Description of Dry Needling in Clinical Practice

Forward

The American Physical Therapy Association (APTA) created this document to provide background information on the performance of dry needling in clinical practice for members and components. APTA is the national professional association representing more than 80,000 physical therapists, physical therapist assistants, and students nationwide.

Description of Dry Needling

Dry Needling is a skilled intervention that uses a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points, muscular, and connective tissues for the management of neuromusculoskeletal pain and movement impairments. Dry needling (DN) is a technique used to treat dysfunctions in skeletal muscle, fascia, and connective tissue, and, diminish persistent peripheral nociceptive input, and reduce or restore impairments of body structure and function leading to improved activity and participation.

The physiological basis for DN depends upon the targeted tissue and treatment objectives. The treatment of myofascial trigger points (referred to as TrPs) has a different physiological basis than treatment of excessive muscle tension, scar tissue, fascia, and connective tissues. TrPs are hyperirritable spots within a taut band of contractured skeletal muscle fibers that produce local and/or referred pain when stimulated. TrPs are divided into active and latent TrPs dependent upon the degree of irritability. Active TrPs are spontaneously painful, while latent TrPs are only painful when stimulated, for example, with digital pressure. TrPs can be visualized by magnetic resonance imaging and sonography elastography,1-5 which has shown that active TrPs are larger than latent TrPs and feature a reduction in circulation.2 TrPs are physiological contractures,6 characterized by local ischemia and hypoxia,2,7 a significantly lowered pH (active TRPs only),8-10 a chemically altered milieu (active TRPs only),8-10 local and referred pain,11-13 and altered muscle activation patterns.14,15 Although latent TrPs are not spontaneously painful, recent research has shown that they do contribute to nociception, therefore they need to be included in the treatment plan. TrPs are associated with dysfunctional motor endplates,16,17 endplate noise,18 and an increased release of acetylcholine.19-23 TrPs activate muscle nociceptors and are peripheral sources of persistent nociceptive input, thus contributing to the development of peripheral and central sensitization.24-27 Stimulation of TrPs activates the periaqueductal grey and anterior cingular cortex in the brain, 28-30 and enkaphalinergic, serotonergic, and noradrenergic inhibitory systems associated with A-δ (A delta) fibers through segmental inhibition.31,32

DN can be divided into deep and superficial DN. Deep DN has been shown to inactivate TrPs by eliciting local twitch responses (LTR),33,34 which are modulated by the central nervous system.35,36 A LTR is a spinal cord reflex that is characterized by an involuntary contraction of the contractured taut band,36,37 which can be elicited by a snapping palpation or penetration with a needle.38-40

The LTR has been shown to be associated with alleviation and mitigation of spontaneous electrical activity or motor endplate noise;17,18,41,42 a reduction of the concentration of numerous nociceptive, inflammatory, and immune system related chemicals;9,10,43 and relaxation of the taut band.44 Deep DN of TrPs is associated with reduced local and referred pain,45,46 improved range of motion,14,15 and decreased TrP irritability both locally18,47 and more remotely.42,48 DN normalizes the chemical milieu and pH of skeletal muscle8-10 and restores the local circulation.49 Superficial DN is thought to activate mechanoreceptors coupled to slow conducting unmyelinated C fiber afferents, and indirectly, stimulate the anterior cingular cortex.50 Superficial DN may also be mediated through stimulation of A-ð fibers,51 or via stretching of fibroblasts in connective tissue.32 Superficial DN is associated with reduced local and referred pain and improved range of motion,52,53 but it is not known at this time whether superficial DN has any impact on normalizing the chemical environment of active TrPs or reducing motor endplate noise associated with TrPs in general.
The physiological basis for DN treatment of excessive muscle tension, scar tissue, fascia, and connective tissues is not as well described in the literature, but the available research shows that there may be several benefits. Muscle tension is determined by a combination of the basic viscoelastic properties of a muscle and its surrounding fascia, and the degree of activation of the contractile apparatus of the muscle.54 There is some evidence that excessive muscle tension, as seen for example in spasticity, can be alleviated with DN.55,56 Scar tissue has been linked to myofascial pain57 and fibroblasts.58,59 Fibroblasts are specialized contractile cells within the fascia that are of particular interest, as they synthesize, organize, and remodel collagen, dependent upon the tension between the extracellular matrix and the cell.60,61 DN, especially when used in combination with rotation of the needle, can place fibroblasts in a high tension matrix, at which point the fibroblast changes shape and assumes a lamellar shape, and increases its collagen synthesis and cell proliferation.62,63 DN has been shown to directly activate fibroblasts through mechanical manipulation of the needle,31,64,65 which in turn activates the release of cytokines and other pro-inflammatory mediators.66-70 DN can play a substantial role in the process of *mechanotransduction*, which is described as the process by which the body converts mechanical loading into cellular responses.20,71-76 Fibroblast activation with a solid filament has been shown to result in pain neuromodulation.32,66

Indications for Use
DN may be incorporated into a treatment plan when myofascial TrPs are present, which may lead to impairments in body structure, pain, and functional limitations. TrPs are sources of persistent peripheral nociceptive input 24 and their inactivation is consistent with current pain management insights.77 DN also is indicated with restrictions in range of motion due to contractured muscle fibers or taut bands, or other soft tissue restrictions, such as fascial adhesions or scar tissue. TrPs have been identified in numerous diagnoses, such as radiculopathies,78 joint dysfunction,79 disk pathology,80 tendonitis,81

craniomandibular dysfunction,82,83 migraines,84,85 tension-type headaches,86,87 carpal tunnel syndrome,88,89 computer-related disorders,90,91 whiplash associated disorders,92-94 spinal dysfunction,95 pelvic pain and other urologic syndromes,96-99 post-herpetic neuralgia,100,101 complex regional pain syndrome,102,103 nocturnal cramps,104 phantom pain,105,106 and other relatively uncommon diagnoses such as Barré Liéou syndrome,107 or neurogenic pruritus,108 among others.109

Patient Selection

Safe DN practice includes the knowledge, skills, and attributes to perform the technique, which at a minimum incorporates appropriate patient selection, creation of a safe and comfortable environment, assessment of one's own capacity to provide the treatment (eg time constraints, stress, fatigue), safe handling of needles, handling and positioning of the patient, anatomical knowledge, appropriate needle technique (direction and depth), and appropriate monitoring of the patient both during and following treatment.

Regarding patient selection, DN is appropriate for nearly all patients who present with any of the indications for DN. Physical therapists (PTs) must recognize when patients present with significant needle phobia or other anxiety about being treated with needles. PTs must decide on an individual basis whether a patient with needle phobia or significant anxiety is an appropriate candidate for DN. If DN treatment is perceived as a threatening input, it is unlikely to be therapeutic.77 In any case, to be considered for DN, patients must be able to communicate with the PT either directly or via an interpreter and they must be able to consent to the treatment.

Caution is warranted with younger patients. Based on empirical evidence, DN is not recommended for children younger than 12 years of age. When treating children, DN should only be performed with parent and child's consent. Care should be taken assuming a child understands the procedure.

Precautions

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

1. Patients with a needle aversion or phobia may object to the physical therapy treatment with DN. With appropriate education, however, these patients may still consider DN.
2. Patients with significant cognitive impairment may have difficulty understanding the treatment parameters and DN intervention.
3. Patients who are unable to communicate directly or via an interpreter may not be appropriate for DN treatments.
4. Patients may not be willing to be treated with DN.
5. Patients need to be able to give consent for the treatment with DN.
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, ie, postmastectomy, 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 easily be remedied by using silver or gold plated needles.
11. Patients with an abnormal bleeding tendency, ie, 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, that 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.110
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 effects.111-113
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 can still be performed as long as the needle is not directed toward the joint or implant.

Procedure

DN techniques should be guided by randomized clinical trials, basic research, systematic reviews, and clinical expertise.114 Clinician education, training, and clinical experience with DN should be clearly communicated to the patient. PTs should use DN only after obtaining the knowledge, skills, and attributes associated with safe and effective DN techniques. The patient should give verbal consent prior to each treatment with DN. Some jurisdictions do require a written consent for treatments with DN.
In clinical practice, DN is performed once the physical therapy examination and evaluation are completed and clear therapeutic goals and objectives are established. The solid filament needle allows the PT to target tissues that are not manually palpable, such as the subscapularis, iliacus, and lateral pterygoid muscles.115

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, “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.”116 As DN creates “non-intact skin” and recent research has

shown that the most common adverse event of dry needling is minor bleeding,110 it follows that the OSHA Blood Borne Pathogens Standard applies.

- All discarded needles must be disposed of in a sharps box clearly marked "Medical Sharps Waste". These should either be incinerated via a needle collection service or a biological waste disposal contractor, or disposed of according to the Local Health Authority's' protocol/policies.
- **The use of disposable needles is essential**. It would be difficult to defend the use of re-usable or re-sterilized needles in a case of acupuncture induced infection. All the major infections reported in the acupuncture literature, including HIV, but more frequently, Hepatitis B, have resulted from errors in sterilization of re-usable needles.
- Care must be taken to avoid contact with the patient's blood, should bleeding occur. A dry cotton wool ball should be used to absorb it and disposed of into an appropriate container marked "Contaminated Material" and disposed of by incineration or according to Local Health Authority practice.
- Linen contaminated with blood or other body fluids should be treated with Hypochlorite solution (Bleach) before laundering.

MANAGEMENT OF BLOOD AND BODILY FLUIDS SPILLS

Large blood and bodily fluid spills are unlikely in acupuncture practice however if a spill occurs then it is recommended to;

1. Wear personal protective equipment. Heavy duty utility gloves are advised.
2. Absorb the spill with dry disposable paper towels. Since most disinfectants are less active, or even ineffective, in the presence of high concentrations of protein as are found in blood or serum, the bulk of the spilled liquid should be absorbed prior to disinfection.
3. Confine waste in a disposable waterproof bag.
4. Clean the spill site with detergent and water, rinse and dry.
5. Disinfect the spill site using a chlorine-generating disinfectant if bare skin will contact the spill site or if it a difficult to clean surface in the clinical area.
6. Surfaces that cannot be cleaned (in carpet) adequately may need replacement.
7. Disinfectants should be left in contact with the surface for 10 minutes.
8. Sodium hypochlorite solutions must be freshly prepared.
9. Sodium hypochlorite may be irritating to skin therefore protective gloves must be worn.
10. Sodium hypochlorite may corrode metal and damage other surfaces.

An explanation of the procedure to the patient should be performed prior to the application of DN. The patient should be educated on DN rationale and theory, what to expect during and after the treatment, the type of needle used, precautions, possible side effects, and expected outcomes. Possible fear of

needling and pain associated with DN must be addressed. Research has shown that by activating patients' conditioned pain modulation system, patients are able to differentiate and even appreciate the inhibition of their pain by a second noxious stimulus, ie, the pain associated with DN.117 This realization can activate an endogenous pain inhibitory mechanism, which inhibits early nociceptive processing. By placing DN in this broader context, patients can usually tolerate the discomfort associated with DN without risking further sensitization or windup.118.

When using DN techniques for the treatment of TrPs, the PT should palpate the target muscle for a taut band and identify a hyperirritable spot within the taut band confirming TrPs to be treated. DN is usually performed with a solid filiform needle in a tube. The filiform needle in its tube is fixed with the non- needling hand against the suspected area by using a pincer grip or flat palpation depending on the muscle orientation, location, and direction of needle penetration. With the needling hand, the needle is gently loosened from the tube. The top of the needle is tapped or flicked allowing the needle to penetrate the skin. With deep DN, the needle is guided toward the TrP until resistance is felt and a LTR is elicited. The elicitation of a LTR is considered essential in obtaining a desirable therapeutic effect.33,34 The needle is then focused in this area or other neighboring areas by drawing the needle back toward the subcutaneous tissue without taking it out of the skin, and then redirecting the needle toward the remaining TrPs.119 Generally, numerous LTRs can be elicited. Cessation of a given DN procedure may occur as a result of notable decreased frequency or eradication of LTRs, decreased resistance to palpation of the underlying tissue, or patient intolerance of continued needling at that particular site. Once the needle has been withdrawn completely from the skin, pressure (hemostasis) can be applied directly to the skin over the needle insertion site to aid in the prevention of possible swelling or post needling soreness. The muscle is then palpated again to reassess for taut bands and TrPs. Further needling can be performed for the same muscle or for other clinically relevant musculature within the same treatment session. With superficial needling, the needle is just slightly into a muscle in the vicinity of a TrP, but LTRs are not elicited. The needle is kept in place for approximately 30 seconds. At that time, the needle is withdrawn to the subcutaneous tissue. The therapist assesses whether the sensitivity of the TrP has decreased. If so, the DN needling can be discontinued. If the TrP is still sensitive, the needle is guided again into the muscle in the vicinity of the TrP and left in place for approximately 2 minutes.51 The superficial DN procedure is usually repeated over several TrPs in a given region. LTRs are not elicited with superficial needling techniques. Superficial DN techniques may be used when patients do not tolerate deep DN, or when excessive cramping or stiffness of the underlying tissue occurs while needling.

DN can be combined with electrical stimulation in which the needles become the electrodes. To use electrical stimulation combined with DN, a minimum of 2 needles is required per channel, but multiple channels can be used simultaneously. The best results are reached when the needles are placed within

the dermatomes corresponding to the region of dysfunction.119 Frequencies between 2 and 4 Hz with high intensity are commonly used in nociceptive pain conditions and may result in the release of endorphins and enkephalins. For neuropathic pain, frequencies between 80 and 100 Hz are recommended, which are thought to affect the release of dynorphin, gamma-aminobutyric acid, and galanin.120 The needles can be placed directly in or at either side of a TrP.121,122

The DN treatment of fascia and connective tissues, including scar tissue, is similar to the approach for TrPs. The PT should palpate the tissues for adhesions and movement restrictions. The needle is inserted in the same manner as for TrPs, but after insertion, the needle is directed more superficially toward the adhesion or restriction. Rotating the needle facilitates mechanotransduction and eventually will lead to tissue relaxation. The needle is left in place until tissue relaxation has been achieved, at which point the needle can easily be removed. DN of fascia usually is a superficial DN technique.

After DN, functional reassessment should be performed to determine if the established outcome has been achieved. Standardized outcome tools such as the modified Oswestry Disability Index, Disability of the Arm Shoulder Hand, Patient Specific Functional Scale or Lower extremity function scale as examples should be utilized to monitor progress. The patient is monitored during the procedure for tolerance and for possible reproduction of local or referred pain sensations. It should be made clear to the patient that the treatment would cease at any time upon his or her request or if he or she was clearly not tolerating the procedure. Tolerance to the treatment should be evaluated during every session.

Manual soft tissue mobilization, therapeutic exercise, neuromuscular re-education, and functional retraining should be used in combination with DN interventions. The patient should be educated in appropriate self-care techniques post DN treatment, which may include specific stretches of the involved muscles, thermo applications, or gentle TrP pressure. DN is rarely a stand-alone procedure and should be part of a broader physical therapy approach.119 DN should result in a more efficient progression to corrective exercises to improve activity limitations and participation restrictions.

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