Neurologic Dry Needling for Cranio-Cervical Pain and Dysfunction

Neurologic Dry Needling for Cranio-Cervical Pain & Dysfunction is an advanced level training program designed for clinicians that have prior dry needling training and are utilizing it clinically. This course will develop the knowledge and clinical skills required to safely and effectively diagnose and treat painful neuromuscular conditions in the cranial, facial and cervical regions. This course details the musculoskeletal and neuroanatomical relationships, both peripheral and central, that exist between the regions. The role of inflammation (neurogenic) in the production of pain and dysfunction is described and discussed. This course is primarily lab-based focusing on clinical decision-making and improving treatment outcomes in this challenging patient population. The clinical rationale for treating both the cervical and cranial regions concurrently is explained to maximize treatment effect. Case examples of common clinical conditions are discussed and treatment plans are practiced.

Learning Objectives

1. By the conclusion of the course the participant will be able to independently evaluate musculoskeletal dysfunction relating to cranio-cervical conditions.

2. Independently evaluate peripheral nerve dysfunctions relating to a given cranio-cervical condition.

3. Independently evaluate peripheral nerve (soft tissue) dysfunctions relating to a given musculoskeletal condition and pain.

4. Independently identify a minimum of three peripheral cranio-cervical neuro-trigger points in a given case study.

5. At the conclusion of the course the participant will be able to independently select proper prevention and management strategies of adverse responses to dry needling based on OSHA requirements during case study presentations.

6. By the conclusion of the course the participant will be able to correctly defend the IDN system for treatment of neuromusculoskeletal pain based on the unique neurology and physiology of neuro-trigger points.

7. By the end of the course, participants will be able to independently integrate Neurologic Dry Needling into a patient’s plan of care with relation to current clinical guidelines.
1) What is dry needling (DN) therapy and how effective is it?

In a 2015 report prepared for the Federation of State Boards of Physical Therapy defined dry needling as “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.”

Overall, dry needling can offer many clinical results that other conventional medical techniques may not offer or offer with limited efficacy. We will explore the current research, and clinical use of neurologic dry needling in the cranio-cervical region.

2) Neurologic Dry Needling (NDN) as a part of the Integrative Dry Needling (IDN) Model

There are currently several different models of dry needling being practiced, each with theoretical concepts and clinical techniques. Each model has its own range of clinical efficacy and its own limits in clinical use. Physiologically, these different techniques do not conflict with each other. As research continues to reveal more clearly the physiologic nature of dry needling, our understanding of it reaches a more mature stage. We are now able to upgrade some hypothesis to more scientifically acceptable levels. This advance not only deepens our understanding of the techniques but also helps to improve our clinical practice and therapeutic outcomes.

NDN treatment model focuses on addressing (neurogenic) inflammation resulting in peripheral nerve sensitization. The NDN system is based on the 3 I’s (Inflammation, Irritation, Inhibition) and the 3 S’s (Symptomatic, Segmental, and Systemic) of musculoskeletal pain and dysfunction. NDN has no preconceived notions of the source of the 3 I’s instead the 3 S’s provides a foundation upon which to build an assessment and dry needling management program. This course will demonstrate and practice the NDN treatment model for cranio-cervical conditions.

3) Local effects of needling

Dry needling inoculating 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 of the tissues (down and up, and/or rotation movement of needle shaft), which creates lesions in soft tissue. When the needle is removed, the lesions are left 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 needling site. The tissue remodeling process includes:

a) local reducing physical stress (tissue tension) and
b) normalizing local inflammation, and

c) replacement of injured tissues with fresh tissues of the same type.

4) 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 tension, 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.

5) Non-specific pathophysiologic feature of needling

It is important to understand that needling itself does not treat specific diseases, but restores tissue homeostasis, during which the physiological processes of self-healing and self-repair are activated. After needling many pathological conditions can be improved, including muscular function as it relates to agonist / antagonist relationships which then directly influence human movement and performance. [50-52] Needling is a non-specific therapy that has systemic effects relating to the physiologic processes of the nervous, endocrine, immune and cardiac systems.

6) Selecting effective points

The choice of needling points is the most inconsistent parameter within needling therapy. 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. [10, 11]. The specificity of needling sites ranges from almost anywhere in the body [23] to multiple sites within the same segment as a source of nociception, [24] to the highly specific needling of classical acupuncture and myofascial trigger point therapy. [25] Despite the apparent ubiquity of needling sites, it is likely that some sites are more effective than others [26], like muscle motor-endpoints, and in the vicinity of peripheral nerve trunks.

Unfortunately, very little evidence is available indicating the most effective needling sites for particular conditions. In the absence of high-quality RCTs directly comparing different point selection, evidence may be gleaned from systematic reviews comparing the effects of different treatments across multiple trials. For example, Tough et al. found that there is no evidence that direct needling is more effective than needling other sites. [27]

In general, needling the sensitized and inflamed area will achieve the same clinical efficacy as selecting precise trigger point locations. [12,13] This is because the most critical pathology of soft tissue dysfunction involves neurogenic inflammation and related conditions such as vasoregulation-dependent dysfunction, especially tissue, blood and lymphatic circulation. Trigger point nodules are not the cause of the inflammation in many cases. Possibly 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 myofascial trigger points causing pain needs to be re-examined. [14]

7) Molecular mechanism of dry needling

Dry 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 sympathetic 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 of understanding the needling mechanisms at this level.

8) Depth of needling

Deeper needling has been shown to be superior to superficial needling in some conditions, [28] however, superficial needling can be as effective as deep needling in some cases. [29, 30] Deep needling can still be recommended for most patients, as it appears to be more consistently effective in reducing pain and may influence both the sensory and affective dimensions. [29]

9) Duration of needle retention

Campbell [31] states that short durations, from a few seconds to 2 minutes can be effective in patients who respond strongly to needling. Li et al [32] have demonstrated broader and more significant characteristic brain responses to needling at a classic point for 3 min than for 30 or 60 seconds. For MTP needling, it is hypothesized that the production of a local twitch response indicates deactivation of the MTP and, therefore, the needle may be withdrawn immediately. However, it is commonly recommended that the needle still be retained for 30s to 3 min. [33,34]

10) Patient expectations

Evidence from several clinical trials further supports a relationship between patient expectations regarding needling treatment and subsequent clinical outcomes. Linde et al. [35] performed a pooled analysis of four randomized trials of acupuncture for chronic pain, including 864 patients, and found that expectations regarding the specific needling treatment strategy patients were receiving had a significant impact on outcomes over a period of several months. Kalaoukalani et al. [36] evaluated the association between a patient’s expectation of benefit from massage or acupuncture for low back pain and found that regardless of the treatment received, the outcome depended on the magnitude of relative expectations. In contrast, general optimism about treatment, divorced from a specific treatment, was not strongly associated with outcome. These results indicate a need for practitioners to clarify patient’s expectations in relation to needling therapies.

11) Adverse events of needling therapy

Adverse events may be categorized as avoidable and unavoidable. Avoidable adverse events are human made mistakes like serious needle traumas, infection, some physiologic reactions like fainting and related accidents. Over-treatment is another example of an avoidable adverse event that is common in clinical practice. In an attempt to maximize the therapeutic effect of dry needling, clinicians inadvertently administer an excessive dose of dry needling and patients can have a strong response that can produce uncomfortable symptoms. These symptoms are short-lived and are avoidable by being conservative with needle dosage, especially in the early phase of treatment.

Unavoidable adverse events are unpredictable pathophysiologic reactions to needling. Almost all the unavoidable adverse events are minor, short-term and not life-threatening. Before treatment patients should be well informed of these possible reactions. [37,38]

The Systemic approach of Integrative Dry Needling System

1) 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 patients
feel pain. Unfortunately, in many cases the most effective treatment is during the pre-pain or pre-symptom stage, not the symptom-stage.

2) Systemic approach:

In fact, all local symptoms have a systemic effect over the entire human body, including physiologic systems and biomechanical balance of neuromusculoskeletal system. Soft tissue pain can affect the biomechanical balance of a part or of the whole musculoskeletal system. [53]

Integrative Dry Needling System (IDNS) connects the local symptoms to the whole system, especially the systemic balance of biomechanics of human movement, which is very important in sports medicine. [22,53]

3) Prevention of pathologic conditions:

Using IDNS, we can prevent soft tissue dysfunction in many cases if applied in the pre-symptom stage or symptom-free people. 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 largely ignore the preventative approach.

4) Health promotion:

IDNS can be used for prevention of soft tissue dysfunctions, which is the major pathologic condition involved in almost all diseases.

5) IDNS for sports medicine:

We developed this IDNS for athletes because the techniques will (a) optimize physical performance by reducing biomechanical and physical stress during pre-symptom stage, (b) prevent chronic soft tissue injuries and some acute injuries, (c) provide treatments for such conditions like overtraining stress, and soft tissue injuries related to the specific profession and (d) rehabilitation treatments for post-surgical case, (e) early management of post-concussion symptoms that directly relate to the cervical region.
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)

1. Sensitivity: Increases or decreases
2. Specificity (Size/area): increases or decreases
3. Sequence: Homeostatic neuro-trigger points become sensitized in a predictable sequence.
Three Types of Neuro-Trigger Points

1. Homeostatic Neuro-Trigger Points (H’s)

1. Form linear along the nerve trunk in the limbs.
2. Form as an area on 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

2. Paravertebral Neuro-Trigger Points (P’s)

1. Formed by the posterior rami of the spinal nerves; either muscular or cutaneous endings
2. Located on the paravertebral muscles.
3. Correspond to the segmental innervation of the dysfunctional area.
4. Systemic mechanical balance
5. Homeostatic balance- soft tissue dysfunction of visceral pathology
Three Types of Neuro-Trigger Points

3. Symptomatic Neuro-Trigger points (S’s)

1. Formed by the anterior rami of the spinal nerves, either muscular or cutaneous endings
2. Can be located on any structure that has a sensory nerve ending.
3. Local to the site of injury or dysfunction.
4. Specific pathology or related
5. May develop during or immediately after injuries or physiological disorders
6. Acute pain
7. Individual pattern and is not symmetrical.

Pathological Process of Soft Tissue Injury

In needling therapy, tissue damage means soft tissue dysfunction, which includes:

1) Neuropathic factors-Inflamed peripheral nerves (esp. sensory)
2) Inflammation/edema
3) Soft tissue spasms/contracture (muscle shortening, muscle spasm, tendon)
4) (Micro)-circulatory deficiency/blockage (blood, lymphatic)
5) Trophic deficiency (ischemia, hypoxia, edema, toxin build up)
6) Tissue adhesion
7) Scar tissue formation
8) Biomechanical imbalance

Usually acute pain may include 1-4, while chronic pain includes all 1-8. Thus, when we treat pain, we should think of what types of tissue damage is involved in each case and what clinical procedures are more effective in solving that type of tissue damage in order to achieve maximum tissue healing. Both clinicians and patients should understand that during these procedures, immediate pain relief may or may not happen.

Needling therapy does not suppress the natural protective physiologic processes, but removes physical and physiologic stress and shortens the duration of those physiologic processes. Those self-protective processes include pain, inflammation, and fever.

If the conditions of tissue damage are irreversible, the efficacy of needling declines. For example, if a patient has significant scar tissue, adhesion, circulatory deficiency, soft tissue shortening, etc., needling may be less effective, but still helpful in addressing pain, edema and function.
Acute inflammation is a localized response to tissue damage and/or microbial invasion, which serves to isolate the injured tissue and destroy invasive agents to prepare the tissue for repair and healing. Inflammation has a survival value for both the injured tissue and the system as a whole.

However, chronic inflammation can lead to extensive tissue damage, organ dysfunction, and even mortality if it is excessive and prolonged. Inflammation plays a critical role in diseases as diverse as atherosclerosis, diabetes, cancer, osteoarthritis, Alzheimer’s disease and more.

12) Sources of local “muscle pain”:
   a) Mechanical, chemical or physical injury
   b) Repetitive strain, over-stretching or contraction beyond a muscle’s natural capability over a long period of time
   c) Diseased viscera projecting pain to the body surface (partially through shared segmental innervation).
   d) Referred pain associated with a diseased joint and its accessory structures.

13) Neurogenic Inflammation:

   Neurogenic inflammation is characterized by sensitized nerve endings, tissue edema, and infiltration by immune cells. The peripheral nerve endings of sensory fibers contain sensitizing neuropeptides e.g. substance P (SP), calcitonin gene-related peptide (CGRP), and somatostatin...
Under pathologic conditions the neuropeptides can be released from the sensory nerve endings and influence basic tissue functions such as neuronal excitability, local microcirculation, and metabolism. This sterile inflammation is directly related to injuries of nerve tissue (mechanical, physical, or chemical) and is triggered by the release of sensitizing neuropeptides. This causes fluids/proteins to shift from blood vessels to interstitial space leading to further release of sensitizing substances. All of these substances diffuse to neighboring tissues, resulting in an expansion of the inflammation. There is objective evidence for the presence of neurogenic inflammation using T2 weighted Magnetic Resonance Imaging. This provides validation, within the limitations of the study, that the nerve itself can be the perpetuator of soft tissue dysfunction/pain. When nociceptors are sensitized their firing threshold decreases causing even light pressure to initiate impulses to CNS that otherwise, in non-sensitized nerve endings, would not fire (i.e. passive/latent trigger points). As sensitization escalates the firing threshold is further reduced resulting in spontaneously initiated impulses to the CNS without provocation (i.e. active trigger points).

If this process continues for a prolonged period of time chronic inflammation develops. Ischemia, hypoxia, low energy supply, and muscle shortening will be perpetuated and become the vicious cycle of chronic inflammation until appropriate treatment interrupts it. Conceivably, a therapeutic intervention that decreases the mechanical, physical or chemical irritation by normalizing blood flow and the releasing endogenous muscle contraction would be of benefit. Clinically, dry needling is well suited to address these dysfunctions, resulting in restoring normal tissue physiology especially microcirculation and desensitizing nerve endings, which leads to pain reduction. With good knowledge of (neuro) anatomy, clinicians can find the most effective sensitive points (areas) for treatment.

14) Systemic Inflammation:

There is compelling evidence that the presence of inflammation occurs locally at the site of injury/dysfunction but that it rapidly manifests systemically. Inflammation and neurogenic inflammation have been shown to be present both in the plasma and the cerebrospinal fluid of patients with chronic widespread pain (fibromyalgia). A correlation has been made between chronic widespread pain and increased risk of all-cause mortality with the development of cancer or cardiovascular disease being most prevalent. The onset of regional and widespread pain leads to a long-term reduction in the levels of physical exercise. One could hypothesize a negative correlation between an increasing amount of pain and a reduced level of physical activity may lead to an increased mortality risk. As clinicians, we can utilize this information to help our patients with musculoskeletal pain by addressing inflammation and neurogenic inflammation. Dry needling provides a stimulus that assists the body in managing the negative effects of inflammation, while at the same time addressing the pain that may be limiting physical activity. Therefore, if we can combine an active approach such as exercise, which is also a potent anti-inflammatory, in conjunction with dry needling, a passive approach, would this positively influence local and systemic inflammation? Empirically and clinically the answer is yes, but this specific question has yet to be addressed in the literature.
Bloodborne Pathogens: How to protect yourself when performing dry needling

*The information in this lecture has been drawn from the Centers for Disease Control and Prevention (CDC), and Occupational Safety and Health Administration (OSHA). This information has been adapted to the specific practice requirements of dry needling therapy. We suggest that you periodically consult the websites of the CDC and OSHA for new information, recommendations and/or requirements.

CDC and OSHA Universal Precautions  (Standard Precaution)

Healthcare professionals should treat all blood or bodily fluid from patients as though it contains hepatitis, HIV or another infectious agent. Medical professionals should take certain infection-control procedures to reduce the risk of transmitting HIV and other infectious diseases. Medical history and examination are not reliable methods of identifying blood-borne illnesses in all patients. This is particularly true during the early weeks of HIV infection, even though HIV testing has improved. This is also a problem for several other illnesses.

Basic Clean Needling Procedures for Dry Needling

1) Always wash hands between patients, and before and after needling. **This is the most important step.**
2) Always prepare a clean field before performing dry needling. Here the clean field means both clean skin area for needling and clean office environment such as table surface for storing needles. **Note: A clean field is not the same as a sterile field.**
3) Use only sterile single-use needles as instructed in the lecture.
4) **Recommendation:** Always use gloves or finger cots to handle needles before and after insertion to avoid touching blood or body fluid of the patient.
5) If a blood drop appears after removing needles, sterile cotton swab should be used to clean the blood and the swab should be properly disposed of according to specific state and federal laws.
6) Always immediately isolate used needles in special disposal containers.

**These procedures will discussed further in class.**
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