research has shown that the most common adverse event of dry needling is minor bleeding, it follows that the OSHA BBPS applies.

Disposal of sharps containers is controlled by the individual state in which you practice.

The website www.safeneedledisposal.org provides information on how to dispose of sharps containers.

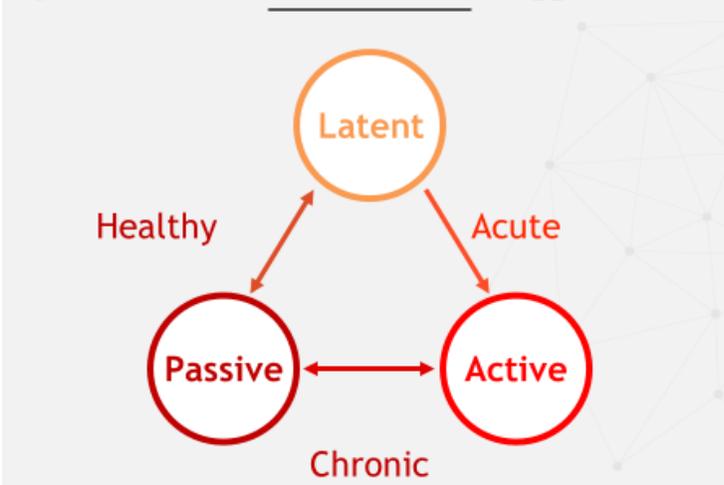
Pathophysiology of Neuro Trigger Points

Sensitized Neuro-trigger points can appear anywhere in the body there is a sensory nerve ending. Different neuro-trigger points have different secondary anatomical structures, they can be associated with tendons, capsules, aponeurosis, vessels, essentially all soft tissue structures can harbor an active or passive Neuro-trigger point

Dynamic Physical Properties of Neuro-Trigger Points (Dr. Dung/Dr. Ma)

- Sensitivity: Increases or decreases.
- Specificity (size/area): Increases or decreases.
- Sequence: Homeostatic neuro-trigger points become sensitized in a predictable sequence.

Dynamic Phases of Neuro-trigger Points



Latent = Normal, non-sensitized tissue
Passive = Sensitive tissue upon palpation
Active = Painful tissue without palpation

Shah, J. P., Danoff, J. V., Desai, M. J., Parikh, S., Nakamura, L. Y., Phillips, T. M., & Gerber, L. H. (2008). Biochemicals Associated with Pain and Inflammation are Elevated in Sites Near to and Remote From Active Myofascial Trigger Points. Archives of Physical Medicine and Rehabilitation, 89(1), 16–23.

- Active MTrP have a greater amount of sensitizing chemicals compared to latent TrP or normal tissue
- These sensitizing chemicals were shown to be elevated systemically
- Lowered concentrations of sensitizing and inflammatory chemicals occurred in the active groups who experienced the LTR
- Explains the temporary pain reduction and PPT clinically
- This suggest that elevations of biochemical associated with pain and inflammation may not be limited to localized areas of active MTrP but occur systemically

Shah, J. P., Danoff, J. V., Desai, M. J., Parikh, S., Nakamura, L. Y., Phillips, T. M., & Gerber, L. H. (2008). Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. *Archives of physical medicine and rehabilitation*, 89(1), 16-23.

Measurement	Sensitive Points
Pressure Pain Threshold (PPT)	↓
pH	↓
Substance P (SP)	↑
Calcitonin Gene-related Peptide	↑
Bradykinin	↑
Serotonin	↑
Norepinephrine	↑
Tumor Necrosis Factor	↑
Interleukin [IL-1 β]	↑

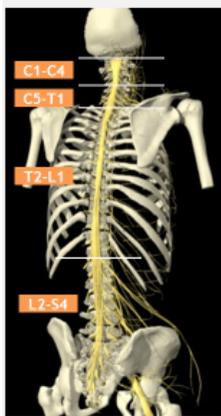
Three Types of Neuro Trigger Points

1. Homeostatic Neuro-Trigger Points (H's)
2. Paravertebral Neuro-Trigger Points (P's)
3. Symptomatic Neuro-Trigger Points (S's)

Homeostatic Neuro Trigger Points

Homeostatic N-TrP's are formed by both anterior and posterior rami of spinal nerves depending on their location on the body. In terms of nomenclature, a homeostatic point is also a symptomatic point (painful with palpation) but not all symptomatic points are homeostatic points.

Peripheral Nerves & Neuro-Trigger Points



1. Cranial nerves:

- Trigeminal & Facial N-TrPoints

2. Anterior rami of spinal nerves

- C1-C4: Cervical points (4)
- C5-T1: Upper Limb/Arm (3)
- C5-T1: Shoulder (4)
- (T6-T7) L2-S1: Torso (6)
- L2-S4: Hip & Lower Limb (7)

3. Posterior rami of spinal Nerves

- C1- S4: Paravertebral N-TrPoints

Segmental Origin of the 24 Homeostatic Neuro-Trigger Points

Arm	3	C5-T1
Head	4	Cranial, C1-4
Shoulder	4	C5-T1
Torso	6	T6-7, L2-S1
Leg	7	L2-S4

Development of Homeostatic Neuro-trigger Points (H's)

1. Linear along the nerve trunk in the limbs
2. Form as an area in the torso and face.
3. Universal in humans
4. Appear in predictable locations and a predictable sequence
5. Are present bilaterally and symmetrically
6. Develop slowly over time (months to years)
7. Measure of health condition / healing potential

IDN

What makes a Homeostatic Neuro-trigger Point? Why do they follow a predictable sequence?

1. Size of nerve trunk. (eg. Deep radial 1 vs Musculocutaneous 9)
2. Depth of nerve. (eg. GAN 2 vs GON 7)
3. Penetration of fascia. (eg. Lateral antebrachial cutaneous 9)
4. Passing through foraminae. (eg supra&infra orbital 23 & 19)
5. Neuromuscular attachments/Motor points. (eg. spinal accessory 3, suprascapular 8)
6. Neurovascular bundles. (eg. Deep radial 1 is part of nv bundle, musculocutaneous 9 is not.)
7. Nerve fiber composition. (eg. Mixed nerves tibial 6 vs sensory only sural 10)
8. Bifurcation points. (eg. Common fibular 24, superficial radial 12)
9. Near dense fibrous connective tissue. (eg. ITB 18, MCL at knee)
10. Suture lines of the skull. (eg. Chronic headaches)

IDN

Quantitative Sensory Testing and the Efficacy of Dry Needling Treatment.

Frank Gargano PT, DPT, CIDN, MCTA, CMP

Quantitative Sensory Testing (QST) is the most widely used paradigm to assess central hypersensitivity, it consists of the application of a standardized stimulus to a peripheral (nerve) tissue and recording the patient's response. (Curatolo & Arendt-Nielsen, 2015) The paradigm relies on the assumption that a non-painful stimulus, when applied to a non-injured tissue, will evoke pain only if central nociceptive pathways are hypersensitive. Determining if the hypersensitivity (neuropathic pain) is caused by a peripheral mechanism, central mechanisms, or a combination of the two, can be difficult clinically due to their interdependence.

Neuropathic pain is defined as: *"Pain caused by a lesion or disease of the somatosensory nervous system"*. (Finnerup et al., 2016) The somatosensory nervous system provides information about the body including skin, musculoskeletal, and visceral organs, which has clinical relevance for the clinicians providing neuromusculoskeletal treatment, specifically dry needling treatment.

Neuropathic pain may be spontaneous or evoked, as an increased response to a painful stimulus (hyperalgesia) or a painful response to a normally non-painful stimulus (allodynia). (Treede et al., 2015) This definition provides a broad concept and shares common features of chronic musculoskeletal pain with other pain conditions e.g. neuropathic, and visceral.

It is an ongoing clinical challenge to make a prognosis on the potential outcome of treatment and certainly the time required to achieve a treatment result. QST has shown some promise in assisting clinicians, specifically neuromusculoskeletal practitioners, in estimating these difficult prognoses. (Georgopoulos et al., 2019) In this paper an overview of a novel bedside (IDN) QST exam is provided, and how it can be used as a part of comprehensive evaluative plan in estimating if dry needling would be of clinical value as a part of the treatment plan.

Application:

The stimulus applied in QST can be chemical, thermal, electrical, vibrational or physical (pressure) to evoke a response. In the IDN bedside QST exam the application of a physical pressure is the most readily available stimulus that can be trained and practiced achieving an acceptable level of intra-tester reliability. (Curatolo & Arendt-Nielsen, 2015) The IDN bedside QST exam involves applying a consistent pressure to 16 standardized assessment points in two peripheral nerve pathways, one in the upper extremity and one in the lower extremity.

In the IDN system, homeostatic neuro-trigger points are defined as areas of increased sensitivity that are universal in all humans, and are proposed to be of central origin based on meeting the following criteria:

- Homeostatic neuro-trigger point sensitivity must be present bilaterally and symmetrically
- Homeostatic neuro-trigger points develop in predictable locations and in a predictable sequence in all humans. The sequence of peripheral sensitization is the result of anatomical, physiological, biomechanical and behavioral factors
- Homeostatic neuro-trigger points develop slowly over time based on intrinsic and extrinsic factors, which may represent the patient's health condition and healing potential
- Homeostatic neuro-trigger point sensitization occurs linearly along nerve trunks in the limbs and occurs as an area or patch on the torso and face.
- The sensitivity and specificity (size/area) of homeostatic neuro-trigger points are highly dynamic.

The Radial and the Saphenous nerves were chosen to be assessed because they are the first peripheral nerves to become sensitized in the upper and lower extremities respectively. (Houchi Dung, 2013) Once the proper application of the stimulus is taught (during the IDN Foundation Course), the examiner applies the stimulus (pressure) down the standardized nerve pathways from proximal to distal (homeostatic points) in all four extremities for a total of 16 possible positive findings.

Because the IDN bedside QST exam is both an objective tactile interpretation by the examiner, and a subjective report of discomfort by the patient, a positive finding requires both. All positive findings are calculated with the range being from 0 to 16. The greater the number of positive findings the greater the correlation to the sensitization being centrally mediated. (Ma, 2016), (Houchi Dung, 2013) (H. Dung, 1986)

To make the IDN bedside QST exam of clinical utility the following was considered:

- Applicable to every patient
- Reproducible with any patient for any condition
- Able to be administered by all clinicians who are properly trained
- Testing is of short duration
- Quantitative results that can assist in clinical decision making
- Efficacy of dry needling treatment

The difficulty in assessing pain, and certainly the measurement of it, relates to its complexity and subjective nature. When we measure pain clinically, we invariably target subjective pain because it is perceivable and easy to find. Objective pain is not perceivable, patients that have objective pain will not know they have it unless it is triggered. Objective pain is, by definition, a passive neuro-trigger point sensitivity that is only perceivable when palpated. It is objective pain that is assessed in the IDN bedside QST exam because it is relatively stable in intensity and location (radial and saphenous nerve pathways). For this discussion objective pain is directly related to the level of sensitivity being maintained within the homeostatic points via central processes. (Ma, 2016) In other words, homeostatic points are objective pain, which are centrally mediated. The greater the number of sensitized homeostatic points a patient carries is directly related to their degree of central sensitization, which in turn influences the manageability of their symptoms and efficacy of the dry needling treatment. (Houchi Dung, 2013) (Ma, 2016) (H. Dung, 1986)

Interpretation:

As is the case in many bedside clinical tests, it is not possible to make definitive statements, this certainly applies to making estimates on the presence and degree of central sensitivity. That said, central sensitivity has been extensively investigated in humans. (Georgopoulos et al., 2019) When exaggerated pain responses and expansion of pain areas occur after limited tissue damage it is reasonable to infer that it is the result of enhanced nociceptive processes within the central nervous system (Curatolo & Arendt-Nielsen, 2015) (Ma, 2016) (Uddin & MacDermid, 2016) (Greening et al., 2018) Unfortunately, we cannot say much more. For instance, clinicians are still unable to say whether, or to what extent pain hypersensitivity is the result of psychosocial factors.

QST is primarily a measure of pain sensitivity and does not allow conclusions to be drawn on the causes, mechanisms or location (peripheral or central) of the underlying hypersensitivity. For example, if a patient with shoulder pain did a vigorous run the morning of the IDN bedside QST exam they would experience exercised induced inflammation, which sensitizes the peripheral nervous system leading to false positive QST findings.

Recognizing the limitations, and understanding the intent is to only discover centrally mediated findings, the IDN bedside QST exam was modified as follows:

- Patients should only be assessed when at a resting baseline of physical activity to minimize acute inflammation influencing the findings.
- Pain medications and chemicals affecting consciousness, such as alcohol or marijuana, may influence the accuracy of the patient's response.
- The assessment of both upper and lower extremities provides a better systemic view of patient condition.
- Assessment of multiple points linearly down the nerve path gains insight into the degree of sensitivity.

The interpretation of the IDN bedside QST exam is empirically based on tens of thousands of patient examinations and treatments dating back from the 1970's to today. (Ma, 2016) (Houchi Dung, 2013) Founded in the premise that when the human body is under stress from injury, disease, surgery or other physiological events, inflammation increases causing peripheral sensitization and likely central effects. In patients presenting with chronic pain, this peripheral sensitization profoundly spreads, represented clinically as inflamed sensory nerves (homeostatic points). (Ma, 2016) The number of positive findings (peripheral sensitization) discovered during the IDN bedside QST exam is an indicator of the severity of inflammation in the body. The greater the number of positive findings is an empirical estimate of how many dry needling treatment sessions are needed to reduce the systemic inflammation and how long the pain relief can last.

Research:

QST has demonstrated potential benefits when compared with traditional neurological diagnostic tools. For example, around 80% of the peripheral nervous system consists of small nerve fibers. (Greening et al., 2018) (Backonja & Lauria, 2010) Deep tissue pain sensation transmits through small caliber A-delta (group III), and C fibers (group IV). (Mense, 1993) QST can target these fibers by using frequencies that target small fibers (e.g., current perception threshold and vibratory perception threshold) or sensory stimuli (e.g., pain and temperature) that are preferential to these fibers. This lends itself to bedside assessment using pain, generated by the examiners pressure, as the measure. Potential disadvantages are that the specificity of these responses has not been adequately demonstrated, and this testing is not completely objective because pain is subjective by nature requiring the patient to provide a voluntary response. Considering the currently used methods of visual analog scales and pain questionnaires, the IDN bedside QST exam may provide a more objective measurement of neural sensitivity.

In the literature there is strong evidence for central hypersensitivity (abnormal pain response) being a prognostic factor for poor outcomes in chronic musculoskeletal pain. (Georgopoulos et al., 2019) (Lim et al., 2011) The evolution of pain theory and evidence of a central component of post-injury pain hypersensitivity implicate central sensitivity in musculoskeletal pain mechanisms. (Uddin & MacDermid, 2016) Involvement of the central nervous system in musculoskeletal pain mechanisms (specifically in chronic or maladaptive pain) is emerging as a new target area for treatment. Interestingly, acute and chronic pain have similar mechanisms and the temporal relationship may be more related to central mechanisms in making the transition from acute to chronic pain. This suggests that early detection might allow clinicians to make a more accurate prognosis for their patients.

Clinically, a patient who has been injured in a motor vehicle accident (MVA) is a good example of persistent pain complaints lasting well past the timeframe that tissue healing is expected to be complete. There is research to show this persistent pain, specifically in post MVA's, to be a function of neurologic sensitivity being maintained within the nerve structure secondary to the early vascular changes resulting from the injury. (Greening et al., 2018) (Shah et al., 2015) Patients present with cervical and upper extremity symptoms that are not localized to specific dermatomes or myotomes. A likely explanation for these diffuse symptoms is the development of central sensitivity driven by the persistent nociceptive barrage into the dorsal horn. (Lim et al., 2011) (Woolf, 2011) Treatment that focuses solely on the peripheral driver misses the complexity of the systemic involvement.

A systematic review and meta-analysis (Georgopoulos et al., 2019) demonstrated a predictive relationship between baseline QST, a measure of pain hypersensitivity, and musculoskeletal pain and disability at follow-up. These studies showed this predictive relationship across multiple musculoskeletal conditions (OA, LBP, WAD, post-operative pain) affecting different anatomical sites (knee, hip, low back, neck, shoulder), and across different QST modalities and study contexts (cohort studies and RCTs). This review demonstrated that pain hypersensitivity predicts prognosis and that QST might help identify patients who could most benefit from interventions aiming to improve pain and disability. Clinically identifying which patients might be at particular risk of a poor outcome is important in order to identify those who are most likely to benefit from treatment. At a minimum this allows the clinician to have an informed discussion with the patient about the expected prognosis and potential treatment outcome prior to initiation of care.

Clinical Relevance:

QST is a safe, simple and useful bedside tool to determine the potential benefit of engaging in a treatment plan and the potential treatment outcome. The IDN bedside QST exam is not intended to differentiate diseases or to investigate the mechanism of diseases. The goal of the IDN bedside QST exam is to provide the information necessary for evaluating the self-healing potential of a patient and the projected efficacy of dry needling treatments. IDN bedside QST exam accompanied by a full patient history, orthopedic examination, diagnostic testing, and the clinician's experience and intuition provides a more inclusive view of patient condition and prognosis.

Future studies are needed to determine the reliability of specific QST approaches and establish clinically meaningful thresholds in specific pathologies in order to validate QST as a clinical decision aid for neuromusculoskeletal conditions.

Quantitative Sensory Testing (QST) - Lab

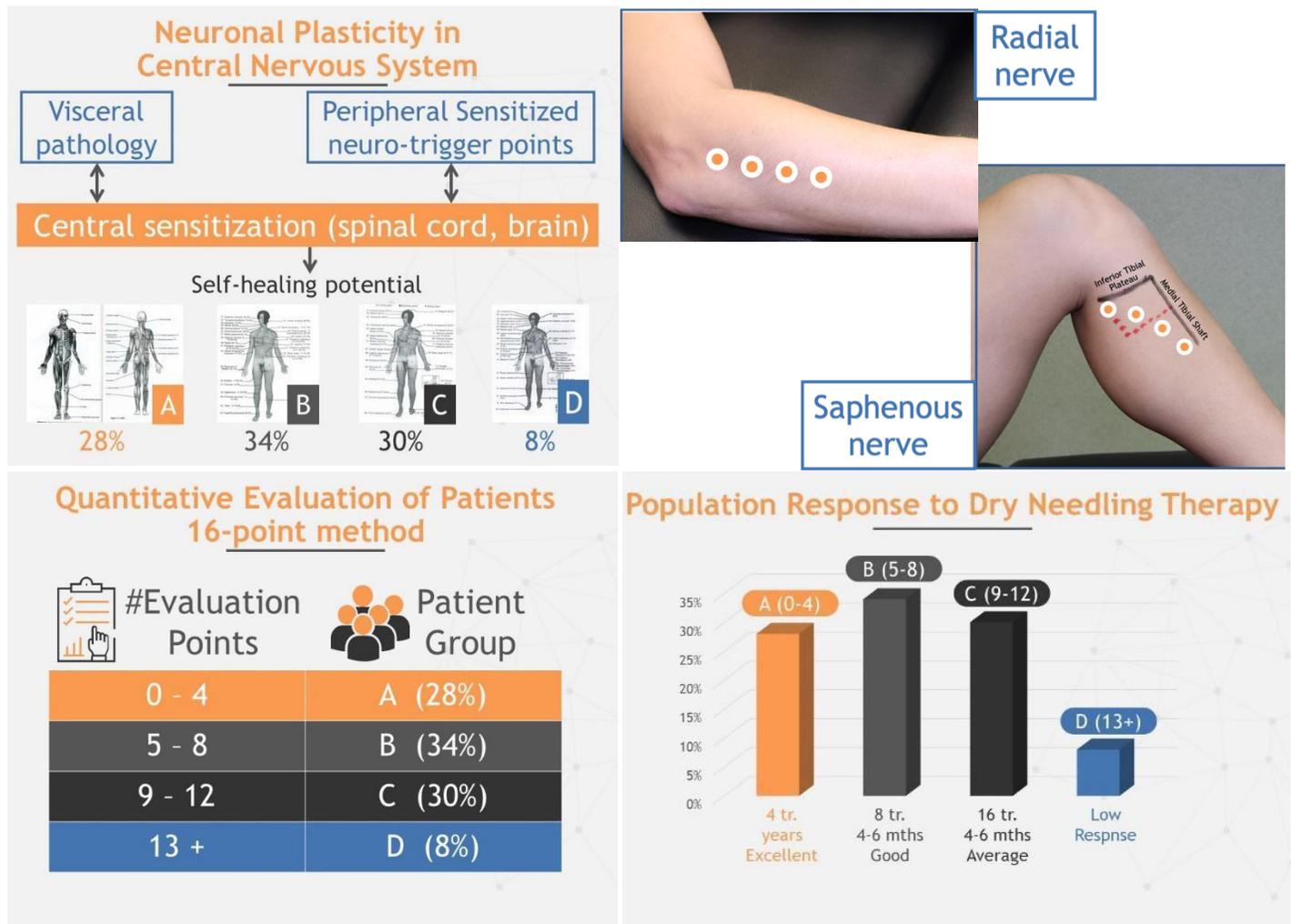
Quantitative Sensory Testing (QST)

“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 2015.

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 (Uddin & MacDermid 2016, Georgopoulos 2019).

Technique:

Apply sufficient pressure using your thumb to compress 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.



Electrical Nerve Stimulation (ENS)

Electrical Nerve Stimulation (ENS) further increases the efficacy of manual needling by rhythmic vibration of the tissues. This rhythmic vibration also creates both local and systemic effects. A powerful local effect includes reducing tissue tension, including tension of scar tissue, and loosening tissue adhesion. Manual and electrical needle procedures help restore vasoregulation of blood and lymphatic circulation and reduce inflammation.

ENS delivers a mild electrical stimulation to soft tissue via a solid monofilament needles for the treatment of pain, abnormal muscle tone or neuromuscular re-education. Alligator clips attach to the metal handle (or shaft) of the filament. The stimulation can be delivered by various types of battery powered stimulators for example, a traditional TENS unit can be utilized. TENS units were not designed for this specific use so care must be taken when increasing and adjusting intensity to avoid patient discomfort. We recommend units specifically designed for use with needles, such as the ES 130, that have a more sensitive intensity regulator.

Indications:

- Acute and chronic pain conditions
- Patients that do not tolerate manual manipulation of the needle
- Higher QST scores due to enhanced central effects of needling with ENS
- Presence of muscular spasm
- Reduce post-treatment soreness following needle manipulation
- Scars and adhesion may benefit from repeated contractions

Precautions:

- All contraindications and precautions for DN and for other electrical device used, should be observed for ENS.
- Do not use ENS near implanted electrical devices such as pacemakers or spinal cord stimulators also avoid contact and areas close to metal implants.
- Avoid areas of sensory denervation and areas where circulation is compromised.
- Care must be taken when stimulating around the posterior cervical region as overstimulation or too aggressive stimulation can result in dizziness, nausea or exacerbation of symptoms. Avoid ENS stimulation in the anterior cervical region.
- Avoid using ENS across the chest region i.e. AP to the thorax.

Parameters:

If you are using a unit that is specifically designed for ENS with needles the only parameters that need adjusting are frequency and intensity. If you are using a traditional TENS unit, the following are simple guidelines to follow:

- Frequency: 1-4 Hz, to provide a slow rhythmical contraction during each session
- Pulse width: Between 100-150 microseconds is a good starting place
- Mode: Normal for most uses
- Time: Can range from seconds up to 5+ minutes depending on the treatment effect you are trying to accomplish. The clinician must be aware of the effects that strong or repeated muscle contractions have on the soft tissue affected by the ENS. In areas where there is possible concern about the health of the soft tissue the intensity and stimulation time need to be administered accordingly to avoid exacerbation of symptoms.

Needle placement:

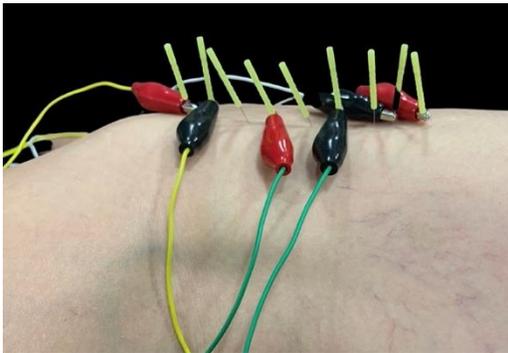
ENS can be applied (adhering to the above precautions) in all the areas that were taught in class.

- ENS can be used effectively to reduce the sensitivity of scars and maximize the needle effect.
- Using ENS down nerve distributions in the upper extremity can be very effective in reducing nerve irritation over a larger areas.
- If reports of a burning, electric or shocking type sensation is reported the needle placement may be too close to the nerve and the needle should be removed and replaced in a position further from the nerve.

**ENS has a stronger analgesic effect than needling alone
(Manheimer 2010, Schliessback, 2011).**

ENS Examples

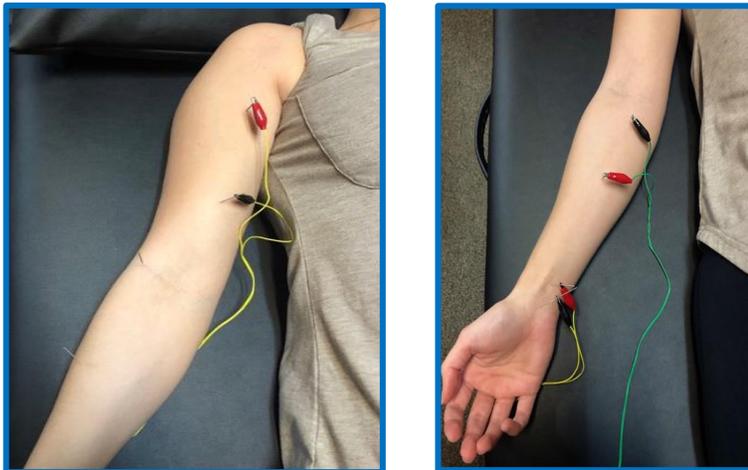
Scar Needling with ENS



Radial Nerve Distribution ENS



Musculocutaneous Nerve & Median Nerve ENS



Central Effects of ENS versus needling alone

- Activates stronger patterning in the central pain matrices (Huang et al., 2012) and increases fMRI signaling in supplemental brain areas (Napadow et al., 2005).
- Increased activity in the periaqueductal grey area (Zyloney et al., 2010).

Local tissue effects of ENS

- Activates local endogenous opioids, local sympathetic nerve fibers (Hsieh, 1998) and increased muscle oxygenation (Kimura et al., 2015).

Treatment of Abnormal Scar Tissue with Dry Needling.

Frank Gargano PT, DPT, CIDN, MCTA, CMP

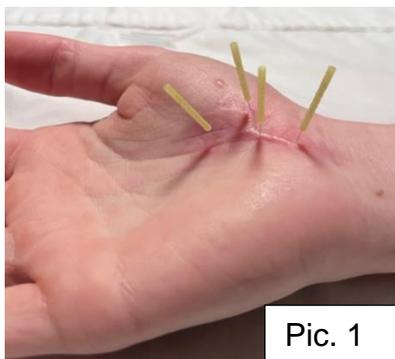
In biomedical terms, the formation of scar tissue creates fibrous adhesions between layers of skin and connective tissue (fascia) which can result in disordered circulation and neural involvement around the scar and adjacent tissues. Uncomplicated skin healing processes in humans leaves a flattened scar that fades as it matures. However, abnormal or prolonged healing responses can lead to the formation of abnormal scars such as hypertrophic scar (HTS), keloid scar or, scars that are painful.

During the first few weeks of the wound healing process an increased nerve density in and around the scar is normal. This gradually decreases to equal or lower than that of uninjured skin during scar maturation (Bijlard et al, 2017). However, chronically painful scars have been shown to have a higher density of nociceptive fibers than non-painful scars (Hamed et al, 2011). Choi et al (2013) described a correlation between increasing scar thickness and intensity of an itch sensation experienced by some patients. The reported itch sensation is mediated by low level C-fiber nociceptor stimulation but with higher levels of stimulation the patient can experience pain (Potenzieri and Udem, 2012). In the presence of a thicker scar; movement may be more likely to be restricted and activate mechanosensitive receptors due to greater pressure and stretch, yet can remain sub-threshold for pain. Ongoing mechanical stimulation can induce the sensory receptors to release neuropeptides that further irritate chemically sensitive nociceptors leading to neurogenic inflammation within the scar tissue, which disrupts and prolongs the healing process (Akaishi et al, 2008). Increased scar thickness, reduced pliability and greater density of nociceptors can be associated with abnormal tissue healing resulting in the symptomatic, and movement restricting scars seen clinically (Bijlard et al, 2017). Needling treatment stimulates mechanoreceptors and nociceptors in the skin and underlying tissue and is thought to enhance the activity of inhibitory local and descending neural mediators, thereby modulating neurogenic inflammation (Zhang et al, 2012). An increase in neurogenic inflammation in the scar tissue is frequently the genesis of the familiar itch, pain and / or loss of movement commonly reported by patients. There are several needling interventions available (see images below) that may reduce or alter abnormal tissue formation, neurogenic inflammation/sensitivity and improve circulation to the tissues.

Unfortunately, a gap in the literature exists between what we know empirically works and what the current research supports. More well-designed, controlled clinical trials are needed to validate the use of dry needling for the treatment of painful and restrictive scar tissue.

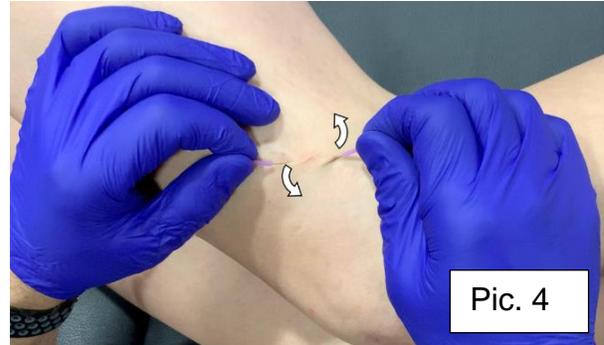
Simple scar tissue Dry Needling (see pic 1 and 2)

Insert small gauge needles (e.g. 0.18 x 15mm needles) into and near to scar tissue. Depending on location of the scar, depth of the needle insertion needs to be considered.



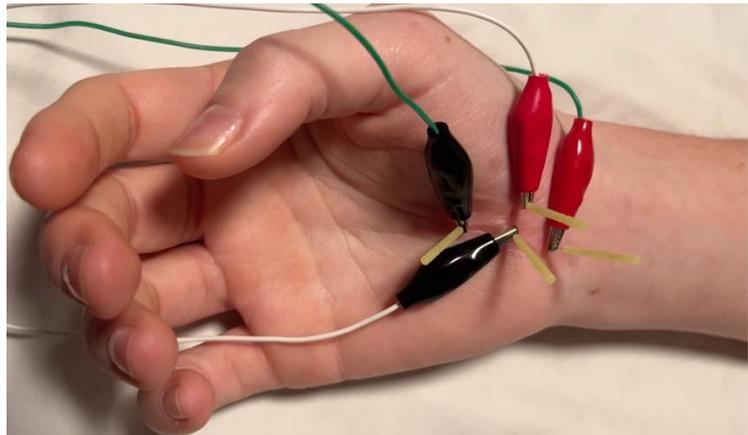
Needle rotation in scar tissue Dry Needling (see pic 3 and 4)

Insert the needle(s) at an angle that penetrates the scar tissue to the desired depth, then rotate the needle(s) creating a progressive increase in tissue tension that will reach a point of strong resistance to further rotation. The patient is likely to feel discomfort upon reaching the resistance point (see pic 3). Moving the needles in multiple directions will stretch or tent the tissue assisting in breaking adhesions and improve the mobility of the scar tissue (see pic 4)



Electrical Nerve Stimulation (ENS) in scar tissue Dry Needling

ENS also activates a stronger patterning effect in the central pain matrices, increased activity in the periaqueductal grey area effecting descending pain modulation (Zyloney et al, 2010, Chae et al, 2013). Locally ENS activates local endogenous opioids, local sympathetic nerve fibers and increases muscle oxygenation (Kimura et al, 2015). There is also a vibratory effect from the ENS that accentuates the needle's mechanical stimulation on the restricted tissue. Not pictured but adding dynamic cupping to scar management is also beneficial in certain cases.



Determining Dosage of Dry Needling Treatment

Frank Gargano PT, DPT, CIDN, MCTA, CMP

The current literature is lacking on a definitive and scientific answer to the question of how dry needling dosage is clinically determined. Currently, the answer relies mostly on empirical and historical knowledge. In general, our definition of needling dosage is based on the number and extent of the therapeutic lesion(s) produced from the needle insertions. Therapeutic lesion is defined as the neurophysiological response of the body to the needle penetrations; the more therapeutic lesion(s) produced, the higher the needle dosage delivered. The extent of a therapeutic lesion(s) is not solely dependent on the number of needles used, but also on the gauge of the needle and how it is manipulated while in situ. Based on that description it is understandable that we do not have a standardized nomenclature to quantify the amount of therapeutic lesion required for optimal clinical effect. This is in contrast to exercise or medication prescription that can have a very specific and easy to follow prescription. For example, the always popular, but highly questionable 3 sets of 10 for exercise or take 2 pills 3 times per day. The lack of a standardized system to measure needle dosage leaves us with vague statements such as continue needling “until it stops twitching”, “until the energy flows”, “until the muscle relaxes”, or the intuitive “until the pain goes away?” This highlights one of the major limitations in dry needling research, lack of identification of the needle dosage used to obtain the clinical effect. When deciding on the treatment dosage for dry needling there are several patient factors to consider. For the purpose of this paper, I would suggest the following short list of considerations related to needle dosage:

- Age and health status of the patient
- State of the condition being treated (acute/chronic)
- Patient experience with dry needling especially within the last 6 months
- Healing potential based on the IDN Quantitative Analysis

When the subjective and physical examinations have been completed, the decision to utilize dry needling has been made, and patient consent obtained, the next step is determining location and dosage of needling. On the first day of treatment it is recommended to “talk more and needle less.” By this we refer to educating the patient about dry needling while also reducing the potential for significant post-needle soreness. Determination of the patient’s tolerance and response to needling is a process so being conservative initially is prudent. With that said, the first treatment should have a therapeutic effect but not at the expense of dogma that states the mission is to “eliminate” knots or points at all costs.

There are several techniques of dry needling that can be integrated into each treatment session, each can be used separately or can be used in combination. The following describes the most common clinical applications utilized:

Superficial needling

The needle is inserted into the dermal and epidermal layers and not into the muscle tissue. This type of needling is the most conservative and very unlikely to cause pain or post-treatment soreness. A minor therapeutic lesion is still produced allowing the patient to receive the neurological and physiological benefits.

Deep Needling

The needle is inserted directly into the muscle tissue. There are various levels of needle penetration from inoculating just the outer layer of muscle or needling through the entire thickness of the muscle. Depending on how deep the needle is placed will determine the neurophysiological responses that result because penetrating deeper provides greater stimulation to the additional soft tissue and neurological levels. When the needle is set without needle manipulation it would be considered a basic deep needling technique of low dosage but is a progression of dosage over superficial needling.

Needle manipulation

The amount of dosage (therapeutic lesion) obtained is also based on the variables of speed, amplitude and intensity of the needle manipulation or movement. This is a progression from basic deep needling and has several manipulation techniques that can be utilized depending on the specific goals you are trying to accomplish. In a subsequent paper, I will describe in detail these different techniques and their specific uses:

- Needle rotation - The in-situ needle is rotated until a definitive endpoint is reached signifying the soft tissue has completely “wound” around the needle shaft inducing additional therapeutic lesion.
- Needle tenting - When the soft tissue is wound tightly around the needle it is pulled up causing a traction or stretch of the tissue inducing additional therapeutic lesion.
- Needle pistoning - A high velocity up and down conical movement of the needle. There are various levels of intensity of pistoning that are dependent on the speed, and amplitude of the needling. The higher the speed and amplitude the larger the therapeutic lesion produced. Pistoning is considered the most aggressive needling technique and produces the greatest post-needling soreness.

Electrical Needle Stimulation (ENS)

ENS delivers a mild electrical stimulation to soft tissue via attaching alligator type clips onto the solid monofilament needles. ENS is a progression of dosage of manual needling by inducing rhythmic vibrations (of non-contractile tissue) and repeated muscle contractions. Because the needle is in situ the repeated muscles contractions will induce additional lesion.

Time in situ

Empirically, the length of time a needle is left in situ (without manipulation) does not influence the dosage, if we define dosage as amount of therapeutic lesion produced.

Dosage determination

Research does not currently exist that provides a definitive guideline of needling dosage for specific diagnoses or conditions. Dry needling is a non-specific treatment that relies on the body’s ability to self-heal the needle induced therapeutic lesions via multiple physiological processes.

Because each patient’s situation, injury and condition are unique, trying to determine the correct dosage is complicated to say the least. Each clinician has their opinion on proper dosage, based primarily on their clinical experience and empirical evidence. This is important information, but it is not easily quantifiable to other patients or for use by other clinicians. We propose a clinical model that quantifies needling dosage into more general categories of low, moderate or high. Each category has an increasing number of needles and progressively more aggressive needling techniques that generate larger therapeutic lesions.

Low Dosage

Applies to the initial treatment session for all patients. Also, patients with compromised physical conditions, low healing potential or are at an advanced age require a cautious start. The following is recommended for this category:

- Superficial needling techniques
- Basic deep needling technique (no needle manipulation)
- Number of needles: 5-10 needles

Moderate Dosage

Applies to patients that have had prior needling treatment (low dosage) with a positive reaction within the last 6 months. They are in relatively good physical condition and have been assessed to have good healing potential.

- Deep needling can now include needle manipulation techniques of moderate intensity, which may include pistoning, rotation and or tenting techniques.
- ENS can be introduced and provided for up to 5 minutes of active muscle contraction.
- Number of needles: Up to 20 needles

High Dosage

Applies to patients that have had significant experience with dry needling treatment and are likely healthy, active individuals with excellent healing potential.

- Deep needling with high intensity needle manipulations, which may include pistoning, rotation and or tenting techniques.
- ENS treatment time can be extended up to 10+ minutes and multiple areas can be treated in one session.
- Number of needles: 21+ needles

Summary

In this short paper we provided general categories for the prescription of dry needling dosage focusing only on the induced therapeutic lesion. What needs to be addressed in a subsequent paper is the patient's perception and response, which are linked to dosage and ultimately the therapeutic outcome.

The current guidelines are intended to help all clinicians, but specifically clinicians new to dry needling treatment, with the clinical decision-making related to the original question of "How many needles should be used?" These guidelines were never intended to be the definitive answer as it is not currently possible to specifically quantify the non-specific and systemic modality of dry needling. As research progresses and physiological healing processes are better elucidated, we may be better able to quantify the amount of therapeutic lesion required to get the desired treatment effect.

Needle Manipulation (Choi et al, 2013, Couto et al, 2014)

There are various forms of needle manipulation that can be used to create a therapeutic lesion. The goal of the treatment needs to be considered and a decision is then made on the dosage of needling based on the variables of speed, amplitude and intensity of the needle manipulation.

No Manipulation:

The needle is set in the targeted soft tissue without additional movement, rotation or manipulation. No to minimal post-needle soreness can be expected with this technique.

Basic Manipulation:

A low velocity, higher amplitude needle manipulation technique that has the intent to create a therapeutic lesion in the targeted soft tissue. Some mild post-needling soreness can be expected.

Pistoning Manipulation:

A high velocity, usually low amplitude, needle manipulation that has the intent to create a *Local Twitch Response (LTR). The movement of the needle is in a conical pattern with the intent to produce as many LTR's as possible in a small area. This is the most aggressive form of needling, which can produce significant post-needling soreness.

Needle Rotation:

The process of rotating the needle in situ with the intent to create a therapeutic lesion by “winding” the soft tissue around the needle. Care must be taken when rotating the needle, as it will become uncomfortable if done too aggressively. Initially, the needle may be difficult to remove, however allowing it to remain in situ longer will allow the soft tissue to relax allowing easy removal of the needle. Some mild to moderate post-needling soreness can be expected depending on how aggressive the rotation is performed. This technique can be performed in all areas except the facial region to reduce the likelihood of bruising.

Tenting:

Needle “tenting” is a technique that can be used after needle rotation. Once the soft tissue is wound up as described above, the clinician can pull the needle up creating a lifting of the soft tissue or the tenting appearance. This technique is theoretically used to put a tension/stretch on the involved soft tissue. Over a short period of time there will be a definite loosening or releasing of the tissue allowing easy removal of the needle.

*** Clinical relevance of the Local Twitch Response (LTR)**

There is conflicting literature for the need to elicit or exhaust a LTR:

- More pain relief (Hong, 1994; D. Rha et al., 2011; Tekin et al., 2013)
- Similar pain relief (Koppenhaver et al., 2017; Perreault et al., 2017)
- Limited visibility, not easily detectable in lumbar musculature as in the upper trap (D. Rha et al., 2011)
- More post-treatment soreness (Hong, 1994; Martín-Pintado-Zugasti et al., 2018)

Example Documents for Dry Needling Standard of Care

Dry Needling Procedures

A solid monofilament needle is inserted through the skin and into symptomatic soft tissue. The proposed mechanism of action for Dry Needling is it creates a micro lesion within the symptomatic tissue releasing the tension in the shortened tissues and promotes an increase in the circulation to the symptomatic tissue. This mechanical and neuromuscular effect provides an environment that enhances the body's ability to heal which ultimately reduces pain.

Documentation will include a daily SOAP note and a body diagram indicating the needle placement.

Only sterile disposable needles are used and are disposed of in the red sharps containers. Sharps will be disposed of accordance with state guidelines. The practitioner is required to wash their hands thoroughly with soap and water before and after performing dry needling. The facility follows the OSHA Blood Borne Pathogens standard 1910.103 (osha.gov).

Dry Needling Policy

To perform Dry Needling all physical therapists must attend a hands-on continuing education seminar. This course must consist of a minimum of hours to be considered competent in this field of practice. The patient or parent/guardian, prior to performing dry needling, must sign the informed consent form.

Billing of Dry Needling

The Integrative Dry Needling Institute, LLC is a continuing education company and cannot provide billing recommendations or guidelines. The Institute will pass on the current information as is provided by CMS, APTA or other agencies about billing policies/procedures. Reimbursement for dry needling varies from payer to payer and from region to region throughout the country.

Clinicians and administrators need to consider the language provided in their individual insurance contracts and it is recommended to consult with a billing specialist or attorney.

There are 2 codes now used when a clinician delivers dry needling services to a patient:

- 20560- Needle insertion(s) without injection(s); 1 or 2 muscle(s)
- 20561- Needle insertion(s) without injection(s); 3 or more muscles

CMS has assigned these codes the status of "non-covered" services under Medicare. This means you will be able to bill a Medicare beneficiary directly for services. They state to follow the below procedures for submitting a claim to Medicare:

1. Provide a mandatory ABN to the patient.
2. Include the appropriate code on the claim — 20560 or 20561.
3. Append the claim with the GA modifier — that's the modifier indicating that you expect Medicare to deny the services, and you have a signed ABN on file.

Source: APTA.org

Dry Needling Consent to Treat Form

A full-scale pdf copy of this consent form is available for download from your IDN account dashboard.

{LOGO}

Dry Needling Consent Form

Dry Needling (DN) involves inserting a thin/flexible monofilament needle into symptomatic tissue to reduce pain and improve function. Benefits from DN can be experienced immediately or over a few days to weeks. DN is not Traditional Chinese Acupuncture. DN is based on anatomy, neurology, and physiology. DN has some risks that can occur with the treatment. In the hands of a skilled professional, these risks are small, but you should still be aware of the potential adverse events. The most likely adverse events are listed below by their level of severity ("Serious", "Significant", and "Mild") and how often it may occur ("Common" <10%, "Uncommon" <1%, and "Rare" < 0.1%).

Adverse Event	Likelihood	Additional Information
Serious Risks (may require hospitalization)		
Collapsed Lung (Pneumothorax)	Rare	Symptoms may include shortness of breath or chest pain that can last for many days to weeks. A more severe lung puncture can require a visit to the hospital.
Fainting (Syncope)	Rare	Symptoms leading to fainting may include: sweating; lightheadedness; dizziness. Let your healthcare provider know if you have any of these symptoms while being treated. People usually recover quickly but a medical exam may be needed if problems occur.
Significant Risks (May continue for days/weeks and can require medical care)		
Bleeding under skin resulting in a bump (Hematoma)	Uncommon	May result in a bruise.
Nerve Injury	Uncommon	May cause temporary numbness, tingling, weakness, or sensation changes. Needles are small, flexible, and do not have a cutting edge. Significant tissue trauma is unlikely.
Skin Irritation	Rare	Local redness, small bumps, and itching that may last a few hours.
Mild Risks (May cause temporary symptoms and little inconvenience)		
Bleeding (Droplet)	Common	Droplet is cleaned by healthcare provider but it may result in a bruise.
Bruising	Common	May last a few days
Sweating (Diaphoresis)	Common	Usually occurs during or after treatment and may last minutes to a few hours
Dizziness	Common	
Fatigue	Common	
Drowsiness	Uncommon	
Temporary Symptom Increase	Common	Usually occurs during or after treatment and may last a few hours up to a few days.
Pain During/After	Common	
Soreness	Uncommon	

There are other conditions that require consideration so please answer the following questions:

- Are you taking blood thinners? Yes / No
- Are you pregnant? Yes / No
- Are you receiving any treatments or have a medical condition effecting your immune system? Yes / No
- Do you have any known disease or infection that can be transmitted through bodily fluids? Yes / No
- Have you experienced an allergic skin reaction to metals like chromium or nickel? Yes / No
- Do you have any medical devices or implants anywhere in your body? Yes / No
- Have you had any surgical procedures? Yes / No

Patient's Consent:

I have read and fully understand this consent form and attest that no guarantees have been made on the success of this procedure related to my condition. I am aware that multiple treatment sessions may be required, thus this consent will cover this treatment as well as subsequent treatments by this facility. All of my questions, related to the procedure and possible risks, were answered to my satisfaction. My signature below represents my consent to receive dry needling and my consent to any measures necessary to correct complications, which may result. I am aware I can withdraw my consent at any time.

I, _____, read and understand the risks, all of my questions have been answered, and I am willing to be treated with dry needling.

Patient or Authorized Representative Signature

Date

I was offered a copy of the consent form and refused.

Dry Needling Patient Information



INTEGRATIVE DRY NEEDLING

Integrative Dry Needling

is a highly effective form of therapy for the treatment of a multitude of musculoskeletal and neuromuscular conditions. It is not appropriate for all conditions or pathologies and the use of the technique will be at the discretion of your physical therapist.

How does it work?

Integrative dry needling is not acupuncture (traditional Chinese medicine), it is based on neuroanatomy and modern scientific study of the musculoskeletal and neuromuscular systems. A very fine filament needle is inserted through the skin and into the deeper tissues that are considered trigger points to your pain. Dry needling works by causing a micro lesion within the pathological tissue thus breaking up shortened tissues, inhibiting a reflex arc from the nervous system to the tissue, normalizing the inflammatory response, and centrally mediating the pain. This mechanical and neuromuscular effect provides an environment that enhances the body's ability to heal which ultimately reduces pain.

What conditions can be treated?

Conditions include, but are not limited to neck, back and shoulder pain, arm pain (tennis elbow, carpal tunnel, golfer's elbow), headache to include migraines and tension-type headaches, jaw pain, buttock pain and leg pain (sciatica, hamstrings strains, calf tightness/spasms).

Are the needles sterile?

Yes, we only use sterile disposable needles.

Is the procedure painful?

The fine filament needle is very thin, solid, and flexible, which allows for the needle to be pushed through the skin versus cutting the skin. This helps reduce any discomfort that may occur with the procedure. We strive to make the treatment virtually painless however at times a local twitch response of the muscle may be felt. When the needle is inserted into the pathological tissue the local twitch response sensation is normal and is felt only momentarily. Many patients describe this twitch response as a little electric shock, cramp or an ache sensation. These sensations are perfectly normal and even a desirable response. Your PT will make every effort to make your experience comfortable and therapeutic.

How will I feel after the Dry Needling treatment?

This will vary but many patients experience immediate relief of their symptoms and an increase in range of motion. Soreness can also be a common response from the needling but does not occur with all people. Some individuals may experience an immediate achiness or a delayed soreness the next day. The soreness, if present, will usually last 1-2 days, use of heat and light massage and movement will be beneficial. Mild bruising may occur at the needling sites and is more prevalent in certain parts of the body. Larger bruising may also occur but is rare. Application of ice on the bruise will help with the soreness and the skin discoloration will last several days but is not harmful.

It is uncommon but possible that the treatment may temporarily increase your symptoms. This is not unusual but if this continues past the 1-2 day window, inform your PT to allow adjustment of your program to enhance your comfort the next time. This does not mean that needling will not be beneficial to your condition.

Will I continue to do exercises or receive other treatments?

Yes, your personalized physical therapy program will still integrate traditional physical therapy methods including manual therapy, therapeutic exercise, endurance training, stabilization and posture training.

How many treatments will I need?

This will depend on the category you fit in, which is determined by the state of the injury and your overall health. Remember we are attempting to cause mechanical and biochemical changes without any pharmacological means. Therefore, we are looking for a cumulative response to break the pain cycle. Your PT will be able to give you more insight after your evaluation.

What should I do to prepare for the treatment?

- Do not eat 30 minutes before the treatment
- Be well hydrated but empty your bladder prior to treatment
- Wear loose fitting clothing, shorts, or bathing suit for easy access to your painful areas

What should/can I do after treatment, what should I avoid?

Our recommendations vary depending on the amount of soreness you have and on the individual response to the treatment. Recommendations may include increasing your water intake, applying heat or ice over the area, gentle stretches and modifications of activities.

Is Dry Needling treatment covered by my insurance?

This is a Physical Therapy treatment and is NOT acupuncture therefore your coverage of Dry Needling should correspond with your Physical Therapy benefits. You can discuss this further with our administrative staff if you require more information.

Not all medical or Physical Therapy professionals are trained to perform the Integrative Dry Needling treatment technique. The physical therapists at **YOUR CLINIC** have been trained through the Integrative Dry Needling Institute.

Supplies/Vendors

The following is a basic list of supplies that you will need to begin dry needling.

- Rubber gloves/ Finger Cots
- Sharp's container
- Cotton swabs and/or cotton balls
- Alcohol swab wipes
- Electrical stimulation unit

Needling Supplies:

We have set up a direct link via the IDN site www.integrativedryneedling.com (under the resources tab) with a distribution company that can get you needling supplies. I also set up some starter kits that have recommended needle lengths/gauges and electrical stimulation units. There is a wide variety of needle manufacturers of various price points as well as different electrical stimulation units. I recommend initially starting with the following guidelines for needle selection then over time you will develop your own style and preferences.

- Half inch/13-15mm, gauge 36-38 (0.18-0.20 mm)
- One inch/25mm, gauge 32-34 (0.22-0.25mm)
- Two inch/50mm, gauge 30-32 (0.25-0.30mm)
- Three inch/75mm, gauge 28-30 (0.30-0.35 mm)
- Four inch/100mm, finest gauge available

Needle Gauges and Thicknesses			
Gauge		Thickness	
Japanese	Chinese	Millimeters	Inches
00	-	0.12	0.0047
0	-	0.14	0.0055
1	40	0.16	0.0063
2	38	0.18	0.0071
3	36	0.20	0.0079
-	34	0.22	0.0087
5	32	0.25	0.0098
8	30	0.30	0.0118
-	28	0.35	0.0137

Needle Length	
Millimeters	Inches
13	0.5
15	0.6
25	1.0
30	1.2
40	1.5
50	2.0
60	2.5
75	3.0
100	4.0
125	5.0

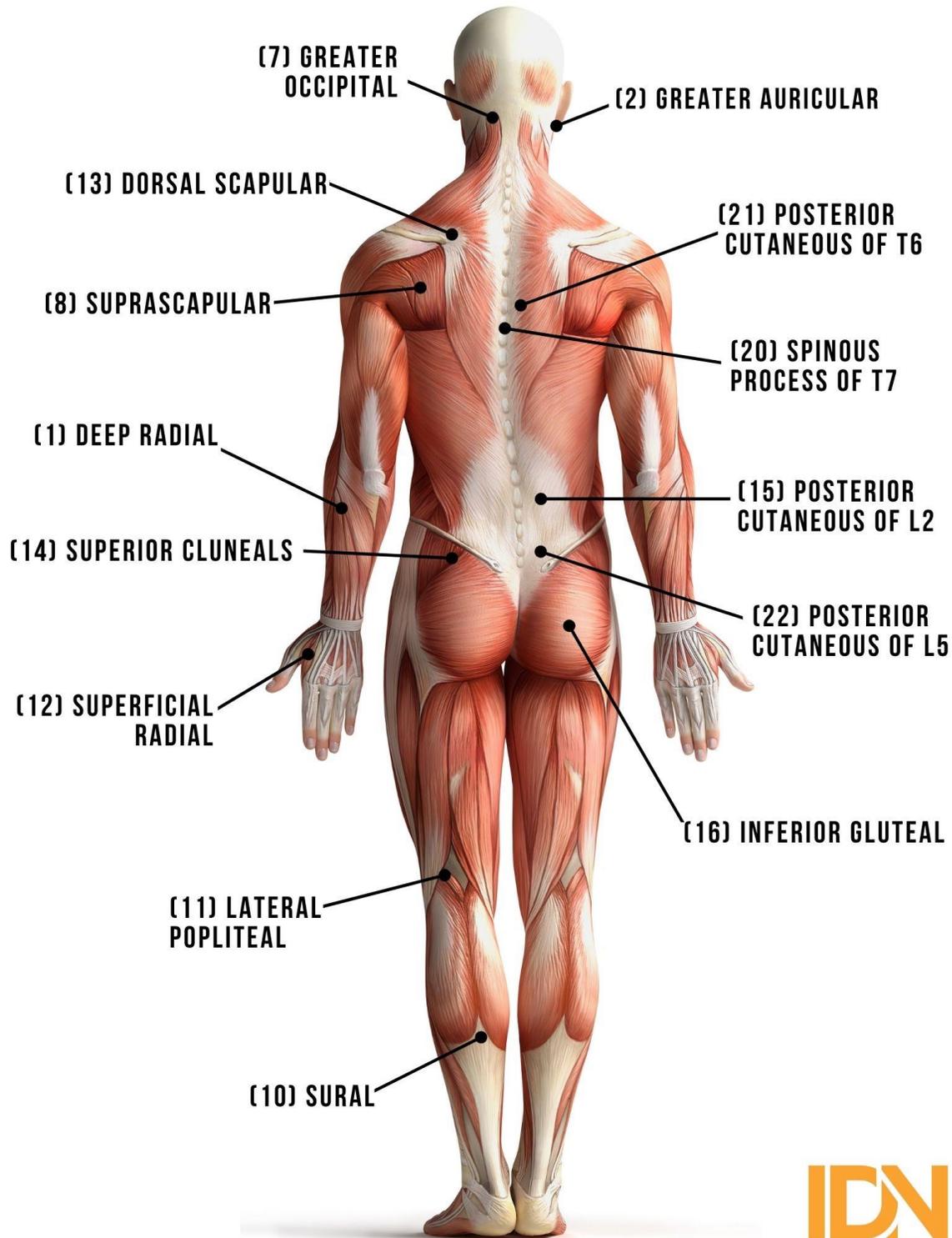
Homeostatic Neuro Trigger Points for the Upper Extremity

KEY: * In the upper extremity, the length and depth of the needle penetration is variable based on patient size and the intended therapeutic result. Different needling techniques can be safely utilized from superficial to deep (including to the depth of bone). This decision is based solely on the specific need of the patient and the therapeutic goal for the treatment.

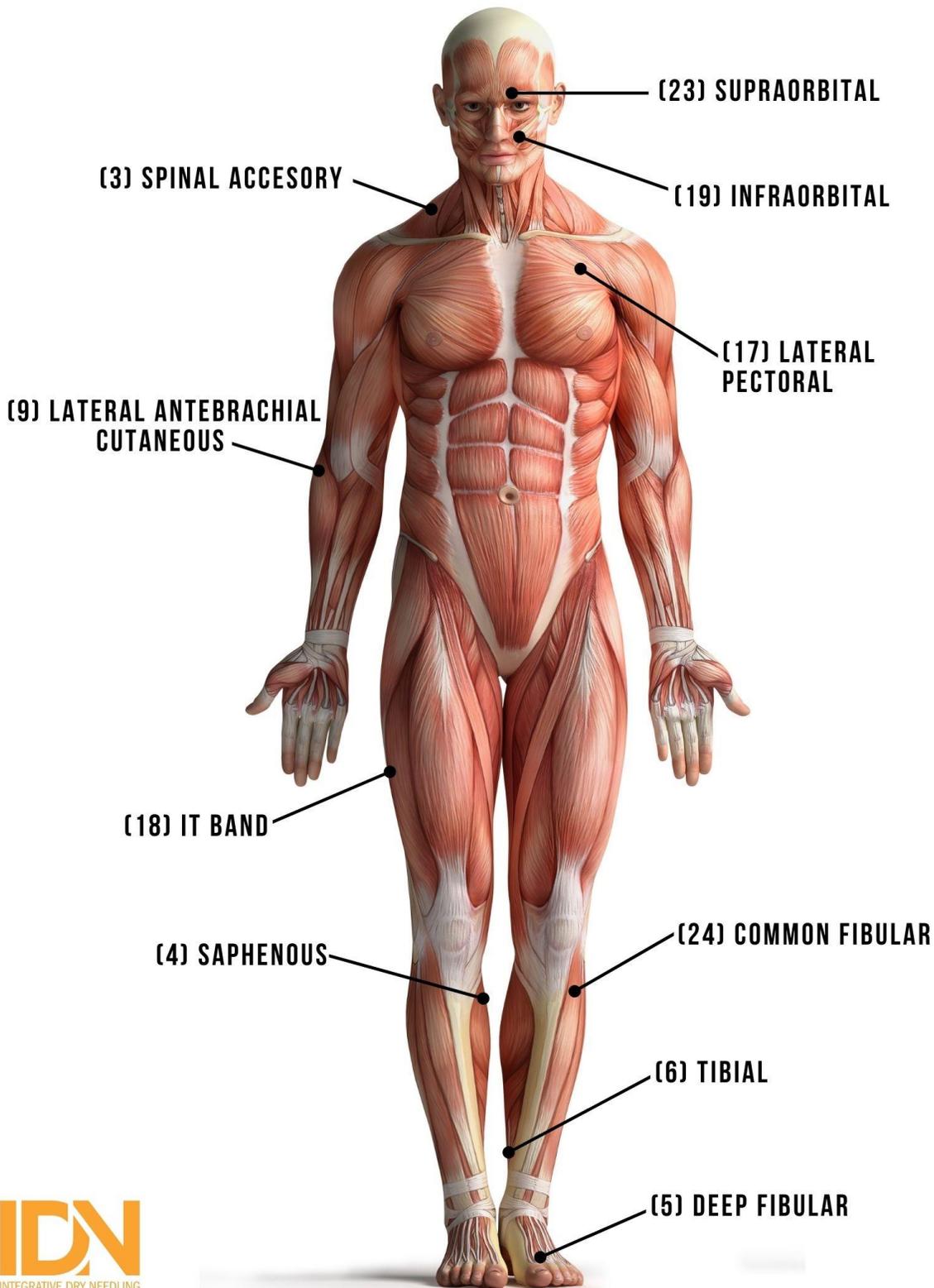
1. Deep Radial	The deep radial nerve homeostatic point is 2-finger widths distal to the lateral epicondyle in the groove under the extensor bulk.
Needle direction	Perpendicular to skin towards the radius
Needle depth	*Depth is variable dependent on patient size and clinical intent.
Special notes	Upper extremity Quantitative Analysis point.
3. Spinal Accessory	Mid-point between the acromion and 7th cervical vertebra on the anterior aspect of the upper trap
Needle length	25-50mm / 1-2 inch
Needle direction	Posterior to anterior, or anterior to posterior, slightly cephalic and always directed toward the clinician's palpating finger
Needle depth	Insert needle into muscle bulk until detected by palpating finger on opposite side
Special notes	LUNG FIELD SAFETY. Must hold muscle between thumb and fingers while needling. Needle IN/OUT +/- pistoning. Release muscle AFTER needle removed.
4. Saphenous	Located in a 'box' below the tibial plateau and on the medial side of the tibial shaft. Palpate for the most tender spot within the box.
Needle direction	Perpendicular to skin
Needle depth	*Depth is variable dependent on patient size and clinical intent.
Special notes	Lower Extremity Quantitative Analysis point.
8. Suprascapular (Infraspinatus)	Bracket the medial border and lateral border of the scapula with your thumb and middle finger; center your index finger between them. (Center of the scapular fossa)
Needle length	25-50mm / 1-2 inch
Needle direction	Perpendicular to skin
Needle depth	As deep as necessary, may go to the bone
Special notes	Care must be taken to verify that you are over the scapula and not medial to it!
9. Lateral Antebrachial Cutaneous	HNTTrP located on the lateral elbow crease medial to the extensor bulk lying over the radial head.
Needle direction	Insert the needle medial to extensor muscle bulk on the lateral aspect of the elbow crease perpendicular to the skin toward the radial head
Needle depth	*Depth is variable dependent on patient size and clinical intent.
Special notes	

12. Superficial Radial	Located between the 1 st and 2 nd metacarpals at the midpoint of the interosseous muscle bulk
Needle length	25mm / 1inch
Needle direction	Perpendicular to skin.
Needle depth	As deep as necessary, until detected by palpating finger on palmar aspect of hand.
Special notes	Use clinician's fingers to palpate palmar aspect of hand between 1 st and 2 nd MC while inserting.
13. DorsalScapular	Locate the superior angle of the scapula, the HNTrP is in the levator scapulae insertion.
Needle length	Up to 25mm / 1inch
Needle direction	The needle should be directed from the medial aspect of the superior angle of the scapula moving laterally away from the thorax, assuring the needle point is over the bony backdrop of superior angle of the scapula.
Needle depth	Assure the needle point is directed toward the bony backdrop of the superior angle of the scapula. It is also acceptable to grasp the soft tissue and lift away from the thorax and needle as described above.
Special notes	LUNG FIELD SAFETY. Needle IN/OUT and verify that you are needling from medial to lateral toward the superior angle of the scapula.
17. Lateral Pectoral	HNTrP is located 2 finger widths inferior and perpendicular to the center of the clavicle (anatomical point only-not directly needled, instead use the innervation field)
Needle length	50mm / 2inch
Needle direction	Medial to lateral direction targeting the <u>lateral third of the pectoralis major</u> aiming the needle tip toward the clinician's palpating fingers.
Needle depth	Until the tip of the needle is detected by the palpating fingers under pectoralis major. It is <u>not</u> necessary to needle the anatomical point of the lateral pectoral homeostatic point.
Special notes	LUNG FIELD SAFETY. Must hold pectoralis muscle between thumb and fingers while needling, always identify the rib cage and needle parallel, never perpendicular, to it. Needle IN/OUT +/- pistoning. Release muscle hold AFTER needle is removed. Care must be taken when IMPLANTED DEVICES (tissue or other device) are present and may be prudent not to perform dry needling.

HOMEOSTATIC NEUROTRIGGER POINTS



HOMEOSTATIC NEUROTRIGGER POINTS



The Five Important Nerves in the Arm

Nerve	Motor Function
Radial nerve	Extension of entire arm, forearm, wrist, and finger joints below the shoulder Forearm supination Thumb abduction in plane of the palm
Median nerve	Thumb flexion and opposition Flexion of digits 2 and 3 Wrist flexion and abduction Forearm pronation
Ulnar nerve	Finger adduction and abduction other than the thumb Thumb adduction Flexion of digits 4 and 5 Wrist flexion and adduction
Axillary nerve	Abduction of arm at shoulder beyond the first 15 degrees
Musculocutaneous nerve	Flexion of arm at elbow Supination of forearm

Summary of Upper Extremity Peripheral Nerve, Muscles and, Nerve Roots.

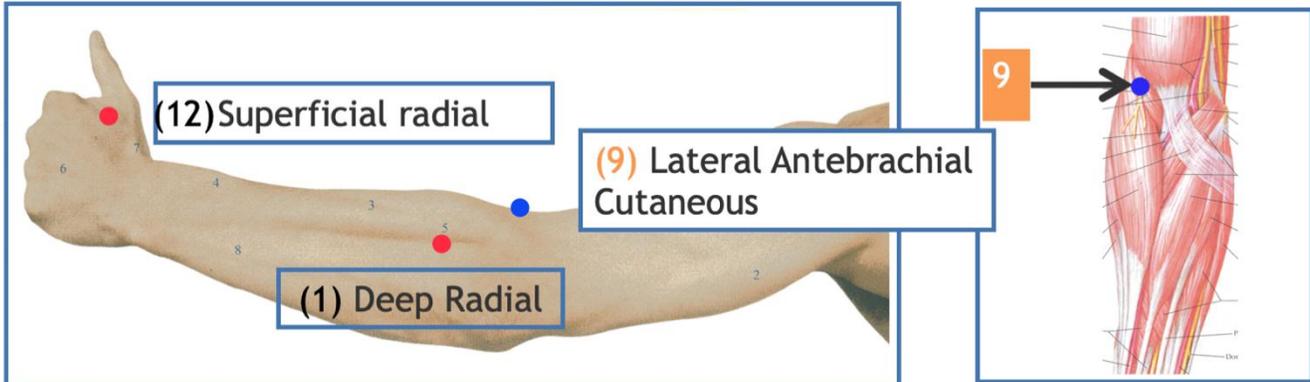
Nerve	Muscle Innervated	Function of the Muscle	Origin of Nerve
Spinal accessory nerve	Trapezius, Sternocleidomastoid	Elevates shoulder and arm; fixes scapula	XI, C3, C4
Phrenic nerve	Diaphragm	Inspiration	C3, C4, C5
Dorsal scapular nerve	Rhomboid	Draws scapula up and in	C4, C5 , C6
	Levator scapulae	Elevates scapula	C3, C4, C5
Long thoracic nerve	Serratus anterior	Fixes scapula on arm raise	C5, C6, C7
Lateral pectoral nerve	Pectoralis major (clavicular head)	Pulls shoulder forward	C5, C6
Medial pectoral nerve	Pectoralis major (sternal head)	Adducts and medially rotates arm	C6, C7, C8, T1
	Pectoralis minor	Depresses scapula and pulls shoulder forward	C6, C7, C8
Suprascapular nerve	Supraspinatus	Abducts humerus from 0° to 15°	C5, C6
	Infraspinatus	Externally rotates humerus	C5, C6
Subscapular nerve	Subscapularis	Internally rotates humerus	C5 , C6
	Teres major	Adducts and internally rotates humerus	C5, C6
Thoracodorsal nerve	Latissimus dorsi	Adducts and internally rotates humerus	C6, C7, C8
Axillary nerve	Teres minor	Adducts and externally rotates humerus	C5, C6
	Deltoid	Abducts humerus beyond 15°	C5 , C6
Musculocutaneous nerve	Biceps brachii	Flexes and supinates arm and forearm	C5, C6
	Brachialis	Flexes forearm	C5, C6

Nerve	Muscle Innervated	Function of the Muscle	Origin of Nerve
Radial nerve	Triceps	Extends forearm	C6, C7 , C8
	Brachioradialis	Flexes forearm	C5, C6
	Extensor carpi radialis (longus and brevis)	Extend wrist; Radial deviation of hand	C5, C6
Posterior interosseus nerve (branch of radial nerve)	Supinator	Supinates forearm	C6, C7
	Extensor carpi ulnaris	Extends wrist; adducts hand	C7 , C8
	Extensor digitorum (communis)	Extends digits	C7 , C8
	Extensor digiti quinti	Extends digit 5	C7 , C8
	Abductor pollicis longus	Abducts thumb in plane of palm	C7 , C8
	Extensor pollicis (longus and brevis)	Extends thumb	C7 , C8
	Extensor indicis proprius	Extends digit 2	C7 , C8
Median nerve	Pronator teres	Pronates and flexes forearm	C6, C7
	Flexor carpi radialis	Flexes wrist; Radial deviation of hand	C6, C7
	Palmaris longus	Flexes wrist	C7, C8 , T1
	Flexor digitorum superficialis	Flexes MCP & proximal IP joints	C7, C8 , T1
	Lumbrical (I, II)	Digits 2 & 3, flex MCP extends other joints	C8, T1
	Opponens pollicis	Flexes and opposes thumb	C8, T1
	Abductor pollicis brevis	Abducts thumb perpendicular to plane of palm	C8, T1
	Flexor pollicis brevis (superficial head)	Flexes first phalanx of thumb	C8, T1
Anterior interosseous nerve (branch of median nerve)	Flex dig Profundus (digits 2 and 3)	Flexes digits 2 and 3	C7, C8
	Flexor pollicis longus	Flexes distal phalanx of thumb	C7, C8
	Pronator quadratus	Pronates forearm	C7, C8

Nerve	Muscle Innervated	Function of the Muscle	Origin of Nerve	
Ulnar nerve	Flexor carpi ulnaris	Flexes wrist; Ulnar deviation of hand	C7, C8, T1	
	Flexor digitorum profundus (digits 4 &5)	Flexes digits 4 & 5	C7, C8	
	Lumbrical (III, IV)	For digits 4 & 5, flex MCP joints; extend other joints	C8, T1	
	Palmar interossei	Adduct fingers; flex MCP joints; extend other joints	C8, T1	
	Dorsal interossei	Abduct fingers; flex MCP joints; extend other joints	C8, T1	
	Flexor pollicis brevis (deep head)	Flexes & adducts thumb	C8, T1	
	Adductor pollicis	Adducts thumb	C8, T1	
	Muscles of Hypothenar Eminence			
	Opponens digiti brevis	Internally rotates digit 5	C8, T1	
	Abductor digiti minimi	Abducts digit 5	C8, T1	
	Flexor digiti minimi	Flexes digit 5 at MCP joint	C8, T1	

Upper Extremity Homeostatic Needling

In the upper extremity, you can use any length of needle required (dependent on the size of the patient). You must follow the rule of angling the needlepoint perpendicular to the skin toward a bone or toward your fingers, so you always know where the needle point is going.



The Deep Radial Nerve Homeostatic Point (#1) Needle Technique

- To identify the extensor bulk (brachioradialis, ECRL, ECRB) use a pincer grip between your thumb and index finger.
- Identify the lateral epicondyle.
- The deep radial nerve homeostatic point is 2-finger widths distal to the lateral epicondyle in the groove next to the extensor bulk.
- Needle is inserted perpendicular to the skin toward the radius. 



The Superficial Radial Nerve Homeostatic Point (#12)

Needle Technique

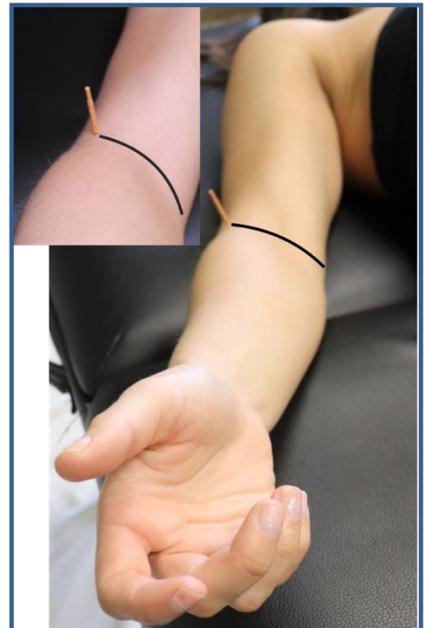
- Located between the 1st & 2nd metacarpals.
- Adduct the thumb and the homeostatic neurotrigger point is at the apex of the muscle bulk (Adductor Pollicus and First Dorsal Interossei muscles).
- Insert the needle perpendicular to the skin toward your finger on the palmer surface.
- Palpate for the needle to push against the soft tissue and stop advancing the needle to assure that the needle does not penetrate into the palm.



The Lateral Antebrachial Cutaneous Nerve Homeostatic Point (#9)

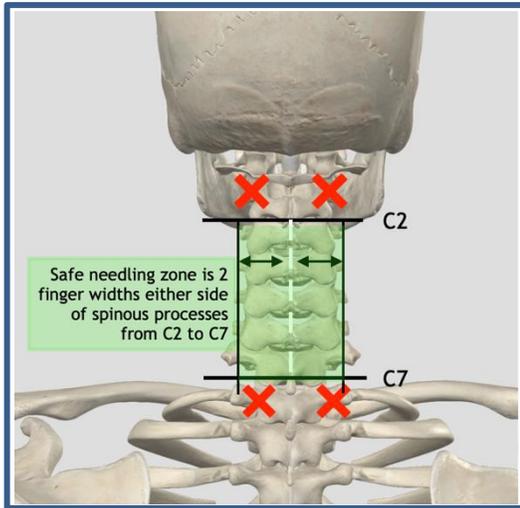
Needle Technique

- A branch of the musculocutaneous nerve that provides sensation to the lateral forearm.
- The homeostatic point is located at the lateral aspect of the cubital crease that is formed when the patient fully bends their elbow
- Place the patient's elbow in slight flexion
- The needle is inserted on the lateral aspect of the cubital crease, medial to the extensor bulk, perpendicular to the skin in a posterior to medial direction towards the radial head.



Cervical Needling Considerations

In this course we only needle below the C2 level and above C7 so it is important to accurately identify the landmarks



C2 spinous process is the first spinous process encountered when moving inferiorly from the occiput - Mark a horizontal line

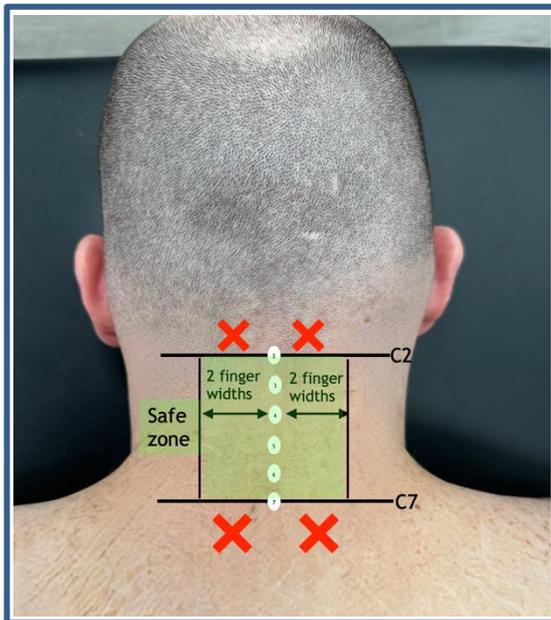
Make a dotted line down the center of the spinous processes - Mark a vertical line 2-fingers widths (*patient's fingers*) from the lateral side of the spinous process.

C7 spinous process is the most prominent spinous process of the cervical spine. Mark with a horizontal line.

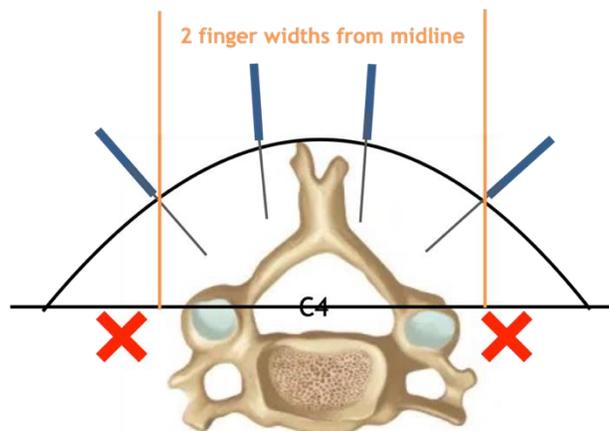
** Need to take great care when needling near C7 secondary to the lung field.

Needle Technique

- Always set the needle perpendicular to the skin within 2-finger widths from the cervical spinous process into symptomatic paravertebral muscles.
- You can insert 25mm up to 50mm needles within the safe zone patient size dependent.



Never push the needle with excessive force in the cervical spine

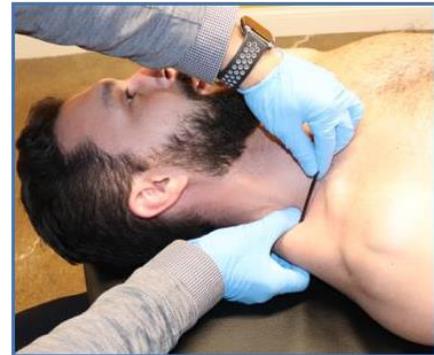


Always insert the needle perpendicular to the skin toward the vertebra

Care must be taken with cervical laminectomies and other surgical procedures that compromise the bony structure of the vertebral column. Treatment is modified by performing superficial needling to the involved segment(s) or choose to needle above and below the involved segments.

Spinal Accessory Homeostatic (#3) – Upper Trapezius muscle Needle Technique

- May be needed in multiple positions and in most patients, there are a considerable number of symptomatic points around it.
- The obvious concern is the apex of the lung in the supraclavicular region.
- To reduce risk, use a pincer grasp of the UT between your thumb and fingers.
- Always locate your fingers above the supraclavicular space so that you are constantly aware of the location of the apex of the lung.
- The needle is always directed toward your fingers and away from the lungs.
- The length of the needle is dependent on patient size (25 mm up to 50 mm is a reasonable guideline).



Lung Field Safety

Care must be taken in these areas because of the potential risk of lung puncture!

Dorsal Scapular Nerve Homeostatic Point(#13) – Levator Scapulae & Rhomboid muscles



Needle Technique

- Use up to a 1” needle directed from the medial aspect of the superior angle of the scapula moving laterally or superiorly away from the thorax.
- Care must be taken to assure the needle point is over the bony backdrop of superior angle of the scapula. You can position the patient’s arm behind their back to assist in identifying the superior angle of the scapula.
- It is also acceptable to grasp the soft tissue and lift away from the thorax and needle as described above. Needle manipulation and ENS can be beneficial.

Shoulder Girdle Needling

Dry needling for Subacromial Pain Syndrome (SAPS) - The addition of DN with other conservative treatments provided moderate to large effect sizes for pain in both the short and long-term. (Griswold 2022)

Suprascapular nerve homeostatic point (8) – Infraspinatus muscle

Suprascapular nerve provides motor innervation to supra and infraspinatus muscles and the majority of the innervation of the anterior and superior-posterior aspects of the glenohumeral joint (Wu et.al 2021).

Needle Technique

- Using your thumb and middle finger outline the medial and lateral boarder of the scapula.
- Care must be taken to assure that you outline the borders of the scapula so that the needle is inserted directly over the boney backdrop of the scapula and not too far medially where the lungs could be at risk.
- Insert a 50mm/2” needle perpendicular to the skin directly over the infraspinatus fossa that provides a boney backdrop.
- Needle manipulation, rotation, and ENS can be used effectively here.



Suprascapular Nerve - Supra & Infraspinatus muscles

Refer to images on next page

#1. Needle directly into the supraspinatus muscle belly located in the bony supraspinatus fossa.

- Identify the spine of the scapula and deliver a 25-50mm needle inferiorly toward the boney backdrop of the supraspinatus fossa.

Care must be taken to assure that you are in the supraspinatus fossa when needling the symptomatic point because the lung is directly below this region.

#2. To needle the musculotendinous junction that is below the medial acromion:

- Patient is seated supported in a chair with the arm in slight abduction to reduce tension in the supraspinatus.
- Apply inferior pressure to the distal end of the guide tube to lower the entry point of the needle to get under the acromion.
- The angle of needle entry should be adjusted so the needle point reaches musculotendinous tissue under the acromion.

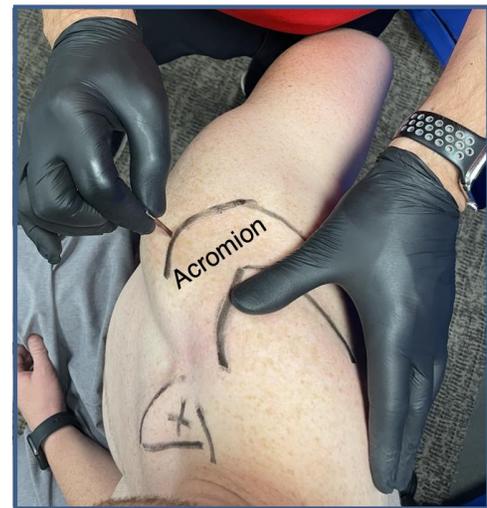
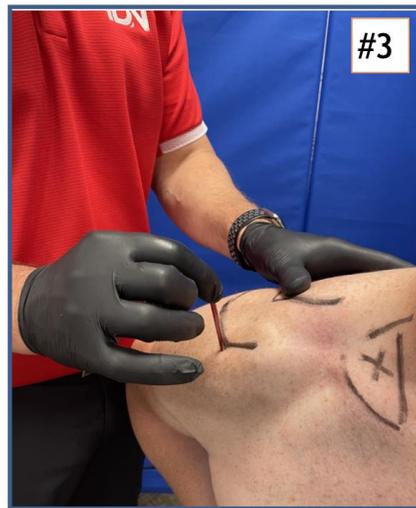


#3. Sub-acromial tendon needling:

- Patient is sitting supported in a chair in a modified Crass position to better expose the greater tubercle of the humerus.
- Palpate just off the anterolateral acromion for the supraspinatus tendon insertion on the greater tubercle.
- The needle is angled toward the tendon as it inserts on to the greater tubercle, the end feel of a tendon is a “rubbery” or “sticky” feel in contrast to a hard end-feel when contacting bone.
- Repeated insertions (fenestrations) into the tendon is indicated to maximize benefit.
- Evidence suggests that local tendon needling (with or without US guidance) improves patient-reported outcome measures in patients with various locations of tendinopathy. Few studies report benefit of medication injection over dry needling alone (Stoychev, 2020; Krey 2015).



Modified Crass Position

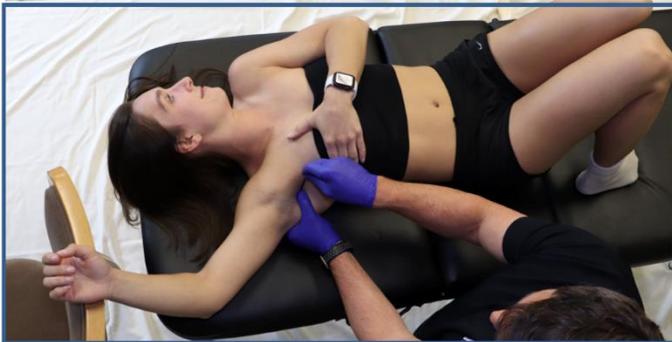


3. Angle needle toward the tendon as it inserts onto the greater tubercle- perform multiple insertions (rubbery type end feel)

Subscapularis muscle (axilla approach)

Needle Technique

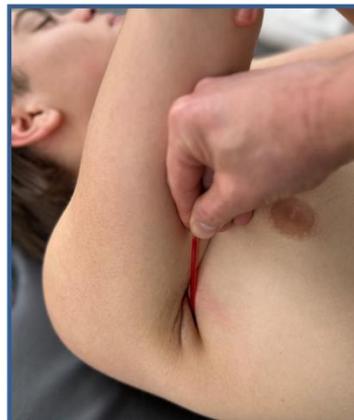
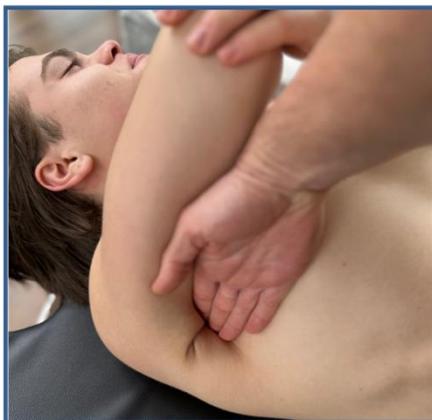
- Patient positioned in supine with the arm abducted with some external rotation to patient tolerance, which promotes scapular protraction to gain better access to the subscapularis.
- Using a pincer grasp (between thumb & index finger) identify the subscapularis muscle by instructing the patient to actively internally rotate the humerus.
- Needling the subscapularis can be technically difficult especially with large chested males or females; have the patient assist by moving the chest tissue medially.
- The needle is directed inferiorly toward the treatment table to avoid the thorax – the backdrop will either be the scapula or your fingers that monitor to assure the needle does not penetrate through the posterior skin.
- Hold the subscapularis with the pincer grasp and perform any desired needle manipulations, then remove the needle before you release the subscapularis.
- Needle length is dependent on patient size.



Subscapularis (Protracted Scapular approach)

Needle Technique

- Patient in supine, arm positioned in horizontal adduction across the chest to bring the scapula into maximum protraction exposing the subscapularis.
- Palpate deep to the anterior scapula to confirm proper location (figure 1).
- Position the needle perpendicular to the table to assure you are parallel to the thorax.
- Advance the needle slowly until the boney backdrop of the anterior surface of the scapula is reached (figure 2)
- Needle length is dependent on patient size- light needle manipulation can be performed.



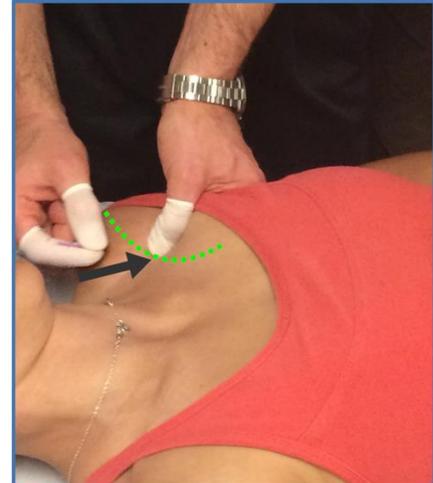
Lateral Pectoral Homeostatic Point (17) – pectoralis major muscle

There is a greater risk of pneumothorax when performing perpendicular needle insertions over the rib cage, therefore we strongly recommend against it.

TO MINIMIZE THE RISK, WE USE A HORIZONTAL INSERTION (PARALLEL TO THE CHEST WALL).

Needle Technique

- Place the back of your bent index finger up against the lateral ribcage.
- Use your thumb to pinch the pectoralis muscle bulk to identify the symptomatic areas.
- For large chested males or females; have the patient assist by moving the chest tissue medially.
- Using a 25-50mm/1-2" needle, angle it so that the needle point is always moving medial to lateral toward your index finger- away from the thorax!
- The target zone for the needling is the lateral third of the pectoralis - it is not necessary to needle the anatomical lateral pectoral homeostatic point.
- Light needle manipulation may be performed once in the region be certain to remove the needle before releasing your grip on the pectoralis muscle.



Latissimus Dorsi muscle (posterior inferior shoulder)

Needle Technique

- The patient can be positioned in prone, side lying or supine.
- Using a pincer grasp (between thumb & index finger) identify the latissimus muscle.
- Gently pull the latissimus away from the rib cage.
- The needle is inserted parallel to the rib cage toward the practitioner's index finger i.e. away from the thorax.
- This technique can also be used to address neuro-trigger points further superiorly into the posterior shoulder (Teres Major and Teres Minor).
- Needle length dependent on patient size.



Brachial Plexus Distribution

Posterior cord gives Post-axial nerves:

- Radial nerve-C5-8 (T1)
- Axillary nerve-C5-6

Lateral & medial cords give Pre-axial nerves:

- Musculocutaneous nerve- C5-7
- Median nerve- (C5) C6-T1
- Ulnar nerve- (C7) C8-T1

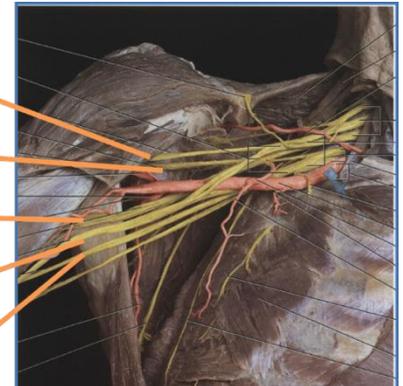
Musculocutaneous

Axillary

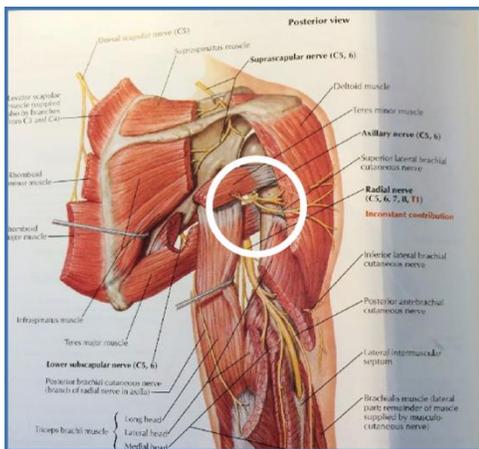
Radial

Median

Ulnar



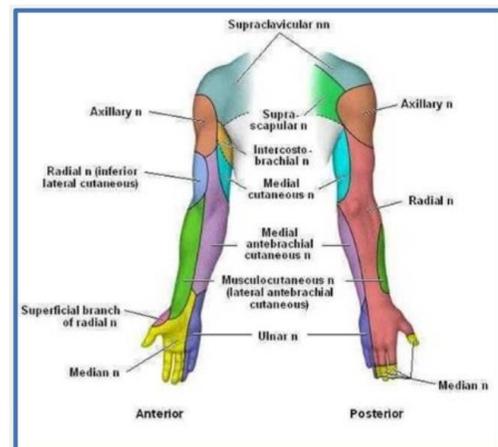
Axillary Nerve Needling



Axillary nerve emergent point



Axillary nerve distribution and Needling points



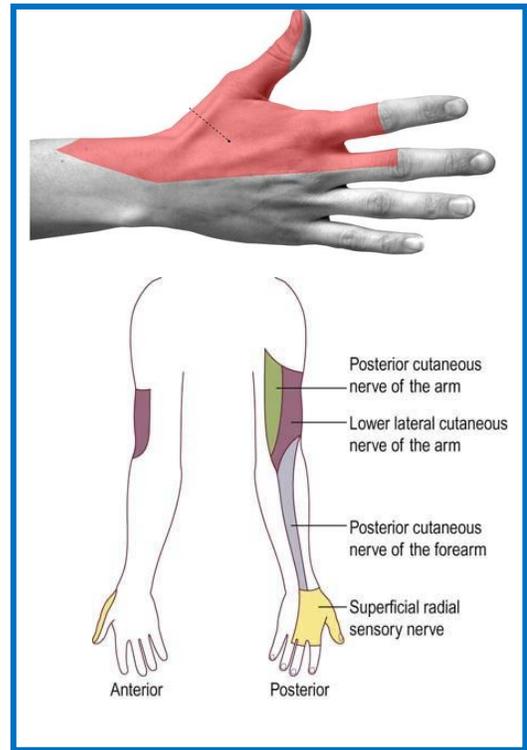
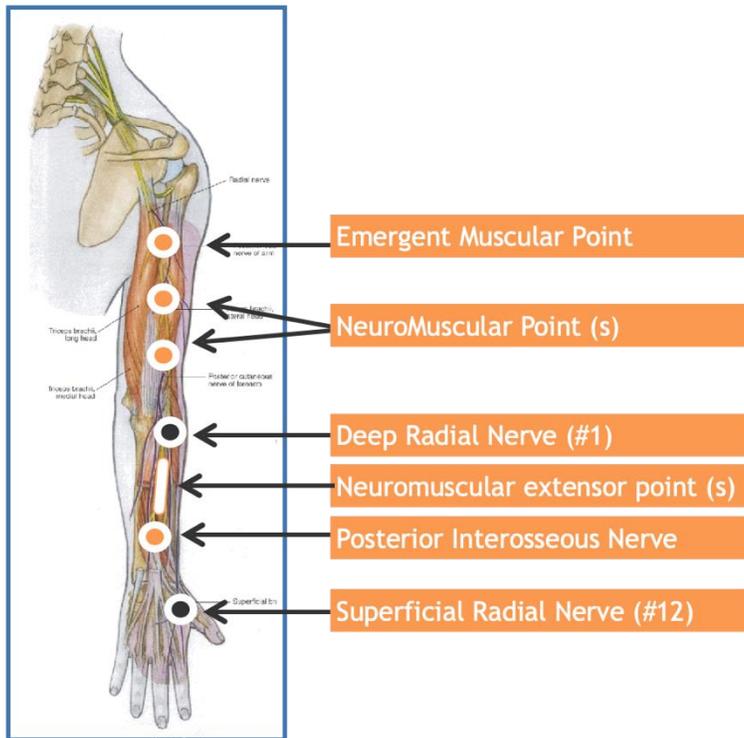
The Axillary nerve emergent point

This point is located in the quadrangular space (Subscapularis/Teres Minor superiorly, Teres Major inferiorly, long head of Triceps Brachii medially, and surgical neck of the humerus laterally).

Needle Technique

- Needle perpendicular to the skin directly into the quadrangular region and overlying soft tissue when symptomatic.
- This is the emergent point and will address the entire distribution of the axillary nerve.
- The location of the axillary nerve point is just lateral to the suprascapular homeostatic point (Infraspinatus) medial to the humerus.
- Needle all branches of the Axillary Nerve in the Deltoid muscle (an example of needle distribution is provided above but different locations and number of needles can be used depending on presentation).
- Always direct the needles perpendicular to the skin so the needle is toward the boney backdrop of the humerus.
- The only caution is the cephalic vein running on the anterior shoulder between the anterior deltoid and the pectoralis major.

Radial Nerve Needling



The Radial nerve emergent point

At the shoulder, the Radial nerve emergent point is deep to the long head of the triceps and inferior to the teres major. The radial nerve then travels in between the triceps before moving laterally toward the elbow.

At the elbow the Radial nerve can be needled by inserting a needle lateral to the insertion of the bicep tendon and medial to the brachioradialis in the cubital crease of the elbow and advancing the needle in a slightly lateral direction toward the radio-humeral joint.

The Deep Radial Nerve Homeostatic Point (#1)

Needle Technique

- To identify the extensor bulk (brachioradialis, ECRL, ECRB) use a pincer grip between your thumb and index finger.
- Identify the lateral epicondyle.
- The deep radial nerve homeostatic point is 2-finger widths distal to the lateral epicondyle in the groove next to the extensor bulk.
- The needle is inserted perpendicular to the skin toward the radius slowly, noting the neurovascular bundle is also in this region.

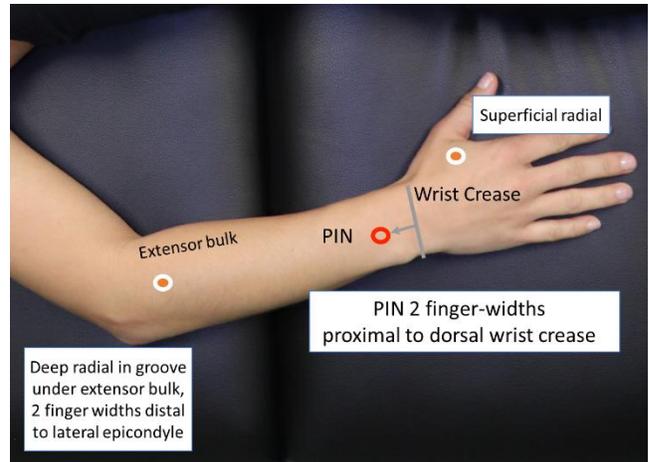


The Posterior Interosseus nerve (PIN)

The PIN is located between the radius and ulna 2 finger widths above the wrist crease. This nerve can be entrapped proximally as it branches off of the deep radial nerve at the *Arcade of Frohse* sometimes called the supinator arch. It is believed this entrapment may play a role in causing progressive paralysis of the PIN, both with and without injury. Sensory loss will not be present because the PIN is a purely motor nerve.

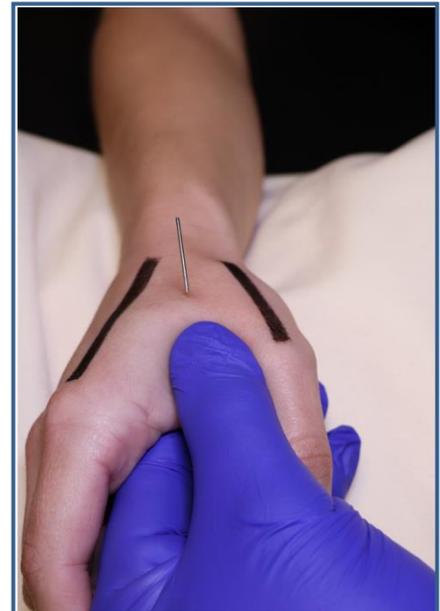
Needle Technique

- Insert a 30mm needle perpendicular to the skin two finger widths above the dorsal wrist crease between the distal radius and ulna.
- Needle rotation works particularly well here as does ENS.



The Superficial Radial Nerve Homeostatic Point (#12)

- The superficial radial nerve needling point is located between the 1st & 2nd metacarpals.
- Adduct the thumb and the homeostatic neurotrigger point is at the apex of the muscle bulk (Adductor Pollicis and First Dorsal Interosseus muscles).
- Insert the needle perpendicular to the skin toward your finger on the palmar surface.
- Palpate for the needle to push against the soft tissue and stop advancing the needle to assure that the needle does not penetrate into the palm



Lateral epicondylalgia (tennis elbow)

Lateral epicondylalgia is probably the most common cause of pain in the lateral aspect of the elbow with a point prevalence ranging from 1% to 3% in the general population. (Navarro-Santana 2020) There are many etiologies of lateral elbow pain that are a combination of local, distal, referred and systemic conditions, which is why resolving pain in the lateral elbow can be challenging.

Potential causes of lateral elbow pain

1. Humeral-radial bursitis, capsulitis, synovitis
2. Annular ligament
3. Osteoarthritis
4. Blunt trauma (fracture, bone bruising)
5. Inflammation (soft tissue, neurogenic)
6. Neuro-trigger points in the forearm extensor muscles
7. Supinator muscle neuro-trigger points (Fernandez et al., 2021)
8. Tendinitis-Tendinosis-Tendinopathy of the Extensor Carpi Radialis Brevis
9. Periosteal/enthesis inflammation of the lateral epicondyle (Epicondylitis, -osis-algia)
10. Radio-ulnar capsulitis, synovitis
11. Humeral-radial bursitis, capsulitis, synovitis
12. Annular ligament
13. Radial (deep) neurogenic inflammation
14. Radial tunnel syndrome - Entrapment of the posterior interosseus nerve in the Arcade of Frohse (supinator arch) (Fernandez et al. 2021))
15. Lateral antebrachial cutaneous sensory nerve (Musculocutaneous nerve)
16. Posterior antebrachial cutaneous sensory nerve (Radial nerve)
17. Superficial radial sensory nerve (distal referral)
18. C6-C7 segmental referral
19. Suprascapular nerve referral (Travell's supra/infraspinatus trigger point pattern, 1983)

The traditional methods of lateral elbow pain treatment typically include activity modification, bracing, modalities, cross friction, manual therapy, eccentric loading, stretching and home program follow ups (Wymore, 2018). If these fail to resolve the condition, dry needling (DN) may offer a viable alternative (Wymore, 2018). Additional medical interventions, such as cortisone, and PRP injections can be performed. Interestingly, the research on the clinical outcomes of the medical interventions compared to DN treatment is encouragingly favorable towards dry needling.

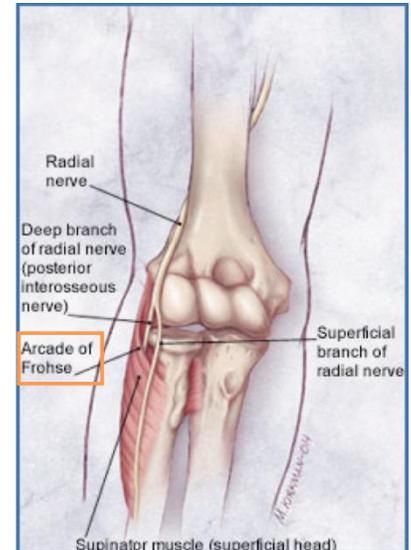
There is moderate evidence to suggest that a variety of DN procedures alone and in conjunction with other therapies reduces pain and improves function in individuals with LET (Lucado, 2022). Percutaneous tendon DN was compared to cortisone injection (CS) and PRP application for lateral epicondylitis (Gungor, 2021, Uyger 2021). DN was found to be as effective to CS and PRP application at 3 weeks and 3 months (Gungor, 2021). Uyger (2021) used the Patient Rated Tennis Elbow Evaluation scores to show that the DN-treated patients indicated significantly greater improvement than the CS-treated patients at both day 20 and month 6. In both studies only one CS injection was performed, and the number of DN treatments performed was 3 and 5 respectively. Consideration on the possible complications that can occur with CS injection include tendon degeneration, compromised healing, skin atrophy and pigment loss (Uyger, 2021). DN does not produce these physiologic complications but discomfort experienced during DN "pistoning" treatment can be a limiting factor so technique modification can be made using the neurologic dry needling model.

From a functional perspective, a meta-analysis by Navarro-Santana (2020) found low to moderate evidence suggesting a positive short-term effect of dry needling for pain and related disability in lateral epicondylalgia of musculoskeletal origin. They also demonstrated low to moderate evidence supporting a short-term positive effect of dry needling on pressure pain sensitivity and strength in individuals with lateral epicondylalgia of musculoskeletal origin. These findings provide a basis for the clinical use of DN to reduce pain and improve upper extremity function.

Lateral elbow pain has a multifactorial etiology with significant negative consequences on the function of the involved extremity. DN, compared to traditional care and medical care, is a viable adjunct and possibly a better alternative to safely manage the pain and disability suffered by patients.

Radial Tunnel Syndrome

When the Deep Radial Nerve passes through deep and superficial heads of the supinator muscle it is renamed the Posterior Interosseus Nerve (PIN). The PIN can become entrapped in the supinator arch (*Arcade of Frohse*) creating symptoms similar to lateral epicondylalgia e.g., deep aching in the lateral elbow and radiating into the lateral forearm, pain tends to increase with resisted supination and wrist extension. Weakness of wrist extension can occur with progressive compression of the PIN. DN treatment consists of needling the supinator muscle to release the entrapment of the PIN. In addition, always assess the entire radial nerve distribution proximally to the cervical paravertebrals (C5-7) and distally to the thumb.

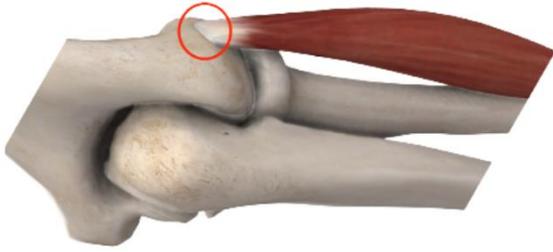


Needle technique

- Patient's pronated forearm resting on a table.
- Locate the lateral epicondyle and move 4 cm distally down the radius, (Fernandez-de-las-Penas, 2021) palpate and have the patient supinate the forearm to confirm you are on the supinator muscle.
- Note: The supinator is just inferior to the groove/deep radial nerve point ■ below the radial head.
- Insert a 30mm+ needle perpendicular to the skin toward the radius, you will first encounter the extensor muscle bulk then the supinator muscle and end at the radius.
- Needle slowly as the Posterior Interosseus Nerve (PIN) and Superficial Radial Nerve travel through or on top of the supinator muscle as they track inferiorly.
- Adding low frequency ENS to produce muscle contraction improves circulation, muscle oxygenation and reduces tone (Kimura 2015).



Periosteal and Enthesis considerations



Epicondylalgia's (medial, lateral or both) of the elbow pain can be a very difficult impairment to treat, this is especially true in chronic cases. Understanding the multitude of potential causes listed above for elbow pain (lateral), I want to focus on the periosteum specifically periosteal inflammation (periostitis).

The periosteum is a layer of connective tissue that surrounds bone and can become inflamed from repeated stress on the involved structures that anchor into bone.

○ The enthesis is where a tendon, ligament, capsule or fascia transition into bone. Under non-pathological condition the periosteum/enthesis has a hard or boney feel when a needle is placed in the region however, an inflamed or pathological periosteum/enthesis has a soft almost spongy texture. This is one possibility that is overlooked in chronic conditions because before dry needling treatment it was very difficult to create a focused lesion to produce acute microtrauma to improve circulation and stimulate healing of this region. The term “periosteal pecking” was coined to describe the process of taking a short needle and inserting or fenestrating the periosteal/enthesis area on the condyle. Depending on the area and the patient's tolerance, 15-20+ insertions are a good baseline to promote healing.

Use of a diagnostic US would provide a clear view of the area to allow a precise targeting of the pathological tissue.

ENS with the needle touching into the periosteum and a low frequency of 1-2 Hz empirically helps to reduce pain and maximizes the needling treatment effect.

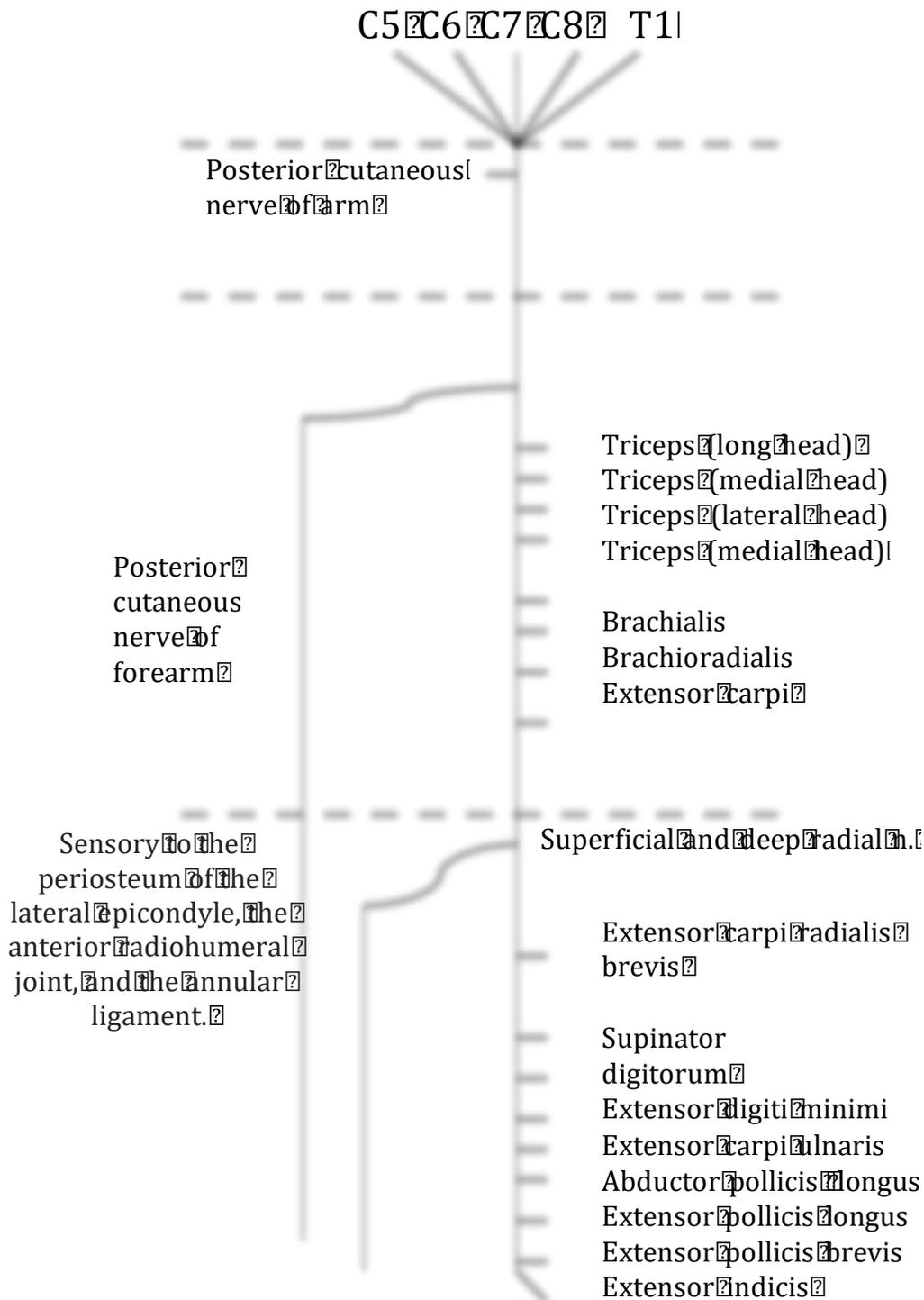
Electrical Nerve Stimulation

In cases of radiculopathy or referred arm pain; needle into the corresponding paravertebral cervical segments and into the distal region of the involved nerve.

In this example, needling and ENS is being performed down the radial nerve distribution.



Radial Nerve Distribution



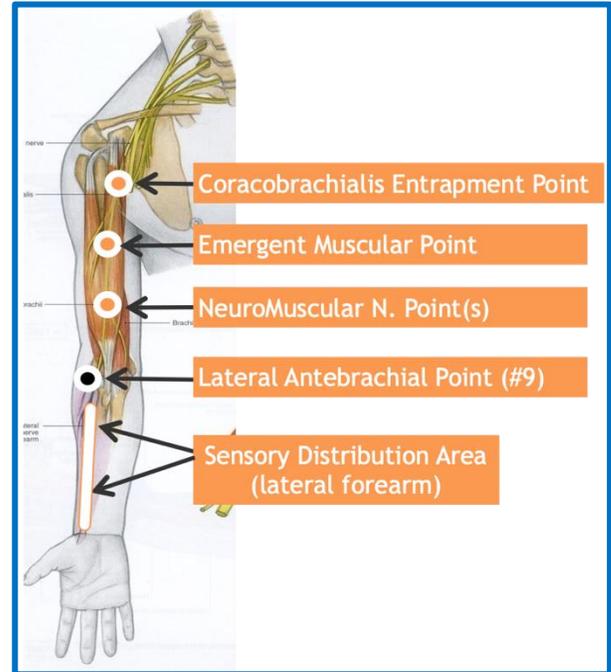
Musculocutaneous Nerve

The arrows are the major points:

- **Point #1** is a potential entrapment area as it passes through the coracobrachialis then obliquely travels down to emerge between the bicep muscles and comes anterior on the brachialis as **point #2**.
- **Point #3** is mid-brachial to lower 3rd of biceps.
- **Point #4** is the Lateral Antebrachial Cutaneous (Homeostatic point# 9).

Sensory distribution is down the radial side to the wrist, not into the hand.

The nerve is on the surface of the brachioradialis so emphasize needling in the nerve innervation field.



Coracobrachialis entrapment point

The Coracobrachialis attaches on coracoid process and inserts on medial 1/3 of humerus.

Needle technique

- Patient is supine with the arm abducted and externally rotated.
- To discern coracobrachialis from the short head of bicep and long head of triceps instruct the patient to flex then extend the elbow-the coracobrachialis is located between them.
- Palpate in the space between the bicep and triceps and instruct the patient to adduct the humerus to contract the coracobrachialis to confirm your palpation.
- Needle perpendicular to the humerus with care to avoid the neurovascular structures present in this region.



Electrical Nerve Stimulation is indicated in this region



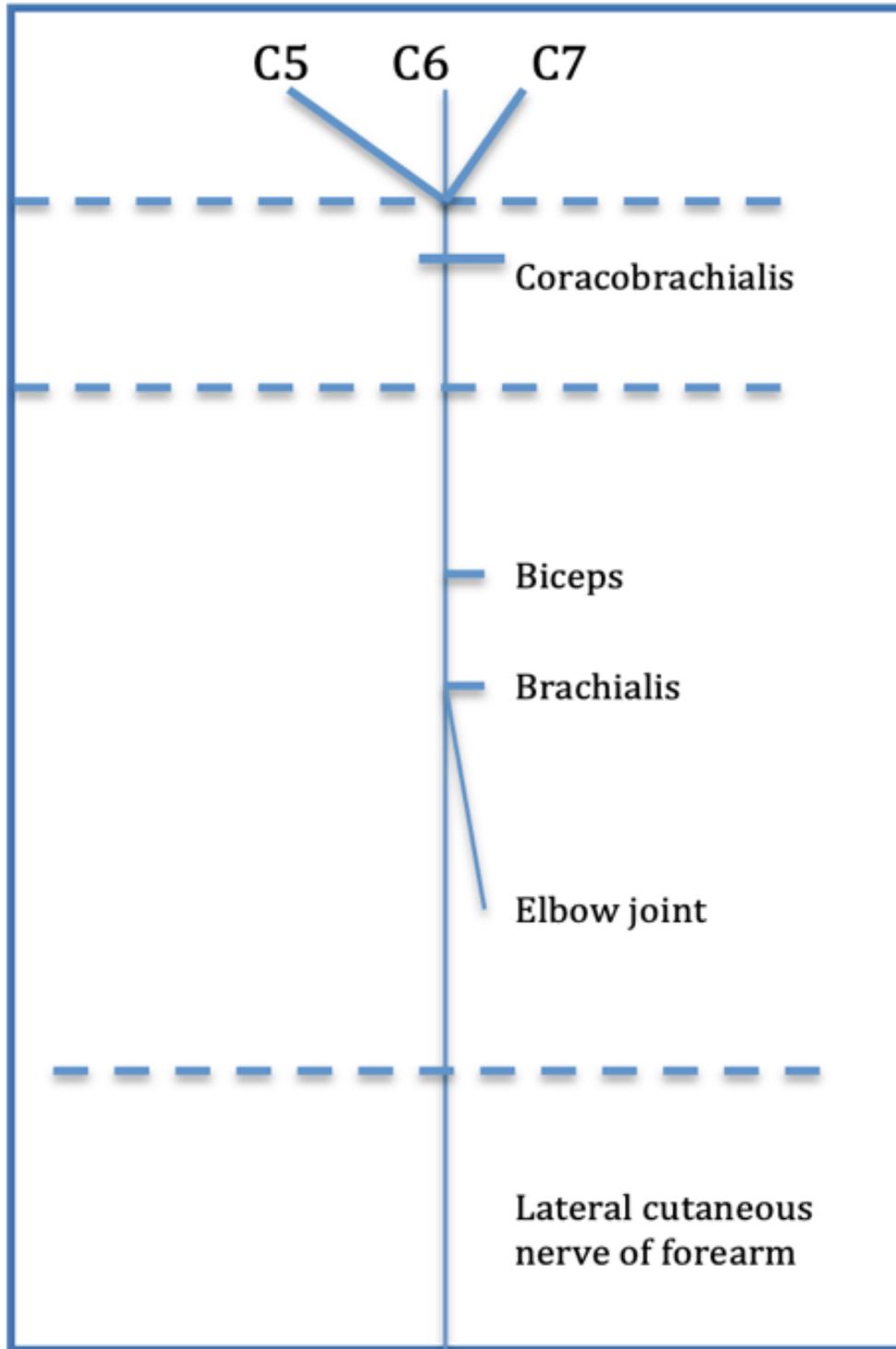
Musculocutaneous Nerve Sensory Distribution



Musculocutaneous Nerve Motor Innervation

- Coracobrachialis: Adducts and flexes the arm at the glenohumeral joint
- Biceps Brachialis (long and short heads): Supinates the forearm and flexes the forearm at the elbow joint
- Brachialis: Flexes the forearm at the elbow joint

Musculocutaneous Nerve Distribution

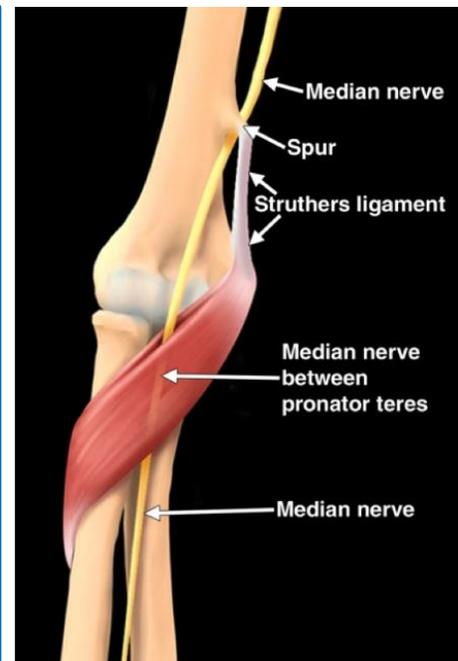
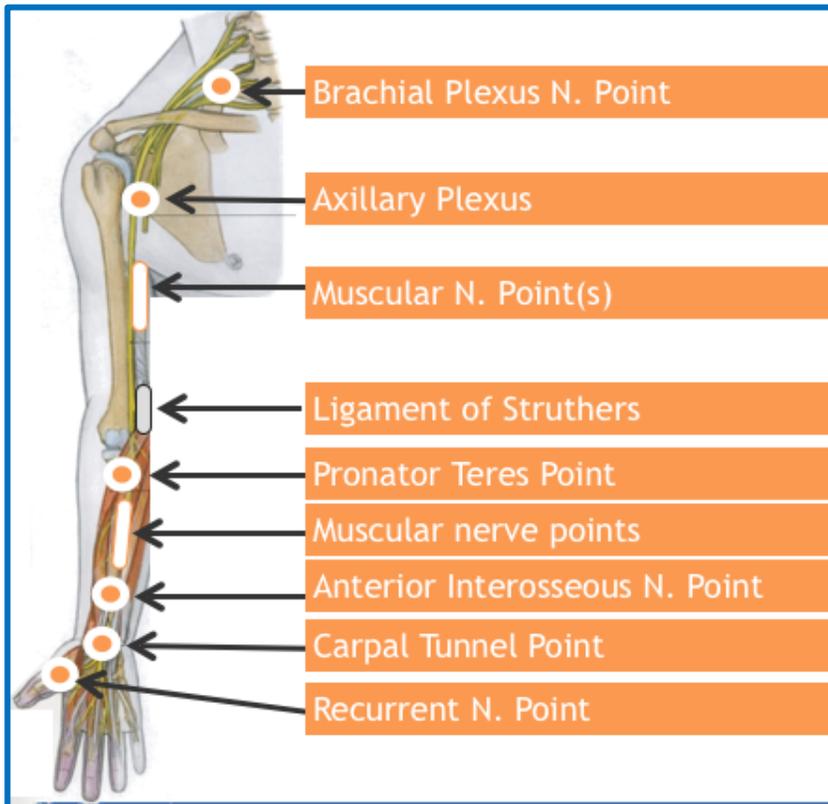


Median Nerve

The Median nerve may be entrapped as it passes under the Ligament of Struthers, a band of connective tissue at the antero-medial aspect of the distal humerus.

The Ligament of Struthers courses from the supracondylar process on the anterior humerus to the medial epicondyle. This is rare and only present in a small percentage of the population.

At the elbow, the median nerve is situated on the medial side of the brachial artery and the biceps tendon, underneath the deep fascia.



Pronator Teres syndrome

The most common area of entrapment of the median nerve is between the two heads of the pronator teres. It can also be compressed in the fibrous arch of the flexor superficialis, or the thickening of the bicipital aponeurosis. Compression of the median nerve in the region of the elbow or proximal part of the forearm can cause pain and/or numbness in the distribution of the distal median nerve, and weakness of the muscles innervated by the anterior interosseous nerve (the flexor pollicis longus, lateral half of the flexor digitorum profundus, and the pronator quadratus). The pain tends to be at the wrist joint, in the distribution of the terminal branch of the anterior interosseous nerve and is exacerbated by sustained or repetitive pronation. The weakness of the FPL and FDP is painless but causes people to "drop things" and have a sense of loss of dexterity.

Needle technique

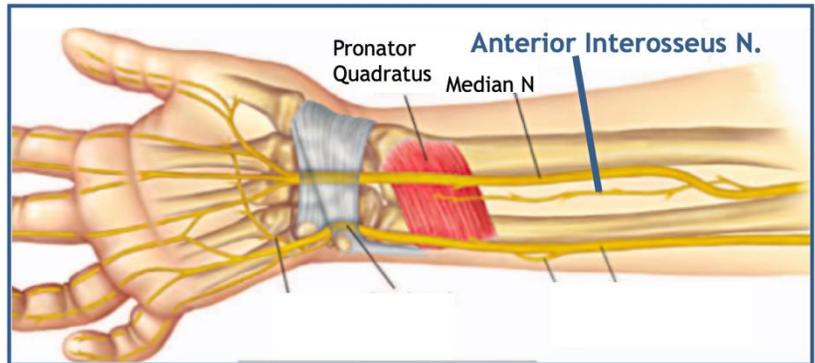
- Forearm is supinated resting on the table.
- The pronator teres originates on the medial supracondylar ridge of the humerus via the common flexor tendon, and medial aspect of the coronoid process. It inserts on the middle third of the anterolateral aspect of radius.
- Fernandez-de-las-Penas 2021 suggests a safe insertion point of the needle is 3cm distal to the mid-point between the bicep tendon insertion and the medial epicondyle.
- Advance the needle slowly because the median nerve and vascular structures are traveling below and through the pronator teres.
- Light needle manipulation and ENS can be performed in this region (aggressive pistoning is not recommended).



The Anterior Interosseus Nerve (AIN) (C7-8)

This is a branch off of the median nerve that branches after the median nerve passes through the two heads of the pronator teres and travels distally between the radius and the ulna ending at the wrist.

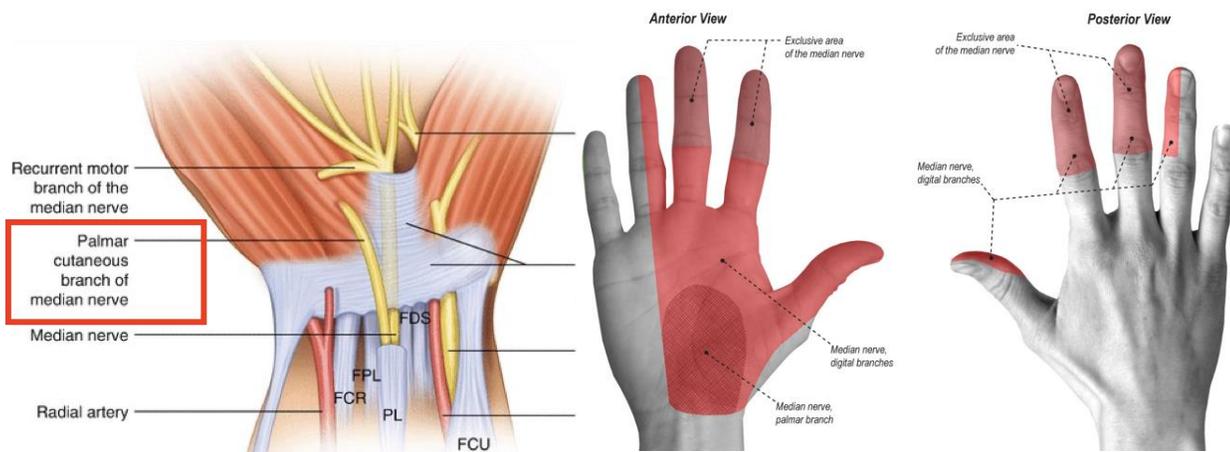
The AIN innervates the flexor pollicis longus, lateral half of the flexor digitorum profundus, pronator quadratus, articular branches to the wrist and distal radioulnar joints between the radius and ulna. Test motor function by having the patient perform the “OK” test.



Lee 2015 demonstrated that needle stimulation of the anterior interosseus point reduced the incidence of postoperative nausea and vomiting (PONV) compared to sham treatment. This stimulation prevented postoperative nausea, vomiting and need for antiemetic rescue by similar amounts that can be considered clinically significant.

Needle Technique

- Use a 30mm needle and insert it perpendicular to the skin 2 finger widths proximal to the wrist crease between the distal radius and ulna.
- Needle rotation is particularly useful here to stimulate the ache sensation and influence patient symptoms.
- ENS can also be applied for symptom relief.



Carpal Tunnel Syndrome

The median nerve is situated medial to the flexor carpi radialis tendon and below the palmaris longus tendon under the deep fascia at the palmar crease of the wrist.

The median nerve travels in an osseo-fibrous tunnel with nine long flexor tendons: flexor superficialis [4], flexor profundus [4], flexor pollicis longus [1].

The clinical presentation typically reveals numbness, weakness, and paresthesias within the thumb, index, middle, and radial side of the ring finger.

The palmar area has normal sensation as the palmar cutaneous sensory branch innervates it, which does not pass through the carpal tunnel.

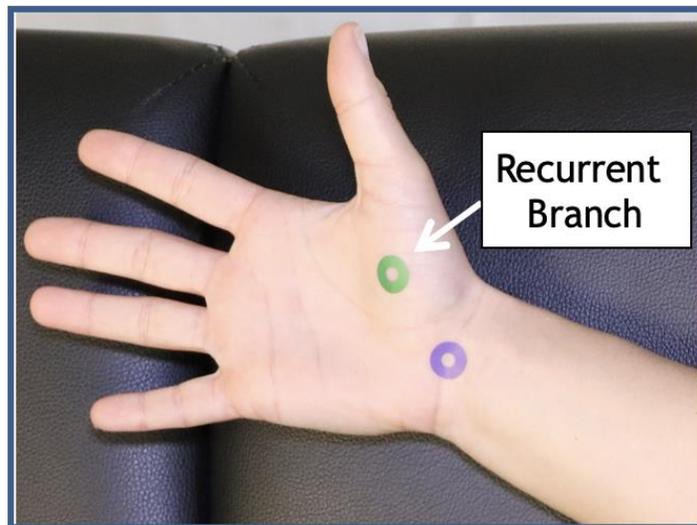
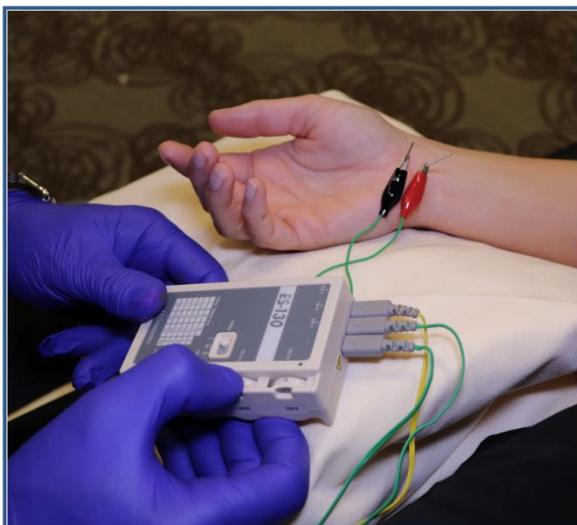
The recurrent thenar motor branch does pass through the carpal tunnel and gives innervation to the opponens pollicis, abductor pollicis brevis, and superficial head of the flexor pollicis brevis, which can undergo atrophy (Genova, 2020).

The pathophysiology of CTS involves a combination of mechanical trauma, increased pressure, (edema/inflammation), and ischemic damage to the median nerve within the carpal tunnel (Genova, 2020, Ural 2017). The goal of dry needling treatment is to improve microcirculation to reduce the inflammation and the compressive effects of edema in the tunnel. Ural 2017 demonstrated needling improved the clinical and electrophysiological findings of CTS and reduces the cross sectional (CSA) of the median nerve.

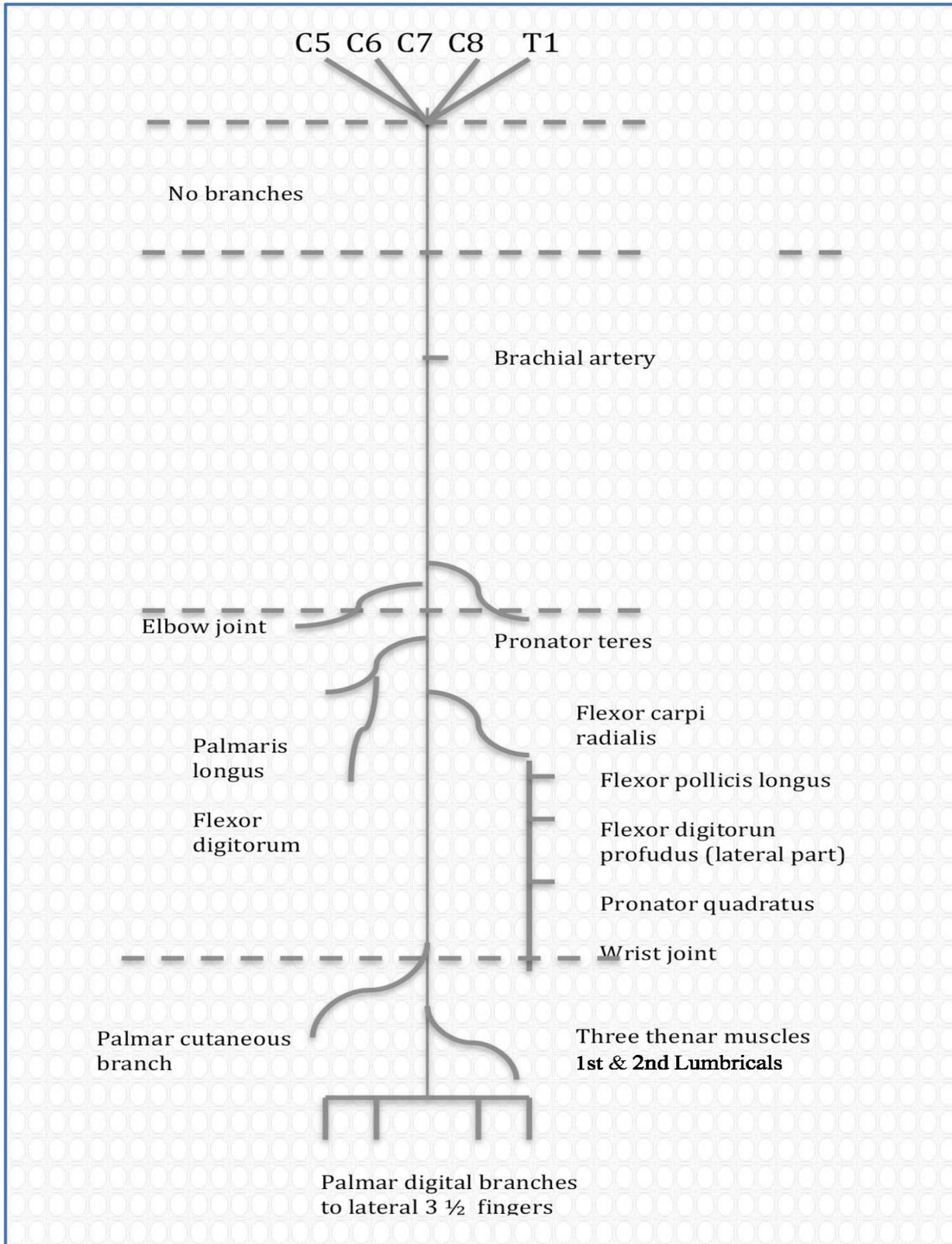
Needle Technique

- Use very small gauge 0.14-0.16mm x 15mm needles that are inserted directly into the canal to improve microcirculation.
- In addition, needling the forearm flexors to reduce neuromuscular tension is indicated.
- No needle manipulation is recommended.
- ENS at higher frequencies can have a pain-relieving effect.

If the thumb is painful or atrophied needling into the recurrent nerve innervation field in the thenar eminence musculature is indicated, and again ENS is a good addition to the treatment plan using a lower frequency of 2-6 Hz.



Median Nerve Distribution



Ulna Nerve

The Ulnar nerve can be entrapped at the Arcade of Struthers, an anatomical band of connective tissue in the medial distal upper arm that crosses the ulnar nerve approximately 8 cm (3") proximal to the medical epicondyle.

The Ulnar nerve travels in a groove (cubital tunnel) midway between the medial epicondyle and olecranon process where it can be influenced by inserting a needle parallel to the nerve. (see cubital tunnel below)

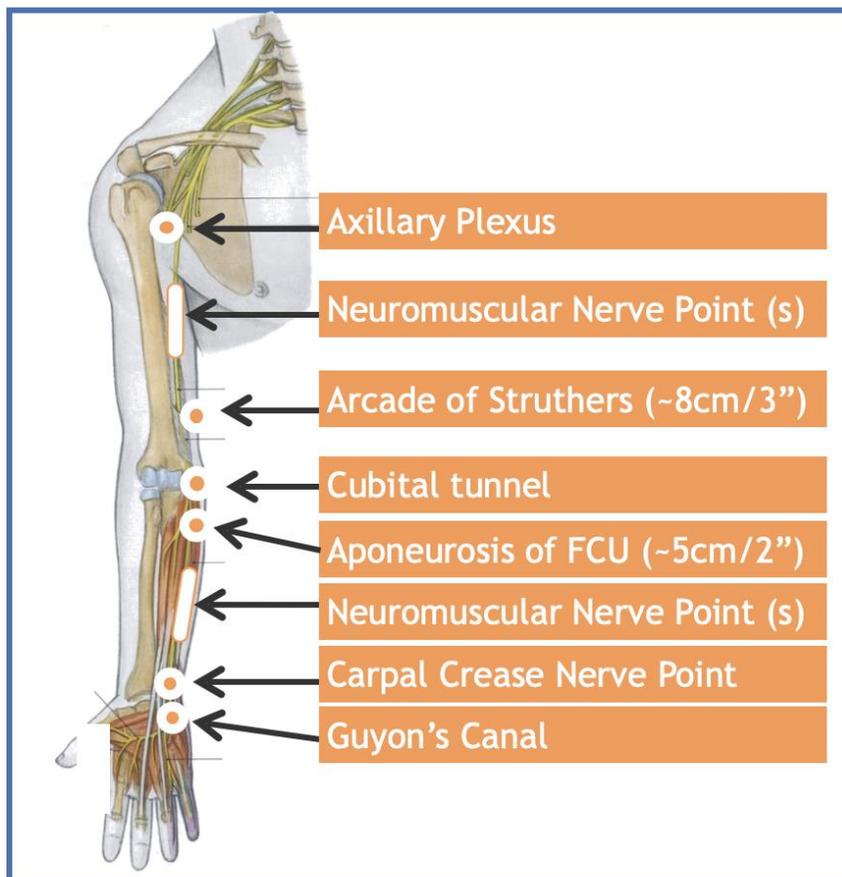
Deep Flexor Aponeurosis of Flexor Carpi Ulnaris

The deep flexor aponeurosis of the Flexor Carpi Ulnaris (FCU) is located approximately 5 cm (2") distal to the medial epicondyle and is a site of possible entrapment of the Ulnar nerve.

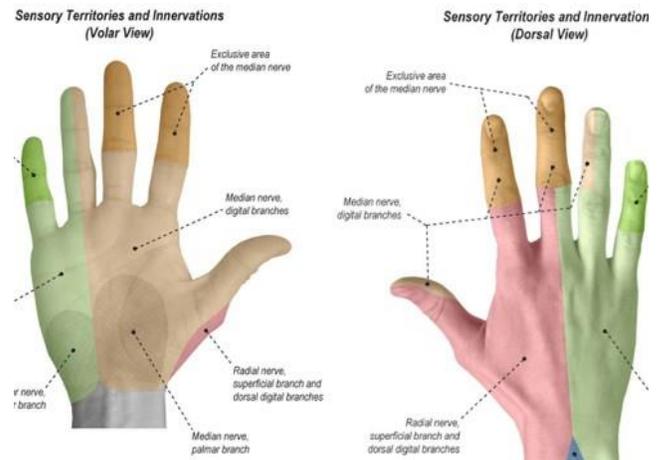
Needle Technique

- Insert a needle perpendicular to the skin where the nerve travels under the aponeurosis and is symptomatic.

Neuromuscular points refer to any point along the nerve path that cause the muscle to go into guarding and present as a neuro-trigger point.



Ulna Nerve Sensory Distribution (highlighted green)



Medial Elbow Pain (medial epicondylitis, epicondylalgia, Golfer's Elbow, Little League Elbow, Climber's Elbow)

Many frustrated patients present to clinic reporting an unknown etiology of their medial elbow symptoms, minimal benefit from NSAIDs and normal diagnostic reports.

Treatment of medial elbow pain has many similarities to lateral elbow pain with traditional methods typically including activity modification, bracing, modalities, cross friction, manual therapy, eccentric loading, stretching and home program follow ups.

The genesis of medial epicondylalgia (ME) in particular, appears to be associated with a combination of mechanical overloading and an abnormal microvascular response, which have been found at the site of tendinopathy (Shariat, 2018).

There are five muscles originating on the medial epicondyle: Pronator Teres, Palmaris Longus, Flexor Carpi Ulnaris, Flexor Digitorum Superficialis, and Flexor Carpi Radialis. Needling the presenting neuro-trigger points is helpful as a first step in treatment.

If common flexor tendinopathy is suspected, diagnostic US can be helpful in identifying the hypoechoic and increased blood flow (color doppler) areas to guide the needling treatment.

Unfortunately, there is a gap in the literature around the effectiveness of DN for the treatment of ME and medial elbow pain in general. We can, however, make inferences based on the literature presented for lateral epicondylalgia as the mechanism of tendon and muscular involvement is similar and DN has been shown to have a good treatment effect on lateral elbow pain and improving function. Shariat, 2018 describes a 40-year old male with a 2-year history of ME (golfer's elbow) that returned to golf and exercise after one dry needling treatment session.

Fenestration Technique

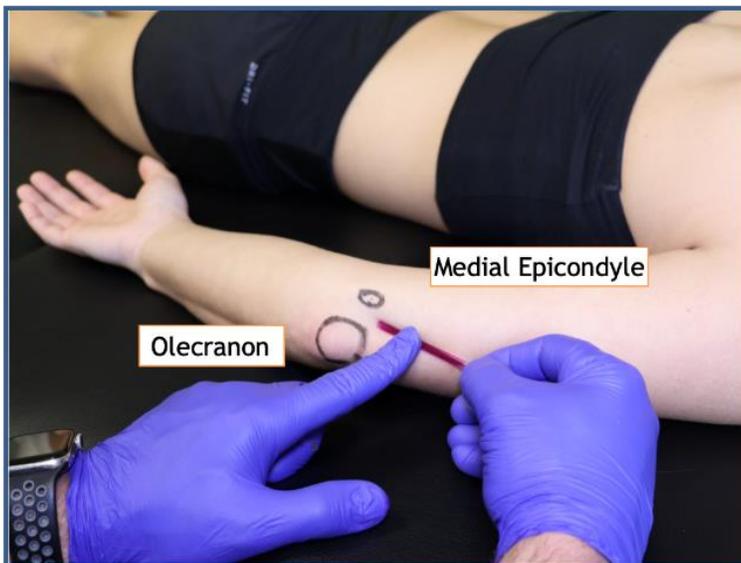
- A fenestration technique on the medial epicondyle can be performed in cases of periosteal inflammation around the medial epicondyle where the flexor tendons originate.
- Repeated "periosteal pecking" is performed with a short needle to the involved area on the epicondyle.
- Dosage of needling is dependent on patient tolerance, but 15 to 20 insertions are a good baseline.

Cubital Tunnel Syndrome

The cubital tunnel is a space that allows passage of the ulnar nerve around the elbow. It is bordered medially by the medial epicondyle of the humerus, laterally by the olecranon process of the ulna and tendinous arch joining the humeral and ulnar heads of the flexor carpi ulnaris. Cubital Tunnel Syndrome is diagnosed when the ulnar nerve becomes inflamed in the tunnel producing motor and or sensory symptoms into the ulnar nerve distribution.

Needle Technique

- Patient can be positioned in prone or supine with the elbow in slight flexion to reduce tension on the ulnar nerve.
- Beginning on either end of the cubital tunnel slide a 30mm needling between the olecranon process and medial epicondyle into the cubital tunnel and parallel to the ulnar nerve.
- Care is taken to insert the needle slowly observing the patient for any unwanted neural symptoms.
- ENS works well in this region by inserting additional needle(s) distal in the ulnar nerve distribution and providing 2-5+ minutes of stimulation.



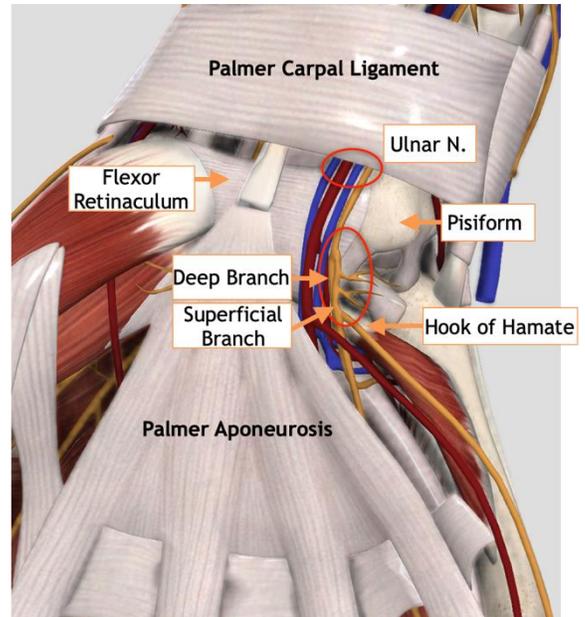
Ulnar Tunnel Syndrome

At the wrist, the ulnar nerve, artery and vein travel through the ulnar tunnel (Guyon's canal) into the hand. The tunnel is bordered superiorly by the palmar carpal ligament, inferiorly by flexor retinaculum, medially by the pisiform and laterally by the hook of the hamate. Symptoms of numbness/tingling/pain into the medial hand are commonly referred to as *handlebar palsy* based on it being common in cyclists.

Impaired motor function of the intrinsic muscles of the hand can also occur.

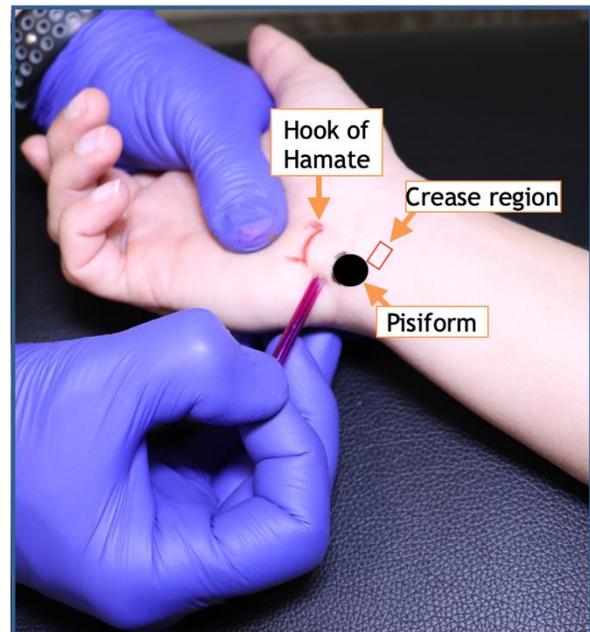
Symptoms are dependent on the area of the entrapment:

1. prior to the ulnar nerve bifurcating resulting in motor and sensory symptoms
2. around the deep branch producing motor symptoms only
3. around the superficial branch producing only sensory symptoms

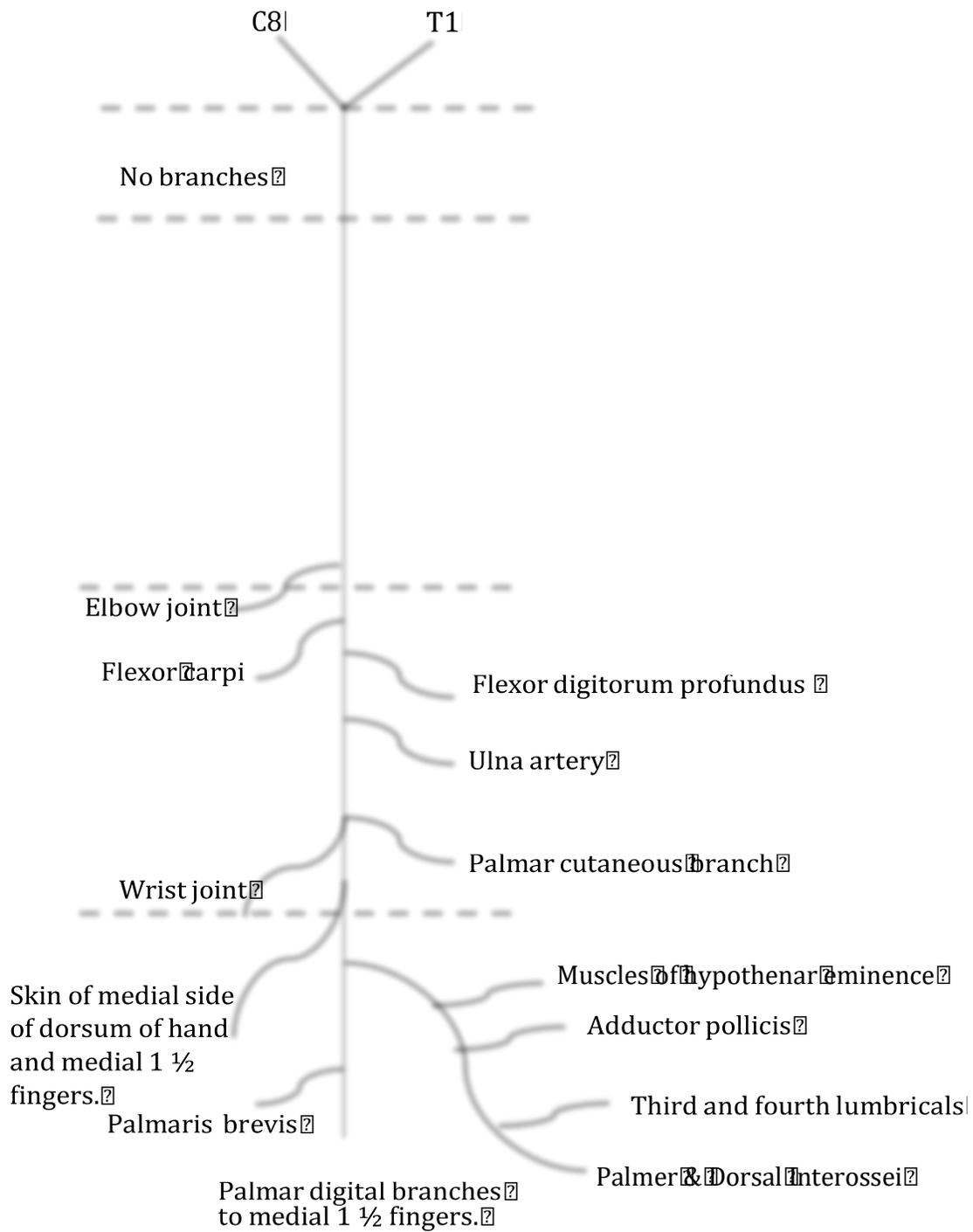


Needle Technique:

- **Crease:** Needling can be performed before the ulnar nerve bifurcates at the palmar carpal ligament (crease region ) by placing a small gauge 15mm needle at the wrist crease in the symptomatic area.
- **Guyon's Canal:** If the symptomatic area is more distal place a small gauge 15mm needle between the pisiform and hook of hamate.
- **Note:** If perpendicular needling into the area is not tolerated, a needle may be delivered starting on the medial aspect of hypothenar muscles needling laterally toward the space between the pisiform and the hook of hamate. (as shown)



Ulna Nerve Distribution



Specialty Hand Needling

Carpal Metacarpal (CMC) considerations and techniques

Thumb CMC OA is the most common and symptomatic form of OA in the hand and is seen by therapists in many practice settings.

Traditional therapy has focused on orthotics, patient education and joint protection. Recent studies have demonstrated that overuse of the adductor pollicis (AP) results in radial subluxation of the first metacarpal and ligamentous laxity. When the first metacarpal is radially subluxed the CMC joint surface is incongruent, resulting in abnormal loading forces and the progression of OA.

The superficial head of the first dorsal interosseus (FDI) inserts on the base of the first metacarpal stabilizing it against the radial subluxing forces of the AP. The opponens pollicis (OP) and FDI have a force coupling effect on the base of the 1st metacarpal (McGee 2015). Decreasing overuse of the AP and increasing the strength of the FDI and OP results in a stable, congruent CMC joint. Studies have found that individuals with first CMC OA have a weak FDI and loss of webspace due to AP contracture.

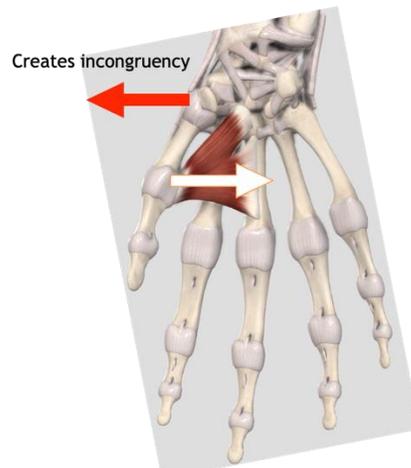
Contracture of the webspace limits full thumb pronation making tip to tip pinch impossible. Full thumb abduction is required for full thumb pronation. Studies have found that the CMC is most congruent when the MCP is positioned at 30° flexion (Moulton 2021).

The AP inserts on the base of the proximal phalanx and the ulnar collateral ligament of the MCP causing the MCP collapse into hyperextension during pinch with pain (Duong 2021). Laxity can be a common activating and perpetuating factor that may produce trigger points in the AP and FDI.

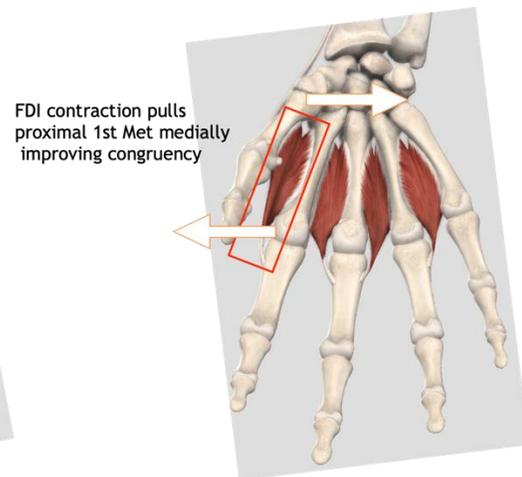
Villafane (2015)

described a program

of joint mobilization combined with dry needling trigger point therapy that can decrease pain and improve function in individuals with CMC OA.



Adductor Pollicis Contraction



First Dorsal Interossei contraction

Adductor Pollicus

Origin

- There are 2 distinct heads
- Transverse head on palmar aspect of the body of the 3rd MC
- Oblique head on the palmar aspect of capitate and base of the 1st, 2nd & 3rd metacarpals

Insertion

- Both heads insert on the ulnar aspect of the base of the proximal phalanx of the thumb and the ulnar collateral ligament of the MCP

Action

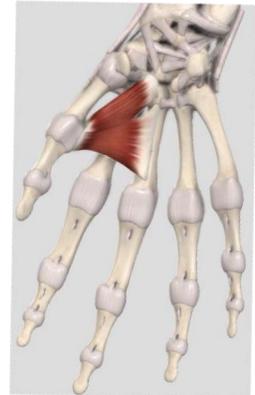
- Adducts the thumb at the MCP and CMC joints

Innervation

- Deep branch of the ulnar nerve (C8, T1)

Needle technique

- Patient is supine with the forearm in neutral resting on the table.
- With a pincer palpation of the 1st web space, resist adduction of thumb to help identify the AP.
- Insert a 0.16-0.18x15-25mm needle in a dorsal to palmar direction between the 1st and 2nd metacarpals.
- The needle is perpendicular to skin and directed toward the AP muscle and your finger, taking care to prevent the needle from penetrating into the palmar skin.
- Light needle manipulation and ENS is indicated and performed to patient tolerance.



First Dorsal Interossei (FDI)

Origin

- medial aspect of the body of 1st metacarpal and lateral aspect of body of 2nd metacarpal

Insertion

- lateral aspect of base of proximal phalanx and extensor mechanism of the index finger.

Action

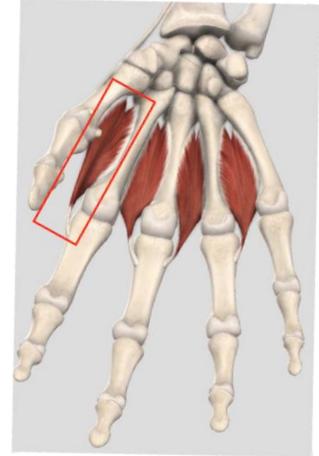
- Abducts the finger at the MCP joint; simultaneously flexes MCP joint and extends interphalangeal joints of index finger.

Innervation

- Deep branch of the ulnar nerve (C8, T1)

Needle technique

- Patient is supine with the forearm pronated resting on the table.
- With a pincer palpation of the 1st webspace, resist abduction of the index finger to help identify the FDI.
- Insert a 0.16-0.18x15-25mm needle perpendicular to the skin with a dorsal to palmar approach, taking care to prevent the needle from penetrating into the palmar skin.
- Stay close to the radial side of the 2nd metacarpal where the FDI is most prominent.
- Light needle manipulation and ENS is indicated and performed to patient tolerance.



Osteoarthritis Treatment (OA)

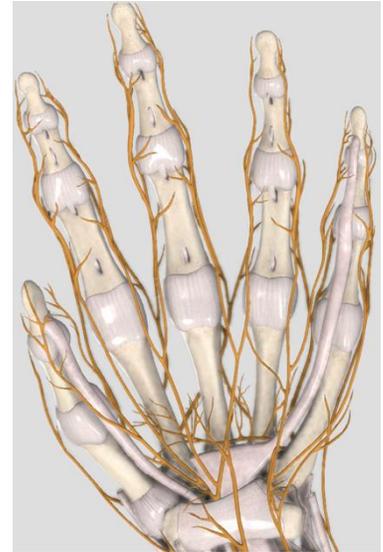
Assessment of neurogenic inflammation

The dorsal and palmar digital nerve branches run on the medial and lateral sides of the metacarpals and phalanges sending smaller communicating branches to the anterior and posterior aspects of the IP joints. These nerves (primarily the palmar branches) innervate the joint and joint capsules (Pastrana 2019).

This anatomical arrangement provides for a predictable presentation of pain; initially with inflammation of the joint, pain will be felt only on the medial and lateral aspects of the joint.

As the neurogenic inflammation progresses, the anterior and posterior aspects of the joint will become painful to palpation.

As the patient's condition improves (i.e. a reduction in neurogenic inflammation), a reversal of this pattern will occur until no further pain is elicited with palpation of the joint.



OA is characterized by cartilage deterioration, exposing the underlying bone, which triggers joint pain and stiffness. Overuse (i.e. hand intensive occupations, aging, and injury) are common risk factors for developing OA in the hand. While the literature on the use of dry needling for the treatment of hand OA is limited, we can draw on research from other OA joints where the use of dry needling and electrical nerve stimulation demonstrated a good treatment effect.

The effects of needling and electrical needle stimulation, (i.e. electroacupuncture (EA)) on knee osteoarthritis has been extensively studied (Chen 2017, Shim 2016).

The following conclusions were made based on the results of these systematic review and meta-analyses.

- EA treatment can more significantly relieve the pain and improve the physical function of patients with knee OA more than control interventions and sham EA treatment with low risk of adverse reactions.
- The effects of EA on OA of the knee have been found to modulate knee joint microcirculation, significantly increase endogenous opioid levels and significantly reduce plasma cortisol levels (Shim 2016).
- Needling and EA resulted in the blocking of the local release of inflammatory cytokines (i.e. interleukin-1 B and tumor necrosis factor α) in the synovium of the OA joints and the systemic release of inflammatory factors in the periaqueductal gray of the brain stem (Zhang 2014).

Stoychev (2020) reported that current research provides initial support for the efficacy of dry needling for tendinopathy in multiple regions throughout the body including the upper extremity.

OA of a joint can have a degenerative effect on the tendons and ligamentous structures that attach and support the joint.

- Tendon needling is thought to disrupt this chronic degenerative process by encouraging localized bleeding and fibroblastic proliferation.
- This is thought to result in collagen formation and ultimately healing of the tendon (Krey 2015).
- Dry Needling is minimally invasive, safe and inexpensive to clinically administer (Stoychev 2020).

(Dunning 2018) reported that inclusion of electrical dry needling into a manual therapy and exercise program was more effective for improving pain function and related disability than the application of manual therapy and exercise alone in individuals with painful knee OA.

Intrinsic hand muscle tightness (Combination of Interossei and Lumbrical Muscles)

Intrinsic hand muscle tightness is a common presentation in many hand pathologies, trauma and postoperative conditions. Intrinsic tightness is associated with metacarpal fractures, post-operative A1 pulley release, arthritis, carpal tunnel syndrome, spasticity, and failure to splint in an intrinsic plus position. Edema and vascular impairment cause adhesion formation and fibrosis of the intrinsic muscles and tendons.

Assessing intrinsic muscle length

- **Interosseous muscle** tightness is measured by passively flexing the IPs with the MCP in full extension. If full passive IP flexion is easily achieved with MCP flexion but not MCP extension, the test is positive for interosseous intrinsic tightness.



To differentiate between **lumbrical muscle** and interosseous muscle tightness, the test is repeated with active IP flexion. The lumbricals have a moving origin on the Flexor Digitorum Profundus (FDP) and insertion on the extensor mechanism.

Dorsal Interossei:

Origin

- All 4 originate on via two heads on the whole length of adjacent sides of the corresponding metacarpal bones.

Insertion

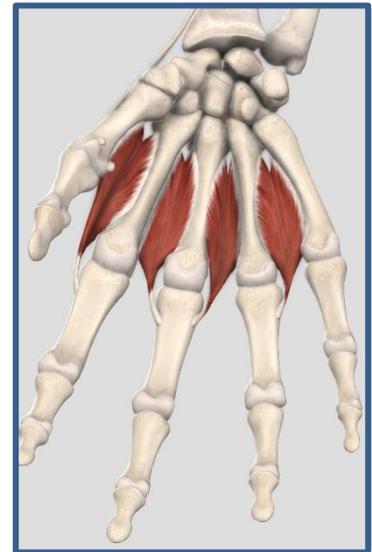
- All 4 insert at the base of the corresponding proximal phalanx and extensor mechanism.

Action

- 1st & 2nd laterally abducts index/middle fingers at the MCP joint while simultaneously flexes the MCP joint and extends the IP joints.
- 3rd & 4th medially abducts middle and ring finger at the MCP joint while simultaneously flexes the MCP joint and extends the IP joints.

Innervation

- deep branch of ulnar nerve (C8, T1)



Palmer Interossei muscles

1st palmer interossei

Origin

- palmar aspect of 2nd metacarpal bone

Insertion

- medial aspect of base of proximal phalanx and extensor mechanism of index finger.

Action

- adducts index finger at the MCP joint, simultaneously flexes MCP joint and extends IP joint of index finger.

2nd palmer interossei

Origin

- palmar aspect of 4th metacarpal bone

Insertion

- lateral aspect of base of proximal phalanx and extensor mechanism of ring finger.

Action

- adducts ring finger at the MCP joint, simultaneously flexes MCP joint and extends IP joint of ring finger.

3rd palmer interossei

Origin

- palmar aspect of 5th metacarpal bone

Insertion

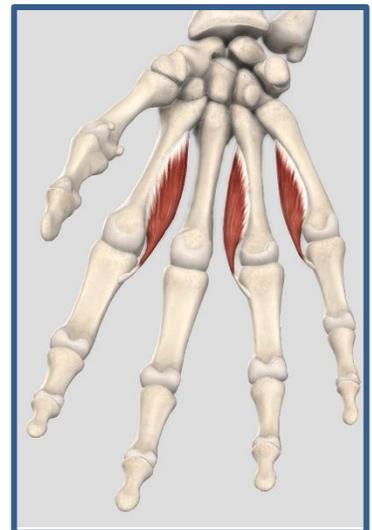
- lateral aspect of base of proximal phalanx and extensor mechanism of little finger

Action

- adducts little finger at the MCP joint, simultaneously flexes MCP joint and extends IP joint of little finger.

Innervation of all Palmer Interossei

- deep branch of ulnar nerve (C8, T1)



Lumbrical muscles:

Origin

- All four lumbricals originate on the tendon of the flexor digitorum profundus.

Insertion

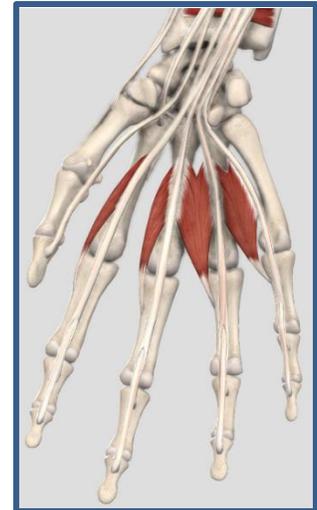
- 1st on the lateral aspect of extensor mechanism of index finger.
- 2nd on the lateral aspect of extensor mechanism of middle finger.
- 3rd on the lateral aspect of extensor mechanism of ring finger.
- 4th on the lateral aspect of extensor mechanism of little finger.

Action

- All four lumbricals simultaneously flex the MCP and extends the IP joints of the finger it inserts upon.

Innervation

- 1st & 2nd lumbricals by the median nerve (C6-7).
- 3rd & 4th lumbricals by the deep branch of the ulnar nerve (C8-T1).



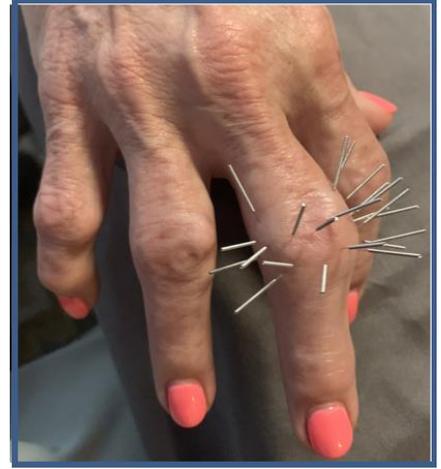
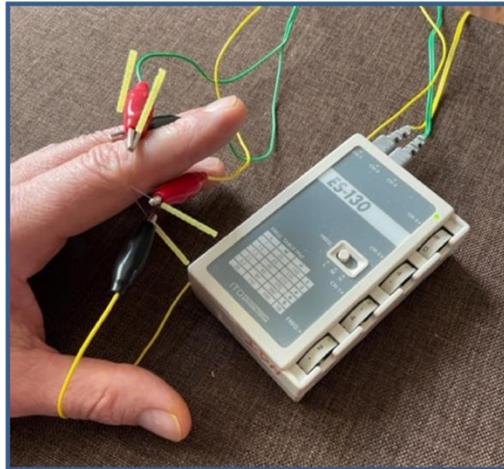
Needle Technique for Intrinsic hand muscle tightness

- Patient lies in supine hand is resting on the table with palm down.
- Palpate the muscles in the space between the metacarpals, thumb on dorsum, fingers on palmar aspect.
- Insert the needle perpendicular to the skin on the dorsal side of the hand. Slowly progress the needle toward the palm palpating for the needle to press against the soft tissue to assure the needle does not penetrate into the palm.
- Take care to avoid the veins on the dorsum of the hand, they are mobile and can be moved to allow access to the metacarpal space.
- Light needle manipulation or rotation can be performed.
- Caution: The palmar digital arteries, veins and nerves are present in the space between the metacarpals therefore, aggressive pistoning is not recommended.



Needle technique (for OA hand and finger joints)

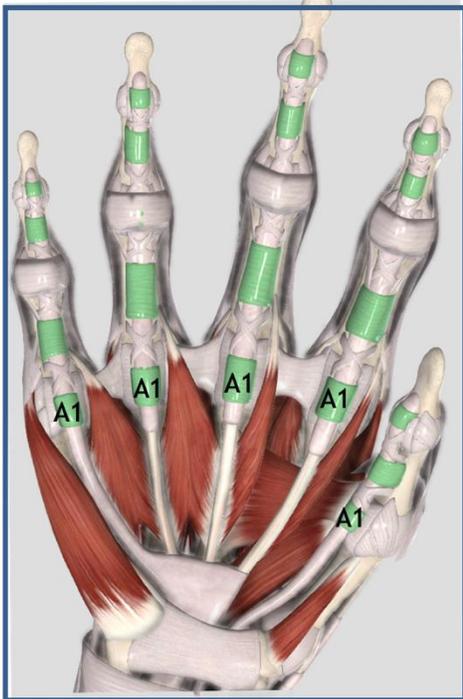
- Patient's arm lying at their side (if supine) or resting on a table allowing access to all sides of the finger(s).
- A small gauge 15mm needle is inserted into the joint region which includes the capsule, ligaments, tendons and other surrounding soft tissue.
- Inserting the needle into the joint space is ideal but understand this is difficult in a small arthritic joint especially if you do not have a diagnostic ultrasound to guide the insertion.
- It is still beneficial to needle into the surrounding capsule and soft tissue by placing multiple needles circumferentially around the joint.
- The addition of electrical nerve stimulation (ENS) at 2hz-4hz at a moderate intensity that the patient can tolerate for 20-30 minutes is indicated to maximize treatment effect (Chen 2017, Shim 2016, Zhang 2014).
- Performing "pecking" of the periosteum and capsule to create additional therapeutic lesions will promote the same physiologic and neurologic benefits that are outlined in the aforementioned research.



Trigger Finger, also known as Stenosing Flexor Tenosynovitis (Langer)

Trigger Finger (TF) is one of the most prevalent causes of hand disability and is the fourth most common cause of referral to Orthopedic hand clinics. The incidence of TF is 28:100,000 per year and a lifetime risk of 2.6% in the general population; the mean age of onset is 58 years and is much more common in women than men (Fathy 2024, Azizian 2019, Langer et al. 2017). Although TF is considered a mild hand pathology, it has wide ranging impact on hand functioning, daily activities and quality of life.

TF commonly occurs at the fibro-osseous tunnel formed by the metacarpal neck and the first annular pulley (A1). It can be caused by inflammation of the long flexor tendons that become thickened with subsequent narrowing of the A1 pulley making it difficult for the tendon to pass through the pulley. When the fingers are flexed, the thickened tendon (nodule) moves proximal to the pulley, however when attempting to extend the digit, the nodule cannot pass back under the pulley. Consequently, the digit becomes locked in flexion causing pain, catching and loss of motion of the affected finger.

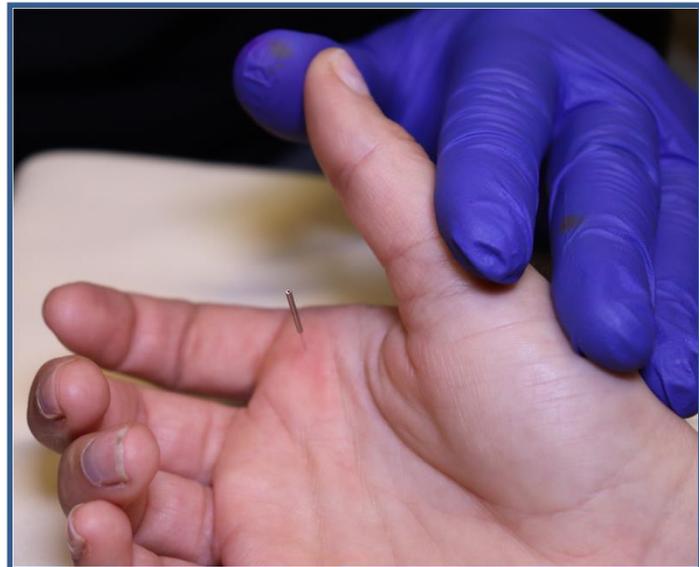
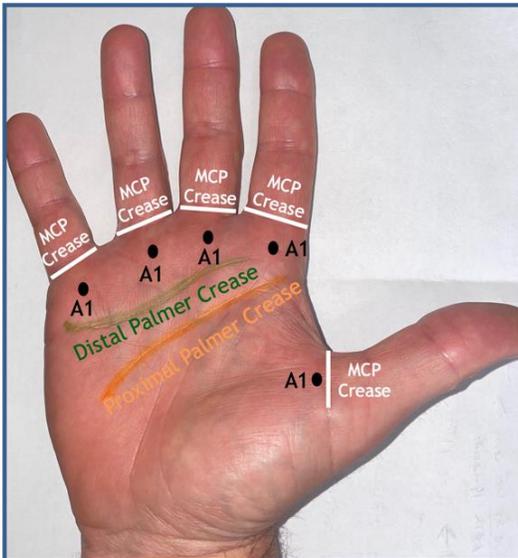


Azizian (2019) found that a single session of dry needling over the flexor tendon nodule and A1 pulley resulted in improved DASH score, increased pinch strength and decreased tendon-pulley thickness. These findings could be due to the dry needling reducing the local inflammation and edema. This results in a decrease in the A1 pulley thickness and flexor tendon volume allowing improved movement. Azizian (2019) states the flexor tendon consists of a dense collagen matrix, whereas the A1 pulley has both a loose connective layer and a dense connective layer. They believe the less dense elements are more susceptible to the physiologic effects of dry needling than the dense tissues, such as tendons. Therefore, DN may affect the tendon sheath to a greater extent than the flexor tendons due to the reduced density of the pulley's connective tissue. The resultant decrease in pain and improvement of hand function was the result of a reduction in the A1 pulley thickness and the flexor tendon volume (cross sectional area) after a single session of DN treatment. Fathy 2024 concluded that 5-week dry needling approach with a traditional physiotherapy program

was effective in improving in quality of life, pain intensity, and hand grip strength in patients with trigger finger, emphasizing it as the better option than traditional PT alone.

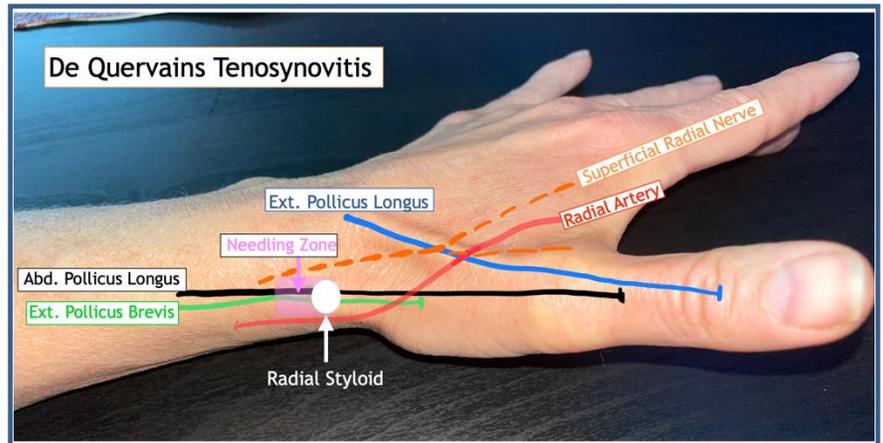
Needle technique (for Trigger Finger)

- Patient's supinated hand is resting on the table.
- A1 pulley is located between the MCP joint crease and the distal palmar crease for the middle, ring and small finger.
- For the index finger, the A1 pulley is located between the MCP crease and the proximal palmar crease.
- Insert a 0.14 - 0.18mm x15mm needle perpendicular to the palm down to a boney back drop.
- The needle should now be in the flexor tendon - this is confirmed by visualizing needle movement when the patient flexes and extends the distal phalanx.
- Slowly withdraw the needle until the movement ceases - the needle tip is now in the A1 pulley. Needle manipulation should be performed on the flexor tendon/sheath and the A1 pulley.
- The needling dosage will be dependent on patient tolerance as this area can be sensitive.



De Quervain's Tenosynovitis

De Quervain's is a painful condition as a result of tenosynovitis of the Abductor Pollicus Longus (APL) and Extensor Pollicus Brevis (EPB) tendons, as they pass through the first dorsal compartment of the wrist. Tenosynovitis is the inflammation of the fluid filled sheath (called the synovium) that surrounds a tendon. The sheath helps reduce friction as a tendon glides but when inflamed the sheath lining thickens reducing the amount of space through which the tendon can pass causing friction pain.



The etiology of de Quervain's tenosynovitis is repetitive and continued strain on the inflamed APL and EPB tendons and sheaths as they pass under the extensor retinaculum. Patients present with inflammation, edema and complaints of pain in the radial styloid region. The genesis of the condition is related to motion and activity requiring ulnar deviation with a clenched fist and thumb MCP flexion. Patients report symptom onset after performing activities such as hammering, gripping a golf club, lifting a child, or even blunt trauma to the region (Dressendorfer 2020).

Eichhoff's test (sometimes referred to as Finkelstein's test) involving thumb MP joint flexion with closed fist combined with active wrist ulnar deviation is used as a standard clinical test to reproduce familiar complaints (Goel 2015).

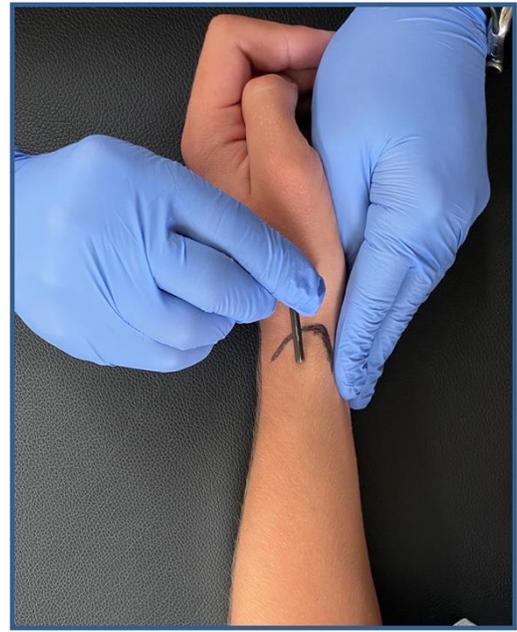
Conservative management includes use of NSAID's, activity modification, patient education, splinting, manual treatment, modalities (US, electrical stimulation), exercise and corticosteroid injections (Goel 2015).

If conservative treatment fails a first dorsal release surgery can be performed to excise the extensor retinaculum and remove the compression on the tendons (Goel 2015).

There is currently no evidence in the literature for the specific use of dry needling to treat De Quervain's tenosynovitis. There is, however, evidence to support the use of dry needling in the treatment of tendon and sheath inflammation (Stoychev 2020, Krey 2015, Azizian 2019). This information can be adapted to treat the APL and EPB in the first dorsal compartment.

Needle technique for De Quervain's tenosynovitis

- Patient's hand is resting on the table in a neutral position.
- Palpate and identify the location of the radial artery and mark its location to avoid needle penetration.
- Look for and mark the visible veins in the region.
- Palpate and identify the radial styloid process.
- Ask the patient to abduct and extend the thumb to identify the APL and EPL tendons.
- Insert a 0.14-0.16mm x15mm needle into the tendon, sheath, extensor retinaculum ending on the bony backdrop of the radial styloid process and lateral surface of radius.
- Placement of the needle within the tendon can be confirmed by visualizing needle movement when the patient slowly abducts or extends the thumb.
- Superficial radial nerve branches are located in this area so needle insertion should be performed slowly listening to the patient for any reports of nerve-based symptoms.
- Light needle manipulation can be performed to create therapeutic lesions in the tendon, sheath and retinaculum.



Dupuytren's contracture

Dupuytren's contracture is a fairly common disorder of the fingers. It most often affects the ring and/or the little finger and often occurs in both hands. Although the exact cause is unknown, it occurs most often in middle-aged, white men and is genetic in nature. Currently, there is no evidence that dry needling is an effective treatment for Dupuytren's Contracture.

Treatment options include radical fasciectomy, dermofasciotomy, percutaneous fasciotomy and collagenase injections. Recent studies have shown improved outcomes with percutaneous needle aponeurotomy (Herrera, 2015; Baur, 2016). It is a less invasive procedure that can be performed in the Physician's office under local surface anesthesia. The Physician inserts an 18-gauge needle with a beveled edge into the contracture; using a sweeping motion cuts through the contracted cords. In comparison, Dry needling creates a vertical lesion, and does not have the beveled edge necessary to be effective in cutting the pathologic cords. DN could be used for the secondary effects of muscle guarding, and neurogenic inflammation that may cause pain. Here is a good YouTube video: <https://www.youtube.com/watch?v=JxkwCw4E4AU>

Case Study – Clinical Applications

A 19-year old college softball pitcher injured her elbow 6 weeks ago and is experiencing pain with a heavy and weak sensation in her forearm limiting her from competing and sleeping through the night.

- Presents with weak and painful (R) wrist extension, pain and weakness with gripping.
- Cervical ROM is limited in right lateral flexion, rotation & extension secondary to pain.
- Shoulder has full ROM; Elbow pain with full extension and pronation; Active wrist extension painful with end range wrist flexion limited and painful.
- Neuro: Reflexes normal; Sensation intact
- Pain with palpation of the extensors, lateral and medial epicondyle and biceps.
- Quantitative Analysis score is 7/16.

Is it possible to change spasticity with dry needling?

Frank Gargano PT, DPT, CIDN, MCTA, CMP

Stroke is a major neurological disease with a high prevalence and, every year, more than 13.7 million individuals suffer an incident stroke (Ebrahimzadeh 2021). Stroke is a leading cause of disability in adults worldwide, and patients suffer post-stroke neurological deficits such as hemiparesis, spasticity, and ataxia (Ebrahimzadeh 2021). Patients with spasticity exhibit lower motor activity performance than patients who do not have spasticity (Salom-Moreno et al., 2014).

Spasticity usually develops slowly, peaking 1-4 months after the onset of stroke and is present in 38% of patients 1-year post-stroke (Salom-Moreno et al., 2014). Spasticity is a motor disorder characterized by a velocity-dependent increase in muscle tone due to hyperexcitability of the stretch reflexes (muscle tone) (Lance 1990; Salom-Moreno et al., 2014). Although spasticity is a common symptom in stroke patients, the mechanisms underlying this disorder are poorly elucidated. Both neural and mechanical mechanisms have been suggested as sources of muscle spasticity in stroke (Kuo, 2018). Spasticity is thought to impede the initiation of active movement due to a hyperactive stretch reflex (Lance, 1990; Kuo, 2018) so it is important to control and manage it to improve voluntary activities in stroke patients.

The use of DN for the treatment of neurological conditions (spasticity) has not been extensively researched and the exact mechanism of how DN reduces spasticity is not known, but there are several papers and theories that are worth discussing.

In a systematic review (Bynum et. al, 2021) they outline the current research related to the effects of dry needling (DN) on spasticity and range of motion (ROM). Their conclusions, based on the inclusion of 10 studies that met the criteria was there is strong evidence to support the use of DN to target spasticity and active and passive ROM. Bynum and her colleagues are Occupational Therapists, so the paper was written from that perspective and provides a different view of the use of DN beyond just pain management. The intent was to determine if DN could manage spasticity and improve ROM to support functional outcomes and improve occupational performance. This is important in the continued development and expansion of DN into other areas of care by different professions for varied outcome measures and goals.

Ortin et al. 2021 described one session of DN on a post-stroke patient with tremor. DN was performed on the extensor digitorum, flexor digitorum superficialis and profundus, brachioradialis, short head of biceps brachii, long head of triceps brachii, mid deltoid, infraspinatus, teres minor, upper trapezius, and supraspinatus muscles. The results demonstrated a decrease in the severity of tremor during postural and functional tasks; EMG activity decreased after the session and returned to basal levels 4 days after. There was an improvement post-intervention and 4 days after in functionality and manual dexterity of the affected limb, measured with the 9-Hole Peg test, as well as in the patient's hand and lateral pinch strength after the treatment that was also maintained 4 days post.

In a randomized controlled trial Salom-Moreno et al. (2014) demonstrated that the application of a single session of deep DN (DDN) to the calf decreased spasticity and widespread pressure pain sensitivity in subjects who had experienced a stroke. In addition, DDN induced changes in plantar pressures by increasing the support surface i.e. being able to get the foot flat to the ground. This finding certainly has implications for improved stability in standing and for gait performance. The results are based on the fact that DDN can reduce stiffness of taut bands. Therefore, because an increased resistance to passive ankle dorsal flexion in spastic muscles appears to be related to the inability of the muscle fascicles to elongate, the restoration of sarcomere length and the decrease in stiffness of spastic taut bands may, at least in part, explain the decrease of post-stroke spasticity observed in those patients receiving DDN (Salom-Moreno et al. 2014).

Mendigutia-Gomez 2016 suggested that the inclusion of dry needling into a rehabilitation program of subjects who had experienced a stroke was effective for decreasing localized pressure pain sensitivity and improving shoulder range of motion. However, the inclusion of dry needling into the treatment program did not induce significant changes in muscle spasticity in the shoulder musculature. Intervention group 1 only received rehabilitation no DN, Intervention group 2 received rehabilitation and DN. They note that DN was not performed as an isolated intervention but was part of a multimodal rehabilitation program (manual techniques, passive positioning and repetitive task training exercises. The fact that they did not find significant reductions in muscle spasticity between interventions does not mean DN is not effective for reducing spasticity because both interventions created similar decreases in muscle tone.

Fernandez-Sanchis et al., (2022) conducted a cost-effectiveness analysis of including a single session of DN in the upper extremity rehabilitation protocols for chronic stroke patients. They used two different effectiveness outcomes: the EQ-5D for Quality of Life (QOL) and the MMAS to measure hypertonia in treatment responders. They found good results in the cost-effectiveness analysis after treatment and at two weeks follow-up. Within the limitations of the study, they concluded the application of DN in the upper extremity is an affordable alternative to use in patients with chronic stroke.

The mechanism of action of how DN reduces spasticity is not fully understood and certainly is multifactorial, a few authors have proposed some possible explanations.

The primary lesion in subjects with spasticity is neural in origin, but profound secondary changes occur in the muscle itself at the protein, single-fiber, and whole-muscle levels (Salom-Moreno 2014). Muscle contractures occurring secondary to spasticity can result in structural changes i.e. a reduction in muscle fiber length, a decrease in the number of serial sarcomeres within muscle fibers, and increased muscle stiffness (Salom-Moreno 2014; Mendigutia-Gomez 2016). DN may help to induce localized stretch of the contracted cytoskeletal structures and reduction of the overlap between muscle actin and myosin filaments (Mendigutia-Gomez 2016). This local theory would support the fact that DN reduces muscle stiffness and therefore would decrease muscle resistance to passive movement.

The corticospinal tract (CST) is a major pathway for skilled voluntary movements. Post-stroke CST damage leads to ataxia and loss of fine motor control of the more affected upper extremity (Ebrahimzadeh 2021). Following a stroke, the neural drive to the muscles is impaired, and CST connectivity is reduced. Thus, post-stroke CST damage leads to both weakness and muscle spasticity, both of which contribute to the development of post-stroke movement disorders. Neuromodulation strategies to reduce muscle spasticity, such as DN, are hypothesized to enhance the engagement of the descending motor Corticospinal Tract (CST) in stroke patients (Ebrahimzadeh 2021). They hypothesize the recovery of active movements after DN of post-stroke spastic muscles may be indicative of increased CST connectivity. Therefore, it follows that potential improvements in CST connectivity after DN will explain the positive outcomes on the level of spasticity as well as active movements and function of the more affected hand. Although various descending motor tracts possibly contribute to voluntary movements, the CST is a major descending motor pathway that contributes to the control of voluntary movements. They anticipate the results of this evolving RCT will provide important evidence of the effects of DN in revealing changes in the CST in stroke patients

Another interesting theory from the Salom-Moreno (2014) article was widespread changes in pressure sensitivity suggests that DN is able to activate central and segmental anti-nociception pathways (Salom-Moreno, 2014; Srbely, 2010). This has been previously reported by Chae et al (2013) that brain areas activated by needle stimulation largely overlap with brain regions that constitute the so-called pain matrix partly responsible for descending pain control. Roosink, (2012) found that persistent post-stroke shoulder pain (pPSSP) in the first 6 months after stroke was associated with somatosensory loss to both innocuous and noxious stimuli (affected side). In addition, pPSSP was associated with sensitization to cold pain (unaffected side) and with widespread sensitization to multimodal innocuous stimuli (affected side). The results support the notion that central somatosensory sensitization could play an important role in the development of pPSSP, the maintenance of pPSSP, or both. This highlights the importance of Quantitative Sensory Testing in gaining an understanding of the degree of central sensitization to make informed clinical decisions when designing the treatment plan (Gargano, 2021).

Based on the cited articles there is evidence that DN reduces spasticity through local, segmental and systemic mechanisms. The onset of stroke initiates a cascade of chemical, physiological and neurological sequelae that causes central neuronal damage. It is this author's opinion that the structural central sensitization that results has a profound effect on the afferent and efferent proprioceptive, motor and a sensory information. The sensitization is likely generated and maintained by neurogenic inflammation within the nerve structures themselves (Greening et al. 2018). It appears possible that successive applications of DN can create change at the local soft tissue level resulting in reduced neurogenic inflammation, muscle tone and improved mobility. It was also suggested that DN can modulate the central nervous system through an anti-nociceptive sensory effect. Unfortunately, the neuronal damage to the central structures cannot be remedied so the positive effects seen in movement and pain may be temporary. However, with repeated applications of DN, as a part of a multimodal rehabilitation program, the positive effects can be maintained with the understanding there is likely a ceiling to the level of pain mitigation and functional improvement achieved.

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