

Trigger Point Dry Needling

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Abstract: Trigger point dry needling is a treatment technique used by physical therapists around the world. In the United States, trigger point dry needling has been approved as within the scope of physical therapy practice in a growing number of states. There are several dry needling techniques, based on different models, including the radiculopathy model and the trigger point model, which are discussed here in detail. Special attention is paid to the clinical evidence for trigger point dry needling and the underlying mechanisms. Comparisons with injection therapy and acupuncture are reviewed. Trigger point dry needling is a relatively new technique used in combination with other physical therapy interventions.

Key Words: Myofascial Pain, Trigger Point, Acupuncture, Injection, Physical Therapy

Trigger point dry needling (TrP-DN), also referred to as intramuscular stimulation (IMS), is an invasive procedure in which an acupuncture needle is inserted into the skin and muscle. As the name implies, TrP-DN is directed at myofascial trigger points (MTrPs), which are defined as “hyperirritable spots in skeletal muscle that are associated with a hypersensitive palpable nodule in a taut band”¹. Physical therapists around the world practice TrP-DN as part of their clinical practice and use the technique in combination with other physical therapy interventions. TrP-DN falls within the scope of physical therapy practice in many countries, including Canada, Chile, Ireland, the Netherlands, South Africa, Spain, and the United Kingdom. In 2002, two Dutch medical

courts ruled that TrP-DN is within the scope of physical therapy practice in the Netherlands even though the Royal Dutch Physical Therapy Association has expressed the opinion that TrP-DN should not be part of physical therapy practice²⁻⁴. Of the approximately 9,000 physical therapists in South Africa, over 75% are estimated to employ the technique at least once daily (Stavrou, personal communication, 2006). Physical therapy continuing education programs in TrP-DN in Ireland, Switzerland, and Spain are popular among physical therapists. In Spain, several universities offer academic and specialist certification programs featuring TrP-DN as an integral component of invasive physical therapy⁵.

In the United States (US) and Australia, TrP-DN is not commonly included in physical therapy entry-level educational curricula or post-graduate continuing education programs. Relatively few physical therapists in those two countries have received training in and employ the technique. The only known US physical therapy academic program that includes course work in TrP-DN is the entry-level doctorate of physical therapy curriculum at Georgia State University (Donnelly, personal communica-

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tion, 2006). However, the physical therapy state boards of Colorado, Georgia, Kentucky, Maryland, New Hampshire, New Mexico, South Carolina, and Virginia have determined in recent years that TrP-DN does fall within the scope of physical therapy in those states. Several other state boards are currently reviewing whether dry needling should fall within the scope of physical therapy practice, and the Director of Regulations of the State of Colorado has issued a specific “Director’s Policy on Intramuscular Stimulation” (Table 1)⁶.

therapy according to the 2006 Florida Statutes states that among others, the practice of physical therapy “means the performance of acupuncture only upon compliance with the criteria set forth by the Board of Medicine, when no penetration of the skin occurs”⁹. Whether TrP-DN would be considered as falling under this peculiar definition has not been contested, and the Florida Statutes do not provide any guidelines as to how to perform acupuncture without penetration of the skin⁹.

Table 1: Colorado Physical Therapy Licensure; Policies of the Director; Director’s Policy on Intramuscular Stimulation or IMS (Williams T. *Colorado Physical Therapy Licensure Policies of the Director; Policy 3 – Director’s Policy on Intramuscular Stimulation*. Denver, CO: State of Colorado, Department of Regulatory Agencies, 2005).

1	IMS is a physical intervention that uses dry needles to stimulate trigger points, diagnose and treat neuromuscular pain and functional movement deficits
2	IMS requires an examination and diagnosis, and it treats specific anatomic entities selected according to physical signs
3	IMS is not considered an entry-level skill
4	Physical therapists receive substantial training and have sufficient knowledge in the areas of reducing the incidence and severity of physical disability, movement dysfunction, bodily malfunction, and pain
5	There is substantial medical literature on IMS that has been subjected to peer review
6	Seven states (Georgia, Kentucky, Maryland, New Mexico, New Hampshire, South Carolina, and Virginia) have found IMS to be within the scope of physical therapy as of this Policy’s adoption date
7	The Director expects physical therapists to obtain the necessary training prior to using IMS
8	The Director determines that IMS falls within the scope of physical therapy as defined in section 12-41-103(6), C.R.S., and may be independently practiced by Colorado-licensed physical therapists

On the other hand, the Tennessee Board of Occupational and Physical Therapy concluded in 2002 that TrP-DN is not an acceptable physical therapy technique. The decision of the Tennessee Board was “based on the need for education and training” or in other words, the realization that TrP-DN is not commonly included in the physical therapy curricula of US academic programs^{5,7}. Some state laws have defined the practice of physical therapy as non-invasive, which would implicitly put TrP-DN outside the scope of physical therapy in those states. For example, the Hawaii Physical Therapy Practice Act specifies that physical therapists not be allowed to penetrate the skin⁸. The definition of the practice of physical

The introduction of TrP-DN to American physical therapists shares many similarities with the introduction of manual therapy. When during the 1960s, Paris expressed his interest in manual therapy, he experienced considerable resistance, not only from academia but also from employers, the American Physical Therapy Association (APTA), and even from Dr. Janet Travell¹⁰. Paris reported that in 1966, Dr. Travell blocked his membership in the North American Academy of Manipulative Medicine, an organization she had founded with Dr. John Mennell, on the grounds that “manipulation is a diagnostic and therapeutic tool to be reserved for physicians only”¹⁰. Similarly, the 2002 rejection of TrP-DN by the Tennessee

Board of Occupational and Physical Therapy was in part based on the testimony of an academic expert witness⁷. In 2006, the APTA omitted an educational activity about physical therapy and dry needling from the tentative agenda of its annual conference, while the Royal Dutch Physical Therapy Association upheld the opinion that TrP-DN should not fall within the scope of physical therapy practice. In October 2006, the Virginia Board of Physical Therapy heard arguments from a physician organization against physical therapists using TrP-DN. To the contrary, physical therapists in South Africa are allowed to perform botulinum toxin injections in the management of persons with MTrPs. Within the context of autonomous physical therapy practice, TrP-DN does seem to fit the current practice model in spite of the reservations of other disciplines and some physical therapy professional organizations.

In order to practice TrP-DN, physical therapists need to be able to demonstrate competence or adequate training in the technique and that they practice in a jurisdiction where TrP-DN is considered within the scope of physical therapy practice. Many country and state physical therapy statutes address the issue of competence by including language such as this: “physical therapists shall not perform any procedure or function which they are by virtue of education or training not competent to perform”⁵. Obviously, physical therapists employing TrP-DN must have excellent knowledge of anatomy and be very familiar with its indications, contraindications, and precautions. This article provides an overview of TrP-DN in the context of contemporary physical therapy practice.

Dry Needling Techniques

Because dry needling techniques emerged empirically, different schools and conceptual models have been developed, including the radiculopathy model, the MTrP model, and the spinal segmental sensitization model^{1,5,11-13}. In addition, there are other less common needling approaches, such as neural acupuncture and automated or electrical twitch-obtaining intramuscular stimulation¹⁴⁻²². In neural acupuncture, acupuncture points are infiltrated with lidocaine for the treatment of myofascial

pain^{14,15}. A medical specialist, Dr. Jennifer Chu, developed electrical twitch-obtaining intramuscular stimulation; this approach combines aspects of the radiculopathy model with the trigger point model¹⁶⁻²³.

The radiculopathy model will be reviewed briefly, while the MTrP model will be discussed in detail. The spinal segmental sensitization model and neural acupuncture are not included in this article due to their exclusive use of injections, which are outside the scope of physical therapy practice in most jurisdictions^{5,12}.

Another classification is based on the depth of the needle insertion and distinguishes superficial dry needling (SDN) and deep dry needling (DDN)^{24,25}. Examples of SDN include Baldry’s SDN approach and Fu’s Subcutaneous Needling, which fall within the trigger point (TrP) model^{24,26-29}. The needling approach advocated by the radiculopathy model is a form of DDN. The TrP model includes both superficial dry needling (TrP-SDN) and deep dry needling (TrP-DDN) (Table 2).

Radiculopathy Model

The radiculopathy model is based on empirical observations by Canadian medical physician Dr. Chan Gunn, who was one of the early pioneers of dry needling. A review of TrP-DN would be incomplete without including a brief summary of Gunn’s needling approach, although the radiculopathy model no longer includes TrP-DN¹³. Initially, Gunn incorporated MTrPs in his thinking, but fairly soon he moved away from MTrPs and further developed and defined his DDN approach, referred to as intramuscular stimulation or IMS¹⁸⁻²⁰. Gunn introduced the term “IMS” to distinguish his approach from other needling and injection approaches, but the term is frequently used to describe any dry needling technique³⁰. According to Gunn’s web site, “hundreds of doctors and physiotherapists from all around the world” have been trained in the technique³¹. The web site also mentions that “some practitioners employ altered versions of IMS not endorsed by Professor Gunn or the medical community”³¹.

The Gunn IMS technique is based on the premise that myofascial pain syndrome (MPS) is always the result of peripheral neuropathy or radiculopathy, defined by Gunn

Table 2: Models of Needling.

	TrP Model	Radiculopathy Model	Spinal Segmental Sensitization Model
Superficial DN	Yes	No	No
Deep DN	Yes	Yes	No
Injection therapy	Yes	No	Yes

TrP- trigger point; DN- dry needling

as “a condition that causes disordered function in the peripheral nerve”³⁰. In Gunn’s view, shortening of the paraspinal muscles, particularly the multifidi muscles, leads to disc compression, narrowing of the intervertebral foramina, or direct pressure on the nerve root, which subsequently would result in peripheral neuropathy and compression of supersensitive nociceptors and pain.

The radiculopathy model is based on Cannon and Rosenblueth’s Law of Denervation, which maintains that the function and integrity of innervated structures is dependent upon the free flow of nerve impulses³². When the flow of nerve impulses is restricted, all innervated structures, including skeletal muscle, smooth muscle, spinal neurons, sympathetic ganglia, adrenal glands, sweat cells, and brain cells become atrophic, highly irritable, and supersensitive³⁰. Gunn suggested that many common diagnoses, such as Achilles tendonitis, lateral epicondylitis, frozen shoulder, chondromalacia patellae, headaches, plantar fasciitis, temporomandibular joint dysfunction, myofascial pain syndrome (MPS), and others, might in fact be the result of neuropathy³⁰. Chu has adapted Gunn’s radiculopathy model in that she has recognized that MTrPs are frequently the result of cervical or lumbar radiculopathy^{16,18,22,23}.

Gunn¹³ maintained that the most effective treatment points are always located close to the muscle motor points or musculotendinous junctions, which are distributed in a segmental or myotomal fashion in muscles supplied by the primary anterior and posterior rami. Because the primary posterior rami are segmentally linked to the paraspinal muscles, including the multifidi, and the primary anterior rami with the remainder of the myotome, the treatment must always include the paraspinal muscles as well as the more peripheral muscles. Gunn found that the tender points usually coincided with painful palpable muscle bands in shortened and contracted muscles. He suggested that nerve root dysfunction is particularly due to spondylotic changes. According to Gunn, relatively minor injuries would not result in severe pain that continues beyond a “reasonable” period, unless the nerve root was already in a sensitized state prior to the injury¹³.

Gunn’s assessment technique is based on the evaluation of specific motor, sensory, and trophic changes. The main objective of the initial examination is to find characteristic signs of neuropathic pain and to determine which segmental levels are involved in a given individual. The examination is rather limited and does not include standard medical and physical therapy evaluation techniques, including common orthopaedic or neurological tests, laboratory tests, electromyographic or nerve conduction tests, or radiologic tests, such as MRI, CT, or even X-rays. Motor changes are assessed through a few functional motor tests and through systematic palpation of the skin and muscle bands along the spine and in those peripheral muscles that belong to the involved

myotomes. Gunn emphasized evaluating the paraspinal regions for trophic changes, which may include orange peel skin (*peau d’orange*), dermatomal hair loss, and differences in skin folds and moisture levels (dry versus moist skin)¹³.

Although Gunn et al completed one of the first dry needling outcome studies, which demonstrated that IMS can be an effective treatment option, there are no studies that substantiate the theoretical basis of the radiculopathy model or of the IMS needling interventions^{5,33}. Although Gunn emphasized the importance of being able to objectively verify the findings of neuropathic pain³⁴, there also are no interrater reliability studies and no studies that support the idea that the described findings are indeed indicative of neuropathic pain⁵. For example, there is no scientific evidence that an MTrP is always a manifestation of radiculopathy resulting from trauma to a nerve, even though it is conceivable that one possible cause of the formation of MTrPs is indeed nerve damage or dysfunction³⁵. Interestingly, Gunn did not regard his model as a hypothesis but rather considered it a mere “description of clinical findings that can be found by anyone who examines a patient for radiculopathy”³⁴. However, without scientific validation, the radiculopathy model was never developed beyond the hypothetical stage. Gunn’s conclusion that relative minor injuries would not result in chronic pain without prior sensitization of the nerve root is inconsistent with many current neurophysiological studies that confirm that persistent and even relatively brief nociceptive input can result in pain-producing plastic dorsal horn changes³⁶⁻⁴².

Trigger Point Model

Clinicians practicing from the perspective of the trigger point model specifically target MTrPs. The clinical manifestation of MTrPs is referred to as MPS and is defined as the “sensory, motor, and autonomic symptoms caused by MTrPs”¹. Myofascial trigger points may consist of multiple contraction knots, which are thought to be due to an excessive release of acetylcholine (ACh) from select motor endplates, and can be divided into active and latent MTrPs^{1,43,44}. The release of ACh has been associated with endplate noise, a characteristic electromyographic discharge at MTrP sites, consisting of low-amplitude discharges in the order of 10-50 μ V and intermittent high-amplitude discharges (up to 500 μ V) in painful MTrPs⁴⁵⁻⁴⁷. Active MTrPs can spontaneously trigger local pain in the vicinity of the MTrP, or they can refer pain or paraesthesiae to more distant locations. They cause muscle weakness, range of motion restrictions, and several autonomic phenomena. Latent MTrPs do not trigger local or referred pain without being stimulated, but they may alter muscle activation patterns and contribute to limited range of motion⁴⁸. Simons, Travell, and Simons documented the referred pain patterns of MTrPs in 147 muscles¹, while Dejung et al⁴⁹ published slightly different

referred pain patterns based on their empirical findings. Several case reports and research studies have examined referred pain patterns from MTrPs⁵⁰⁻⁷¹. Following Kellgren's early studies of muscle referred pain patterns, which contributed to Travell's interest in musculoskeletal pain, many studies have been published on muscle referred pain without specifically mentioning MTrPs. This brings up the question as to whether referred pain patterns are characteristic of each muscle or can be established for specific MTrPs⁷²⁻⁸⁴. MTrPs are identified manually by using either a flat palpation—for example with palpation of the infraspinatus, the masseter, temporalis, and lower trapezius—or a pincer-type palpation technique, for example with palpation of the sternocleidomastoid, the upper trapezius, and the gastrocnemius¹.

The interrater reliability of identifying MTrPs has been studied by several researchers and was established in a small number of studies⁸⁵⁻⁸⁷. Gerwin et al⁸⁶ concluded that training is essential to reliably identify MTrPs, while Sciotti et al⁸⁷ confirmed the clinically adequate interrater reliability of locating latent MTrPs in the trapezius muscle. In an unpublished study by Bron et al, three blinded observers were able to reach acceptable agreement on the presence or absence of TrPs in the shoulder region. The authors concluded that palpation of MTrPs is reliable and might be a useful tool in the diagnosis of myofascial pain in patients with non-traumatic shoulder pain⁸⁵. A recent study of the intrarater reliability of identifying MTrPs in patients with rotator cuff tendonitis reached perfect agreement ($\kappa=1.0$) for the taut band, spot tenderness, jump sign, and pain recognition, which the author attributed to methodological rigor⁸⁸. However, considering the small sample size and limited variation in the subjects used in this study, it might have been inappropriate to establish the intrarater reliability using the kappa statistic⁸⁹.

Diagnostically, TrP-DDN can assist in differentiating between pain that originates from a joint, an entrapped nerve, or a muscle. Mechanical stimulation or deformation of a sensitized MTrP can reproduce the patient's pain complaint due to MTrPs when the DDN technique is used^{90,91}. In most instances, it is relatively easy to trigger the patient's referred pain pattern with TrP-DDN compared to manual techniques. When the pain originates in deeper structures, such as the multifidi, supraspinatus, psoas, or soleus muscles, manual techniques may be inadequate and may not provide sufficient diagnostic information. In addition, myofascial pain may mimic radicular pain syndromes⁵⁵. For example, pain resembling a C8 or L5 radiculopathy may be due to MTrPs in the teres minor muscle or the gluteus minimus muscle, respectively. If needling an MTrP elicits the patient's familiar referred pain down the involved extremity, the cause of at least part of the pain is likely myofascial in nature and not (solely) neurogenic^{55,92}. The ability to reproduce the patient's pain has great diagnostic value and can assist

in the differential diagnostic process.

One of the unique features of MTrPs is the phenomenon of the so-called local twitch response (LTR), which is an involuntary spinal cord reflex contraction of the muscle fibers in a taut band following palpation or needling of the band or MTrP^{93,94}. Local twitch responses can be elicited manually by snapping taut bands that harbor MTrPs. When using invasive procedures like TrP-DDN or injections therapeutically, eliciting LTRs is essential⁹⁵. Not only is the treatment outcome much improved, but LTRs also confirm that the needle was indeed placed into a taut band, which is particularly important when needling MTrPs close to peripheral nerves or viscera, such as the lungs²⁵.

Intramuscular Electrical Stimulation

One of the advantages of TrP-DN is that physical therapists can easily combine the needling procedures with electrical stimulation. Several terms have been used to describe electrical stimulation through acupuncture needles, including percutaneous electrical nerve stimulation (PENS), percutaneous electrical muscle stimulation, percutaneous neuromodulation therapy, and electroacupuncture (EA)⁹⁶⁻⁹⁹. Mayoral del Moral suggested using the term "intramuscular electrical stimulation" (IES) when applied within the context of physical therapy practice²⁵. White et al⁹⁹ demonstrated that the best results were achieved when the needles were placed within the dermatomes corresponding to the local pathology. Using the needles as electrodes offers many advantages over more traditional transcutaneous nerve stimulation (TENS). Not only is the resistance of the skin to electrical currents eliminated, but several studies have also demonstrated that PENS provided more pain relief and improved functionality than TENS, for example in patients with sciatica and chronic low back pain^{100,101}. Animal experiments have shown that EA can modulate the expression of N-methyl-D-aspartate in primary sensory neurons with involvement of glutamate receptors^{102,103}.

Not much is known about the optimal treatment parameters for IES. While EA units offer many options for amplitude and frequencies, there is little research linking these options to the management of pain. 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, it is recommended to use currents with a frequency between 80 and 100 Hz, which are thought to affect release of dynorphin, gamma-aminobutyric acid, and galanin¹⁰⁴. However, a study examining the effects of high- and low-frequency EA in pain after abdominal surgery found that both frequencies significantly reduced the pain¹⁰⁵. Another study concluded that high-intensity levels were more effective than low-intensity stimulation⁹⁷. In IES, the negative electrode is usually placed in the

MTrP and the positive in the taut band but outside the MTrP. Elorriaga recommended inserting two converging electrodes in the MTrP, while Mayoral del Moral et al suggested inserting the electrodes at both sides of an MTrP inside the taut band^{106,107}. Chu developed an electrical stimulation modality that automatically elicits LTRs, which she referred to as “electrical twitch-obtaining intramuscular stimulation” or ETOIMS^{18,21,22}. The technique can also be simulated using standard EMG equipment²³.

Superficial Dry Needling

In the early 1980s, Baldry was concerned about the risk of causing a pneumothorax when treating a patient with an MTrP in the anterior scalene muscle. Rather than using TrP-DDN, he inserted the needle superficially into the tissue immediately overlying the MTrP. After leaving the needle in for a short time, the exquisite tenderness at the MTrP was abolished and the spontaneous pain was alleviated²⁴. Based on this experience, Baldry expanded the practice of SDN and applied the technique to MTrPs throughout the body with good empirical results, even in the treatment of MTrPs in deeper muscles²⁴. He recommended inserting an acupuncture needle into the tissues overlying each MTrP to a depth of 5-10 mm for 30 seconds²⁴. Because the needle does not necessarily reach the MTrP, LTRs are not expected. Nevertheless, the patient commonly experiences an immediate decrease in sensitivity following the needling procedure. If there is any residual pain, the needle is reinserted for another 2-3 minutes. When using the TrP-SDN technique, Baldry commented that the amount of needle stimulation depends on an individual’s responsiveness. In so-called average responders, Baldry recommended leaving the needle *in situ* for 30-60 seconds. In weak responders, the needle may be left for up to 2 or 3 minutes. There is some evidence from animal studies that this responsiveness is at least partially genetically determined. Mice deficient in endogenous opioid peptide receptors did not respond well to needle-evoked nerve stimulation¹⁰⁸. Baldry suggested that weak responders might have excessive amounts of endogenous opioid peptide antagonists²⁴. Baldry preferred TrP-SDN over TrP-DDN, but indicated that in cases where MTrPs were secondary to the development of radiculopathy, he would consider using TrP-DDN²⁴.

Another SDN technique was developed in 1996 in China^{27,29}. Initially, Fu’s subcutaneous needling (FSN), also referred to as “floating needling,” was developed to treat various pain problems without consideration of MTrPs, such as chronic low back pain, fibromyalgia, osteoarthritis, chronic pelvic pain, post-herpetic pain, peripheral neuropathy, and complex regional pain syndrome²⁹. In a recent paper, Fu et al²⁸ applied their needling technique to MTrPs and examined whether the direction of the needle is relevant in that treatment. The needle



Fig. 1: Trigger point dry needling of the trapezius muscle



Fig. 2: Trigger point dry needling of the thoracic multifidi muscles using a Japanese needle plunger



Fig. 3: Trigger point dry needling of the gluteus medius muscle

was either directed across muscle fibers or along muscle fibers toward an MTrP. The authors concluded that FSN had an immediate effect on inactivating MTrPs in the neck, irrespective of the direction of the needle²⁸.

The FSN needle consists of three parts: a 31 mm beveled-tip needle with a 1 mm diameter, a soft tube similar to an intravenous catheter, and a cap. The needle is directed toward a painful spot or MTrP at an angle of 20–30° with the skin but does not penetrate muscle tissue. The technique acts solely in the subcutaneous layers. The needle is advanced parallel to the skin surface until the soft tube is also under the skin. At that time, the needle is moved smoothly and rhythmically from side to side for at least two minutes, after which the needle is removed from the soft tube, which stays in place. Patients go home with the soft tube still inserted under the skin. The soft tube can move slightly underneath the skin because of patients' movements and is thought to continue to stimulate subcutaneous connective tissues while in place²⁷⁻²⁹. The soft tube is kept under the skin for a few hours for acute injuries and for at least 24 hours for chronic pain problems, after which it is removed^{27,29}. According to Fu et al, the technique has no adverse or side effects and usually induces an immediate reduction of pain. The needle technique should not be painful as subcutaneous layers are poorly innervated²⁷⁻²⁹. Because FSN was only recently introduced to the Western world, the technique has not been used much outside of China and there are no other clinical outcome studies.

Effectiveness of Trigger Point Dry Needling

The effectiveness of TrP-DN is, to some extent, dependent upon the ability to accurately palpate MTrPs. Without the required excellent palpation skills, TrP-DN can be a rather random process. In addition to being able to palpate MTrPs before using TrP-DN, it is equally important that clinicians develop the skills to accurately needle the MTrPs identified with palpation. Physical therapists need to learn how to visualize a 3-dimensional image of the exact location and depth of the MTrP within the muscle. The level of kinaesthetic perception needed to perform TrP-DN safely and accurately is a learned skill. Noë¹⁰⁹ maintained that such perception is constituted in part by sensori-motor knowledge but also depends on having sufficient knowledge of the subject. The ability to perceive the end of the needle and the pathways the needle takes inside the patient's body is a developed skill on the part of the physical therapist, a process Noë referred to as an "enactive" approach to perception¹⁰⁹. A high degree of kinaesthetic perception allows a physical therapist to use the needle as a palpation tool and to appreciate changes in the firmness of those tissues pierced by the needle²⁵. For example, a trained clinician will appreciate the difference between needling the skin, the subcutaneous tissue, the anterior lamina of the rectus abdominis muscle, the muscle itself, a taut band in the muscle,

the posterior lamina, and the peritoneal cavity, thereby increasing the accuracy of the needling procedure and reducing the risks associated with it²⁵.

Considering the invasive nature of TrP-DN, it is very difficult to develop and implement double blind and randomized placebo-controlled studies¹¹⁰⁻¹¹³. When researchers use minimal, sham, superficial, or placebo needling, there is growing evidence that even light touch of the skin can stimulate mechanoreceptors coupled to slow conducting afferents, which causes activity in the insular region and subsequent increased feelings of well-being and decreased feelings of unpleasantness¹¹⁴⁻¹¹⁷. However, several case reports, review articles, and research studies have attested to the effectiveness of TrP-DN. Ingber¹¹⁸ documented the successful TrP-DN treatment of the subscapularis muscles in three patients diagnosed with chronic shoulder impingement syndrome. One patient required a total of 6 TrP-DN treatments out of a total of 11 visits. The treatments were combined with a progressive therapeutic stretching program and later with muscle strengthening. The second patient had a 1-year history of shoulder impingement. He required 11 treatments with TrP-DN before returning to playing racquetball. Both patients had failed previous physical therapy treatments, which included ice, electrical stimulation, ultrasound, massage, shoulder limbering, isotonic strengthening, and the use of an upper body ergometer. The third patient was a competitive racquetball player with a 5-month history of sharp anterior shoulder pain, who was unable to play in spite of medical treatment. After one session of TrP-DN, he was able to compete in a racquetball tournament. Throughout the tournament, he required twice weekly TrP-DN treatments. Following the tournament, he had just a few follow-up visits. The patient reported a return of full power on serves and forehand strokes¹¹⁸.

In 1979, Czech medical physician Karel Lewit published one of the first clinical reports on the subject¹¹⁹. Lewit confirmed the findings of Steinbrocker that the effects of needling were primarily due to mechanical stimulation of MTrPs. As early as 1944, Steinbrocker had commented on the effects of needle insertions on musculoskeletal pain without using an injectable¹²⁰. Lewit found that dry needling of MTrPs caused immediate analgesia in nearly 87% of needle sites. In over 31% of cases, the analgesia was permanent, while 20% had several months of pain relief, 22% several weeks, and 11% several days; 14% had no relief at all¹¹⁹.

Cummings¹²¹ reported a case of a 28-year-old female with a history of a left axillary vein thrombosis, a subsequent venoplasty, and a trans-axillary resection of the left first rib. The patient developed chronic chest pain with left arm, forearm, and hand pain. The symptoms were initially attributed to traction on the intercostobrachial nerve, rotator cuff atrophy, Raynaud's phenomenon, and possible scarring around the C8/T1 nerve root. After 7

months of chronic pain, the patient consulted with a clinician familiar with MTrPs, who identified an MTrP in the left pectoralis major muscle. She was treated with only 2 gentle and brief needle insertions of 10 seconds each, combined with a home stretching program. After 2 weeks, she had few remaining symptoms. One additional treatment with two TrP-DN insertions resolved the symptoms within two hours¹²¹. In another case report, Cummings described a 33-year-old woman with an 8-year history of knee pain, who was successfully treated with two sessions of EA directed at an MTrP in the ilopsoas muscle⁵⁴.

Weiner and Schmäder⁶⁴ described the successful use of TrP-DN in the treatment of five persons with post-herpetic neuralgia. For example, a 71-year-old female with post-herpetic neuralgia for 18 months required only 3 TrP-DN sessions during which LTRs were elicited. Previous treatments included gabapentin, oxycodone, acetaminophen, chiropractic manipulations, and epidural corticosteroids. Another patient was treated with a combination of cervical percutaneous electrical nerve stimulation and TrP-DN for 4 sessions resulting in a dramatic decrease in pain. The authors suggested that prospective studies of the correlation between MTrPs and post-herpetic neuralgia are desperately needed⁶⁴. Only one previous report has described the relevance of MTrPs in the symptomatology of post-herpetic neuralgia⁵².

A recent study comparing the effects of therapeutic and placebo dry needling on hip straight leg raising, internal rotation, muscle pain, and muscle tightness in subjects recruited from Australian Rules football clubs found no differences in range of motion and reported pain between the two groups¹²². Unfortunately, the researchers attempted to treat MTrPs in the gluteal muscles of presumably well-trained athletes with a 25 mm needle, which most likely is too short to reach deeper points in conditioned individuals. In other words, both interventions may have been placebos, as direct needling of pertinent MTrPs may not have occurred. At the same time, there are many other muscles that may need to be treated before changes in hip range of motion would be measurable, including the piriformis and other hip rotators, the abductor magnus, and the hamstrings. Hamstring pain is frequently due to MTrPs in the hamstrings or the adductor magnus and not from gluteal MTrPs¹²³.

Another Australian study considered the effects of latent MTrPs on muscle activation patterns in the shoulder region⁴⁸. During the first phase of the study, subjects with latent MTrPs were found to have abnormal muscle activation patterns compared to healthy control subjects. The time of onset of muscle activity of the upper and lower trapezius, the serratus anterior, the infraspinatus, and middle deltoid muscles was determined using surface electromyography. During the second phase, the subjects with latent MTrPs and abnormal muscle activation patterns

were randomly assigned to either a treatment group or a placebo group. Subjects in the treatment group were treated with TrP-DN and passive stretching. Subjects in the placebo group received sham ultrasound. After TrP-DN and stretching, the muscle activation patterns of the treated subjects had returned to normal. Subjects in the placebo treatment group did not change after the sham treatment. This study confirmed that latent MTrPs could significantly impair muscle activation patterns⁴⁸. The authors also established that TrP-DN combined with muscle stretches facilitated an immediate return to normal muscle activation patterns, which may be especially relevant when optimal movement efficiency is required in sports participation, musical performance, and other demanding motor tasks, for example.

A 2005 Cochrane review aimed to “assess the effects of acupuncture for the treatment of non-specific low back pain and dry needling for myofascial pain syndrome in the low back region”¹²⁴. Cochrane reviews are highly regarded, rigorous reviews of the available evidence of clinical treatments. The reviews become part of the Cochrane Database of Systematic Reviews, which is published quarterly as part of the Cochrane Library. For this 2005 review, the researchers reviewed the CENTRAL, MEDLINE, and EMBASE databases, the Chinese Cochrane Centre database of clinical trials, and Japanese databases from 1996 to February 2003. Only randomized controlled trials were included in this review using the strict guidelines from the Cochrane Collaboration. Although the authors did not find many high-quality studies, they concluded that dry needling might be a useful adjunct to other therapies for chronic low back pain. They did call for more and better quality studies with greater sample sizes¹²⁴.

Recent research by Shah et al¹²⁵ at the US National Institutes of Health underscored the importance of eliciting LTRs with TrP-DDN. Those authors sampled and measured the *in vitro* biochemical milieu within normal muscle and at active and latent MTrPs in near real-time at the sub-nanogram level of concentration; they found significantly increased concentrations of bradykin, calcitonin-gene-related-peptide, substance P, tumor necrosis factor-, interleukin-1, serotonin, and norepinephrine in the immediate milieu of active MTrPs only¹²⁵. After the researchers elicited an LTR at the active and latent MTrPs, the concentrations of the chemicals in the immediate vicinity of active MTrPs spontaneously reduced to normal levels. Not only did this study suggest that LTRs might normalize the chemical environment near active MTrPs and reduce the concentration of several nociceptive substances, it also confirmed that the clinical distinction between latent and active MTrPs was associated with a highly significant objective difference in the nociceptive milieu¹²⁵. Another study confirmed the importance of eliciting LTRs with TrP-DDN¹²⁶. In a rabbit study of the effect of LTRs on endplate noise, Chen et al found that eliciting LTRs actually diminished the spontaneous

electrical activity associated with MTrPs^{44,126}.

Dilorenzo et al¹²⁷ conducted a prospective, open-label, randomized study on the effect of DDN on shoulder pain in 101 patients with a cerebrovascular accident. The patients were randomly assigned to a standard rehabilitation-only group or to a standard rehabilitation and DDN group. Subjects in the DDN group received 4 DDN treatments at 5- to 7-day intervals into MTrPs in the supraspinatus, infraspinatus, upper and lower trapezius, levator scapulae, rhomboids, teres major, subscapularis, latissimus dorsi, triceps, pectoralis, and deltoid muscles. Compared to subjects in the rehabilitation-only group, subjects in the DDN group reported significantly less pain during sleep and during physical therapy treatments, had more restful sleep, and experienced significantly less frequent and less intense pain. They reduced their use of analgesic medications and demonstrated increased compliance with the rehabilitation program. The authors concluded that DDN might provide a new therapeutic approach to managing shoulder pain in patients with hemiparesis.

Several studies have compared SDN to DDN¹²⁸⁻¹³⁰. Ceccherelli et al¹²⁸ randomly assigned 42 patients with lumbar myofascial pain into two groups. The first group was treated with a shallow needle technique to a depth of 2 mm at 5 predetermined traditional acupuncture points, while the second group received intramuscular needling at 4 arbitrarily selected MTrPs. The DDN technique resulted in significantly better analgesia than the SDN technique¹²⁸. Another randomized controlled clinical study compared the efficacy of standard acupuncture, SDN, and DDN in the treatment of elderly patients with chronic low back pain¹²⁹. The standard acupuncture group received treatment at traditional acupuncture points with the needles inserted into the muscle to a depth of 20 mm. The points were stimulated with alternate pushing and pulling of the needle until the subjects felt dull pain or the “de qi” acupuncture sensation, after which the needle was left in place for 10 minutes. This “de qi” sensation is a desired sensation in traditional acupuncture. The TrP-DN groups received treatment at MTrPs in the quadratus lumborum, iliopsoas, piriformis, and gluteus maximus muscles, among others. In the SDN group, the needles were inserted into the skin over MTrPs to a depth of approximately 3 mm. Once a subject reported dull pain or the “de qi” sensation mentioned above, the needle was kept in place for 10 more minutes. In the DDN group, the needle was advanced an additional 20 mm. Using the same alternate pushing and pulling needle technique, the needle was again kept in place for an additional 10 minutes once an LTR was elicited. The authors concluded that DDN might be more effective in the treatment of low back pain in elderly patients than either standard acupuncture or SDN¹²⁹. While the authors of both studies concluded that DDN might be the most effective treatment option, it is important to

realize that the protocols used in these studies for both SDN and DDN do not reflect common clinical practice for either needling technique. For example, needles are rarely kept in place for 10 minutes. Also, Baldry²⁴ did not recommend inserting the needle to only a 2 mm depth. In the second study, only one LTR was required in the DDN group. In clinical practice, multiple LTRs are elicited per MTrP⁹⁵. The second study had a relatively small sample size of only 9 subjects per group, which may make any definitive conclusions somewhat premature. Neither study considered Baldry's notion of differentiating the technique based on the response pattern of the patient.

Edwards and Knowles¹³¹ conducted a randomized prospective study of superficial dry needling combined with active stretching. Subjects received either SDN combined with active stretching exercises, stretching exercises alone, or no treatments. After 3 weeks, there were no statistically significant differences between the three groups. However, after another 3 weeks, the SDN group had significantly less pain compared to the no-intervention group and significantly higher pressure threshold measures compared to the active stretching-only group. This study did support the SDN technique, even though not all outcome measures were blinded¹³¹. Macdonald et al¹³² demonstrated the efficacy of SDN in a randomized study of subjects with chronic lumbar MTrPs. The active group received SDN with the needles inserted to a depth of 4 mm over the MTrPs. The control group received sham electrotherapy. The researchers concluded that SDN was significantly better than this placebo¹³². Unfortunately, these studies did not follow Baldry's procedures either. However, the techniques are similar with some variations in duration and depth of insertion. Lastly, a study comparing superficial versus deep acupuncture found no statistical difference in reduction of idiopathic anterior knee pain between the two methods. Pain measurements decreased significantly for both groups¹³³.

Mechanisms of Trigger Point Dry Needling

In spite of a growing body of literature exploring the etiology and pathophysiology of MTrPs, the exact mechanisms of TrP-DN remain elusive⁵. The finding that LTRs can normalize the chemical environment of active MTrPs and diminish endplate noise associated with MTrPs in rabbits nearly instantaneously is critical in understanding the effects of TrP-DN, but neither has been explored in depth^{125,126}. Simons, Travell, and Simons¹ indicated that the therapeutic effect of TrP-DDN was mechanical disruption of the MTrP contraction knots. Since MTrPs are associated with dysfunctional motor endplates, it is conceivable that TrP-DDN damages or even destroys motor endplates and causes distal axon denervations when the needle hits an MTrP. There is some evidence that this could trigger specific changes in the

endplate cholinesterase and ACh receptors as part of the normal muscle regeneration process^{134,135}. Needles used in TrP-DDN have a diameter of approximately 160–300 μm , which would cause very small focal lesions without any significant risk of scar tissue formation. In comparison, the diameter of human muscle fibers ranges from 10–100 μm . Muscle regeneration involves satellite cells, which repair or replace damaged myofibers¹³⁶. Satellite cells may migrate from other areas in the muscle and are activated following actual muscle damage but also after light pressure as used in manual trigger point therapy^{134,137}. Muscle regeneration following TrP-DN is expected to be complete in approximately 7–10 days¹³⁸. It is not known whether repeated needling during the regeneration phase in the same area of a muscle can exhaust the regenerative capacity of muscle tissue, giving rise to an increase in connective tissue and impairing the reinnervation process¹³⁸. An accurately placed needle may also provide a localized stretch to the contracted cytoskeletal structures, which would allow the involved sarcomeres to resume their resting length by reducing the degree of overlap between actin and myosin filaments⁵. To provide ultra-localized stretch to the contracted structures, it may be beneficial to rotate the needle¹³⁹. In addition, the mechanical pressure exerted via the needle may electrically polarize muscle and connective tissues. A physical characteristic of collagen fibers is their intrinsic piezoelectricity, a property that allows tissues to transform mechanical stress into electrical activity necessary for tissue remodeling¹⁴⁰.

TrP-SDN involves a very light stimulus aimed at minimizing pain responses²⁴. Based on their studies on rats and mice, Swedish researchers have suggested that the reduction of pain after TrP-SDN may partially be due to the central release of oxytocine^{141,142}. Baldry²⁴ suggested that with TrP-SDN, the acupuncture needle stimulates A δ sensory nerve afferents, an assumption based primarily on the work of Bowsher, who maintained that sticking a needle into the skin is always a noxious stimulus¹⁴³. According to Baldry, A δ nerve fibers are stimulated for as long as 72 hours after needle insertion. Prolonged stimulation of the sensory afferent A δ nerve fibers may activate enkephalinergic, serotonergic, and noradrenergic inhibitory systems, which would imply that TrP-SDN could cause opioid-mediated pain suppression¹⁴⁴. However, other than in so-called “strong responders,” TrP-SDN is usually painless even when applied over painful MTrPs. It is, therefore, questionable that the effects of TrP-SDN can be explained through their alleged stimulation of A δ fibers. As Millan has summarized in his comprehensive review¹⁴⁵, A δ fibers are divided into two types: Type I A δ fibers are high-threshold, rapidly conducting mechanoreceptors and are activated only by mechanical stimuli in the noxious range while type II A δ fibers are more responsive to thermal stimuli. Superficial trigger point

dry needling as advocated by Baldry does not seem to be able to stimulate either type of A δ fiber, unless the patient experiences the needling as a noxious event. As an alternative to invasive procedures, several quartz stimulators have been developed. When pressed against the skin, they cause a small painful spark, similar to an electric barbecue igniter. While these devices are likely to cause A δ fiber activation, and at least theoretically could be used as an alternative to TrP-SDN, the US Food and Drug Administration has not approved their use¹⁴⁶.

Skin and muscle needle stimulation of A δ and C afferent fibers in anaesthetized rats was capable of producing an increase in cortical cerebral blood flow, which was thought to be due to a reflex response of the afferent pathway, including group II and IV afferent nerves, and the efferent intrinsic nerve pathway, including cholinergic vasodilators¹⁴⁷. Superficial needling of certain acupuncture points in patients with chronic pain showed similar changes in cerebral blood flow¹⁴⁸. Takeshige et al¹⁴⁹ determined that direct needling into the gastrocnemius muscle and into the ipsilateral L5 paraspinal muscles of a guinea pig resulted in significant recovery of the circulation, after ischaemia was introduced to the muscle using tetanic muscle stimulation. They also confirmed that needling of acupuncture points and non-acupuncture points involved the descending pain inhibitory system, although the actual afferent pathways were distinctly different. Acupuncture analgesia involved the medial hypothalamic arcuate nucleus of the descending pain inhibitory system, while non-acupuncture analgesia involved the anterior part of the hypothalamic arcuate nucleus. In both kinds of needle stimulation, the posterior hypothalamic arcuate nucleus was involved^{149–151}. Several other acupuncture studies reported specific changes in various parts of the brain with needling of acupuncture points in comparison with control points^{152,153}. While traditional acupuncturists have maintained that acupuncture points have unique clinical effects, the findings of these studies are not specific necessarily to acupuncture but may be more related to the patients’ expectations¹⁵⁴. It is likely that any needling, including TrP-DN, causes similar changes, although there is no research to date that provides definitive evidence for the role of the descending pain inhibitory system when needling MTrPs¹⁵⁵.

Recent studies by Langevin et al^{139,156–161} are of particular interest even though they did not consider TrP-DN in their work. A common finding when using acupuncture needles is the phenomenon of the “needle grasp,” which has been attributed to muscle fibers contracting around the needle and holding the needle tightly in place¹⁶². During needle grasp, a clinician experiences an increased pulling at the needle and an increased resistance to further movement of the inserted needle. The studies by Langevin et al provided evidence that

needle grasp is not necessarily due to muscle contractions, but that subcutaneous tissues play a crucial role, especially when the needle is manipulated. Rotation of the needle did not only increase the force required to remove the needle from connective tissues, but it also created measurable changes in connective tissue architecture, due to winding of connective tissue and creation of a tight mechanical coupling between needle and tissue¹⁵⁹. Even small amounts of needle rotation caused pulling of collagen fibers towards the needle and initiated specific changes in fibroblasts further away from the needle. The fibroblasts responded by changing shape from a rounded appearance to a more spindle-like shape, which the researchers described as “large and sheet-like”^{139,156,157,159}. The transduction of the mechanical signal into fibroblasts can lead to a wide variety of cellular and extracellular events, including mechanoreceptor and nociceptor stimulation, changes in the actin cytoskeleton, cell contraction, variations in gene expression and extracellular matrix composition, and eventually to neuromodulation^{156,163,164}. Although the significance of these studies is not yet clear for TrP-DDN, it is likely that loose connective tissue plays an important role in TrP-SDN. Fu et al²⁸ attributed the effects of their subcutaneous needle approach to the manipulation of the needle and referred to this groundbreaking research done by Langevin et al. To increase the effectiveness of TrP-SDN, it may prove beneficial to rotate the needle rather than leave it in place without manipulation, especially in weak responders. Needle rotation may stimulate Aδ fibers and activate enkephalinergic, serotonergic, and noradrenergic inhibitory systems^{24,143}. With TrP-DDN, rotation of a needle placed within an MTrP can facilitate the eliciting of typical referred pain patterns. More research is needed to determine the various aspects of the mechanisms of TrP-DN.

Trigger Point Dry Needling versus Injection Therapy

The term “dry needling” is used to differentiate this technique from MTrP injections. Myofascial trigger point injections are performed with a variety of injectables, such as procaine, lidocaine, and other local anesthetics; isotonic saline solutions; non-steroidal anti-inflammatories; corticosteroids; bee venom; botulinum toxin; and serotonin antagonists¹⁶⁵⁻¹⁷³. There is no evidence that MTrP injections with steroids are superior to lidocaine injections¹⁷⁴. In fact, intramuscular steroid injections may lead to muscle breakdown and degeneration^{175,176}. Travell preferred to use procaine^{173,177}. As procaine is difficult to obtain, it is now recommended to use a 0.25% lidocaine solution¹⁶⁹. Recent studies in Germany demonstrated that injections with tropisetron, which is a serotonin receptor antagonist, were superior to injections with local anesthetics^{171,178}. However, injectable serotonin receptor antagonists are not available in the

US. Myofascial trigger point injections are generally limited to medical practice only, although in some jurisdictions, such as South Africa and the State of Maryland, physical therapists are legally allowed to perform MTrP injections. Similarly, physical therapists in the UK are allowed to perform joint and soft tissue injections¹⁷⁹.

When comparing MTrP injection therapy with TrP-DN, many authors have suggested that “dry needling of the MTrP provides as much pain relief as injection of lidocaine but causes more post-injection soreness”¹⁸⁰. Usually, these authors reference a study by Hong⁹⁵ comparing lidocaine injections with TrP-DN; however, this author compared lidocaine injections with TrP-DN using a syringe and not an acupuncture needle. Recently, Kamanli et al¹⁸¹ updated the 1994 Hong study and compared the effects of lidocaine injections, botulinum toxin injections, and TrP-DN. In this study, the researchers also used a syringe and not an acupuncture needle, and they did not consider LTRs. In clinical practice, TrP-DN is typically performed with an acupuncture needle. There are no scientific studies that compare TrP-DN with acupuncture needles to MTrP injections with syringes. Based on published research studies, the assumption that TrP-DN would cause more post-needling soreness when compared to lidocaine injections cannot be substantiated when acupuncture needles are used.

Prior to the development of TrP-DN, MTrPs were treated primarily with injections, which explains why many clinical outcome studies are based on injection therapy^{67,165,166,169,174,176,182-188}. Several recent studies have confirmed that TrP-DN is equally effective as injection therapy, which may justify extrapolating the effects of injection therapy to TrP-DN^{25,95,176,181,189,190}. Cummings and White¹⁹⁰ concluded, “the nature of the injected substance makes no difference to the outcome, and wet needling is not therapeutically superior to dry needling”. A possible exception may be the use of botulinum toxin for those MTrPs that have not responded well to other interventions^{166,191-196}. A recent consensus paper specifically recommended that botulinum toxin should only be used after physical therapy and TrP-DN do not provide satisfactory relief¹⁹³. Botulinum toxin does not only prevent the release of ACh from cholinergic nerve endings, but there is also growing evidence that it inhibits the release of other selected neuropeptide transmitters from primary sensory neurons^{192,197,198}.

Many patients with chronic pain conditions frequently report having received previous MTrP injections. However, many also report that they never experienced LTRs, which raises the question as to how well trained and skilled physicians are in identifying and injecting MTrPs. A recent study revealed that MTrP injections were the second most common procedure used by Canadian pain anaesthesiologists after epidural steroid injections.

The study did not mention whether these anaesthesiologists had received any training in the identification and treatment of MTrPs with injections¹⁹⁹.

Trigger Point Dry Needling versus Acupuncture

Although some patients erroneously refer to TrP-DN as a form of acupuncture, TrP-DN did not originate as part of the practice of traditional Chinese acupuncture. When Gunn started exploring the use of acupuncture needles in the treatment of persons with chronic pain problems, he used the term “acupuncture” in his earlier papers. However, his thinking was grounded in neurology and segmental relationships, and he did not consider the more esoteric and metaphysical nature of traditional acupuncture²⁰⁰⁻²⁰². As reviewed previously, Gunn advocated needling motor points instead of traditional acupuncture points^{33,203,204}. Baldry has not advocated using the traditional system of Chinese acupuncture with energy pathways or meridians either and he has described them as “not of any practical importance”²⁴.

A few researchers have attempted to link the two needling approaches²⁰⁵⁻²¹¹. In an older study, Melzack et al^{206,211} concluded that there was a 71% overlap between MTrPs and acupuncture points based on their anatomical location. This study had a profound impact particularly on the development of the theoretical foundations of acupuncture. Many researchers and clinicians quoted this study by Melzack et al as evidence that acupuncture had an established physiologic basis and that acupuncture practice could be based on reported correlations with MTrPs²⁰⁵. More recently, Dorsher²⁰⁷ compared the anatomical and clinical relationships between 255 MTrPs described by Travell and Simons, and 386 acupuncture points described by the Shanghai College of Traditional Medicine and other acupuncture publications. He concluded that there is a significant overlap between MTrPs and acupuncture points and argued that “the strong correspondence between trigger point therapy and acupuncture should facilitate the increased integration of acupuncture into contemporary clinical pain management”. While these studies appear to provide evidence that TrP-DN could be considered a form of acupuncture, both studies assume that there are distinct anatomical locations of MTrPs and that acupuncture points have point specificity.

It is questionable whether MTrPs have distinct anatomical locations and whether these can be reliably used in comparisons with other points²¹². In part, the *Trigger Point Manuals* are to blame for suggesting that MTrPs have distinct locations^{1,213}. Simons, Travell, and Simons¹ described specific MTrPs in numbered sequences based on their “approximate order of appearance” and may have contributed to the widely accepted impression that indeed MTrPs do have distinct anatomical locations. There is no scientific research

that validates the notion that MTrPs have distinctive anatomical locations, other than their close proximity to motor endplate zones. Based on empirical evidence, the numbering sequences are inconsistent with clinical practice and do not reflect patients’ presentations. On the other hand, Dorsher’s observation²⁰⁷ that MTrP referred pain patterns have striking similarities with described courses of acupuncture meridians may be of interest. However, the same dilemma arises: Are referred pain patterns MTrP-specific or should they be described for muscles in general or perhaps for certain parts of muscles? Recent studies of experimentally induced referred pain have suggested that referred pain patterns might be characteristic of muscles rather than of individual MTrPs as Simons, Travell, and Simons suggested^{1,77,82,83,214}.

Birch²⁰⁵ re-assessed the Melzack et al 1977 paper and concluded that the study was based on several “poorly conceived aspects” and “questionable” assumptions. According to Birch, Melzack et al mistakenly assumed that all acupuncture points must exhibit pressure pain and that local pain indications of acupuncture points are sufficient to establish a correlation. He determined that only approximately 18% – 19% of acupuncture points examined in the 1977 study could possibly correlate with MTrPs, but he did suggest that there may be a relevant correlation between the so-called “Ah Shi” points and MTrPs. In traditional acupuncture, the Ah Shi points belong to one of three major classes of acupuncture points. There are 361 primary acupuncture points referred to as “channel” points. There are hundreds of secondary class acupuncture points, known as “extra” or “non-channel” points. The third class of acupuncture points is referred to as “Ah Shi” points. By definition, Ah Shi points must have pressure pain. They are used primarily for pain and spasm conditions. Melzack et al did not consider the Ah Shi points in their study but focused exclusively on the channel points and extra points. Hong²⁰⁹, as well as Audette and Binder²¹⁰, agreed that acupuncturists might well be treating MTrPs whenever they are treating Ah Shi points.

Whether TrP-DN could be considered a form of acupuncture depends partially on how acupuncture is defined. For example, the New Mexico Acupuncture and Oriental Medicine Practice Act defined acupuncture in a rather generic and broad fashion as “the use of needles inserted into and removed from the human body and the use of other devices, modalities, and procedures at specific locations on the body for the prevention, cure, or correction of any disease, illness, injury, pain, or other condition by controlling and regulating the flow and balance of energy and functioning of the person to restore and maintain health”²¹⁵. According to this definition of acupuncture, nearly all physical therapy and medical interventions could be considered a form of acupuncture, including TrP-DN, but also any other

modality or procedure. Physicians and nurses could be accused of practicing acupuncture as they “insert and remove needles.” From a physical therapy perspective, TrP-DN has no similarities with traditional acupuncture other than the tool. The objective of TrP-DN is not to control and regulate the flow and balance of energy and is not based on Eastern esoteric and metaphysical concepts. Trigger point dry needling and other physical therapy procedures are based on scientific neurophysiological and biomechanical principles that have no similarities with the hypothesized control and regulation of the flow and balance of energy^{5,24}. In fact, there is growing evidence against the notion that acupuncture points have unique and reproducible clinical effects¹⁵⁵. Three recent well-designed randomized controlled clinical trials with 302, 270, and 1007 patients, respectively, demonstrated that acupuncture and sham acupuncture treatments were more effective than no treatment at all, but there was no statistically significant difference between acupuncture and sham acupuncture²¹⁶⁻²¹⁸. As Campbell pointed out, acupuncture does not appear to have unique effects on the central nervous system, or

on pain and pain modulation, which implies that the discussion whether TrP-DN is a form of acupuncture becomes irrelevant¹⁵⁵.

Summary and Conclusions

Trigger point dry needling is a relatively new treatment modality used by physical therapists worldwide. The introduction of trigger point dry needling to American physical therapists has many similarities with the introduction of manual therapy during the 1960s. During the past few decades, much progress has been made toward the understanding of the nature of MTrPs and, thereby, of the various treatment options. Trigger point dry needling has been recognized by prestigious organizations such as the Cochrane Collaboration and is recommended as an option for the treatment of persons with chronic low back pain. Several clinical outcome studies have demonstrated the effectiveness of trigger point dry needling. However, questions remain regarding the mechanisms of needling procedures. Physical therapists are encouraged to explore using trigger point dry needling techniques in their practices. ■

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Dry Needling in Orthopaedic Physical Therapy Practice

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NOTE: Consistent with ethical guidelines, the author wishes to disclose that he is co-founder and co-program director of the Janet G. Travell, MD Seminar SeriesSM, the only US-based continuing education program that offers courses for physical therapists in the technique of dry needling. Readers, check with your own state practice acts on the use of this technique.

INTRODUCTION

Orthopaedic physical therapists employ a wide range of intervention strategies to reduce patients' pain and improve function. From time to time, new treatment approaches are being introduced to the field of physical therapy. The arrival of manual therapy in the United States is a good example. Although for several decades, manual physical therapy was already an essential part of the scope of orthopaedic physical therapy practice in Europe, New Zealand, and Australia, manual therapy did not make its debut in the United States until the 1960s.¹ Initially many US state boards of physical therapy opposed the use of manual therapy. In spite of the early resistance, manual physical therapy has become a mainstream treatment approach. Manual therapy techniques are now taught in academic programs and continuing education courses. During the past few years, physical therapists, the APTA, and the AAOMPT even have had to defend the right to practice manual therapy especially when challenged by the chiropractic community! A similar development is in progress with the relatively new technique of dry needling. While some physical therapy state boards have already decided that dry needling falls within the scope of physical therapy practice, others are still more hesitant. The goal of this paper is to introduce the American orthopaedic physical therapy community to the technique of dry needling.

DRY NEEDLING

Dry needling is commonly used by physical therapists around the world. For example, in Canada, many provinces allow physical therapists to use dry needling techniques. In Spain, several universities

offer academic programs that include dry needling courses. The University of Castilla-La Mancha offers a postgraduate degree in conservative and invasive physical therapy. At the University of Valencia, dry needling is included in the curriculum of the master's degree program in manipulative physical therapy. In Switzerland, dry needling courses are offered via the accredited continuing education program of the 'Interessengemeinschaft für Manuelle Triggerpunkt Therapie' (Society for Manual Trigger Point Therapy). Physical therapists in the UK are increasingly being trained in joint injection techniques.²

In the United States, dry needling is not included in physical therapy educational curricula and relatively few physical therapists employ the technique. Dry needling is erroneously assumed to fall under the scopes of medical practice or oriental medicine and acupuncture. However, physical therapy state boards of Maryland, New Hampshire, New Mexico, and Virginia have already ruled that dry needling does fall within the scope of physical therapy in those states. The Tennessee Board of Occupational and Physical Therapy recently rejected dry needling by physical therapists. The general counsel of the Illinois Department of Regulation advised that dry needling would not fall within the scope of practice of physical therapy but should be covered by the board of acupuncture. In the mean time, physical therapists who are adequately trained in the technique of dry needling are successfully employing the technique with a wide variety of patients.

DRY NEEDLING TECHNIQUES

Several dry needling approaches have been developed based on different individual theories, insights, and hypotheses. The 3 main schools of dry needling are presented: the myofascial trigger point model, the radiculopathy model, and the spinal segmental sensitization model.

Myofascial Trigger Point Model

Dry needling is used primarily in the treatment of myofascial trigger points (MTrPs), defined as "hyperirritable spots in skeletal muscle associated with hypersensitive palpable nodules in a taut band."³ The

MTrPs are the hallmark characteristic of myofascial pain syndrome (MPS). A recent survey of physician members of the American Pain Society showed general agreement that MPS is a distinct syndrome.⁴ Throughout the history of manual physical therapy, MPS and MTrPs have received little or no attention, although several studies have demonstrated that MTrPs are commonly seen in acute and chronic pain conditions, and in nearly all orthopaedic conditions.⁵ Vecchiet and colleagues demonstrated that acute pain following exercise or sports participation is often due to acutely painful MTrPs. Myofascial trigger points are often responsible for complaints of pain in persons with hip osteoarthritis,⁶ pain with cervical disc lesions,⁷ pain with TMD,⁸ pelvic pain,⁹ headaches,¹⁰ epicondylitis,¹¹ etc. Hendler and Kozikowski concluded that MPS is the most commonly missed diagnoses in chronic pain patients.¹² A brief review of the current knowledge of MTrPs and MPS is indicated to better understand the place of dry needling within orthopaedic physical therapy.

Already during the early 1940s, Dr. Janet Travell (1901-1997) realized the importance of MPS and MTrPs. Recent insights in the nature, etiology, and neurophysiology of MTrPs and their associated symptoms have propelled the interest in the diagnosis and treatment of persons with MPS worldwide. The mechanism that underlies the development of MTrPs is not known, but altered activity of the motor end plate, or neuromuscular junction, is most likely. Changes in acetylcholine receptor (AChR) activity, in the number of receptors, and changes in acetylcholinesterase (AChE) activity are consistent with known mechanisms of end plate function, and could explain the changes in end plate activity that occur in the MTrP. There is a marked increase in the frequency of miniature end plate potential activity at the point of maximum tenderness in the taut band in the human, and in the neuromuscular junction end plate zone of the taut band in the rabbit model and in humans.

Normally, ACh is broken down by AChE. Preliminary results of studies by Shah and associates at the National Institutes of Health indicate that a number

of biochemical alterations are commonly found at the active MTrP site using microdialysis sampling techniques.¹³ Among the changes found are elevated bradykinin, substance P, and calcitonin gene-related peptide (CGRP) levels, and lowered pH when compared to inactive (asymptomatic) MTrPs and to normal controls.¹³ The combination of increased levels of CGRP and lowered pH suggest that the milieu of a MTrP is too acidic for AChE to function efficiently. The possible implications for the development of MTrPs is outside the scope of this article and will be addressed in a future article.¹⁴ The administration of botulinum toxin can block the release of ACh, and is therefore now widely used in the management of chronic and persistent MPS.

Abnormal end plate noise (EPN) associated with MTrPs can be visualized with electromyography using a monopolar teflon-coated needle electrode and a slow insertion technique.^{15,16} Active MTrPs are spontaneously painful, refer pain to more distant locations, and cause muscle weakness, mechanical range of motion restrictions, and several autonomic phenomena. One of the unique features of MTrPs is the phenomenon of the local twitch response (LTR), which is an involuntary spinal cord reflex contraction of the contracted muscle fibers in a taut band following palpation or needling of the band or trigger point.¹⁷ The LTR can be visualized with needle electromyography and ultrasonography.^{18,19}

To make a diagnosis of MPS, the minimum essential features that need to be present are the taut band, an exquisitely tender spot in the taut band, and the patient's recognition of the pain complaint by pressure on the tender nodule.²⁰ Simons, Travell, and Simons add a painful limit to stretch range of motion as the fourth essential criterion.³ Referred pain, the LTR, and the electromyographic demonstration of end plate noise are confirmatory observations and not essential for the clinical diagnosis.

From a biomechanical perspective, National Institutes of Health researchers Wang and Yu hypothesized that MTrPs are severely contracted sarcomeres whereby myosin filaments literally get stuck in titin gel at the Z-band of the sarcomere (Figures 1 and 2).²¹ Titin is the largest known protein that connects the Z-band with myosin filaments within a sarcomere. Approximately 90% of titin consists of 244 repeating copies of fibronectin

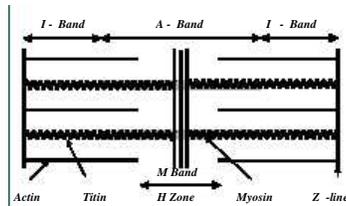


Figure 1. Schematic representation of a normal sarcomere.

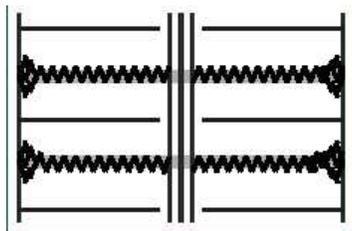


Figure 2. Schematic representation of a MTrP with myosin filaments literally stuck in titin gel at the Z-line (after Wang K, Yu L. Emerging Concepts of Muscle Contraction and Clinical Implications for Myofascial Pain Syndrome. Presented at Focus on Pain 2000, Mesa, AZ: Janet G. Travell, MD Seminar Series²¹.)

type III and immunoglobulin domains, which may contribute to the sticky nature of titin once muscle fibers are contracted.

Histological studies have confirmed the presence of extreme sarcomere contractions, resulting in localized tissue hypoxia.²² Brücke and colleagues established that the local oxygen saturation at a MTrP site is less than 5% of normal.²³ Hypoxia leads to the release of local release of several nociceptive chemicals, including bradykinin, CGRP, and substance P, among others, which have been detected in abnormal high concentrations at MTrPs.¹⁷ Bradykinin is a nociceptive agent that stimulates the release of tumor necrosis factor and interleukins, some of which in turn can stimulate the further release of bradykinin. Calcitonin gene-related peptide modulates synaptic transmission at the neuromuscular junction by inhibiting the expression of AChE, which is another likely mechanism that contributes to the excessively high concentration of ACh.

Split fibers, ragged red fibers, type II fiber atrophy, and fibers with a moth-eaten appearance have been detected in MTrPs.²² Ragged red fibers and moth-

eaten fibers are also associated with muscle ischemia and represent an accumulation of mitochondria or a change in the distribution of mitochondria or the sarco-tubular system respectively.

Combining these various lines of research, it can be concluded that MTrPs function as peripheral nociceptors that can initiate, accentuate, and maintain the process of central sensitization.²⁴ As a source of peripheral nociceptive input, MTrPs are capable of unmasking sleeping receptors in the dorsal horn, resulting in spatial summation and the appearance of new receptive fields, which clinically are identified as areas of referred pain. The MTrPs are commonly associated with other pain states and diagnoses, including complex regional pain syndrome, and should be considered in the clinical management.²⁵ Treatment of MTrPs is only one of the components of the therapeutic program, and does not replace other therapeutic measures, such as joint mobilizations, posture training, strengthening, etc. As MTrPs are easily accessible to trained hands, inactivating MTrPs is one of the most effective and fastest means to reduce pain. Dry needling is the most precise method currently available to physical therapists.

Myofascial trigger points can be identified by palpation only. There are no other diagnostic tests that can accurately identify an MTrP, although new methodologies using piezoelectric shockwave emitters are being explored.²⁶ Excellent inter-rater reliability has been established.^{20,27} Simons, Travell, and Simons describe 2 palpation techniques for the proper identification of MTrPs. A flat palpation technique is used for example with palpation of the infraspinatus, the masseter, temporalis, and lower trapezius. A pincher palpation technique is used for example with palpation of the sternocleidomastoid, the upper trapezius, and the gastrocnemius.

Trigger point dry needling

Janet Travell pioneered the use of MTrP injections that eventually led to the development of dry needling. Her first paper describing MTrP injection techniques was published in 1942, followed by many others. Together with Dr. David Simons she wrote the 2-volume Trigger Point Manual.^{1,28} Many studies have confirmed the benefits of trigger point injections even though a recent review article could not demonstrate clinical efficacy

beyond placebo.^{5,29} In 1979 Lewit confirmed that the effects of needling were primarily due to mechanical stimulation of a MTrP with the needle.³⁰ Dry needling of a MTrP using an acupuncture needle caused immediate analgesia in nearly 87% of needle sites. In over 31% of cases, the analgesia was permanent. Twenty percent had several months of pain relief, 22% several weeks, and 11% several days. Fourteen percent had no relief at all.³⁰

Dry needling an MTrP is most effective, when local twitch responses (LTR) are elicited.³¹ A LTR has been shown to inhibit abnormal end plate noise. Current (unpublished) research strongly suggests that a LTR is essential in altering the chemical milieu of an MTrP (Shah, 2004, personal communication). Patients commonly describe an immediate reduction or elimination of the pain complaint after eliciting LTRs. Once the pain is reduced, patients can start active stretching, strengthening, and stabilization programs. Eliciting a LTR with dry needling is usually a rather painful procedure. Post-needling soreness may last for 1 to 2 days, but can easily be distinguished from the original pain complaint. Patients with chronic pain frequently report to have received previous trigger point injections; however, many state that they never experienced LTRs. Accurate needling requires clinical familiarity with MTrPs and excellent palpation skills.

Dr. Peter Baldry has adopted the Travell and Simons trigger point model, but prefers a gentler and less mechanistic approach to needling MTrPs when possible. According to Baldry, using a superficial needling technique is nearly always effective. With superficial dry needling, the needle is placed in the skin and cutaneous tissues overlying an MTrP. Baldry agrees that both superficial and deep dry needling have their place in the management of MTrPs.³² A recent study confirmed that both superficial and deep dry needling are effective with dry needling having a stronger and more immediate effect.³³

Radiculopathy Model

In Canada, Dr. Chan Gunn developed his 'radiculopathy model' and coined the term 'intramuscular stimulation' instead of dry needling.³⁴ Gunn has expressed the belief that myofascial pain is always secondary to peripheral neuropathy or radiculopathy and therefore, myofascial pain would always be a reflection of neuropathic pain

in the musculoskeletal system. Because of muscle shortening, which in this model is always due to neuropathy, 'supersensitive nociceptors' may be compressed, leading to pain. The radiculopathy model is based on Cannon and Rosenblueth's "Law of Denervation." According to this law, the function and integrity of innervated structures is dependent upon the free flow of nerve impulses to provide a regulatory or trophic effect. When the flow of nerve impulses is restricted, the innervated structures become atrophic, highly irritable, and supersensitive. Striated muscles are thought to be the most sensitive innervated structures and according to Gunn, become the "key to myofascial pain of neuropathic origin." Because of the neuropathic supersensitivity, Gunn states that muscle fibers "can overreact to a wide variety of chemical and physical inputs including stretch and pressure." The mechanical effects of muscle shortening may result in commonly seen conditions, such as tendonitis, arthralgia, and osteoarthritis. Shortening of the paraspinal muscles is thought to perpetuate radiculopathy by disc compression, narrowing of the intervertebral foramina, or by direct pressure on the nerve root.

Gunn found that the most effective treatment points are always located close to the muscle motor points or musculotendinous junctions. They are distributed in a segmental or myotomal fashion in muscles supplied by the primary anterior and posterior rami. In Gunn's model, MTrPs do not play an important role. Because the primary posterior rami are segmentally involved in the muscles of the paraspinal region, including the multifidi, and the primary anterior rami with the remainder of the myotome, the treatment must always include the paraspinal muscles as well as the more peripheral muscles. Gunn found that the tender points usually coincide with painful palpable muscle bands in shortened and contracted muscles. He suggests that nerve root dysfunction is particularly due to spondylotic changes. He maintains that relatively minor injuries would not result in severe pain that continues beyond a 'reasonable' period, unless the nerve root would already be in a sensitized state prior to the injury.

Gunn's assessment technique is based on the evaluation of specific motor, sensory, and trophic changes. The main objective of the initial examination is to determine which levels of neuropathic dys-

function are present in a given individual. The examination is rather limited and does not include standard medical and physical therapy evaluation techniques, including common orthopaedic or neurological tests, laboratory tests, electromyographic or nerve conduction tests or radiologic tests, such as MRI, CT scan, or even X-rays. Motor changes are assessed through a few functional motor tests and through systematic palpation of the skin and muscle bands along the spine and in the peripheral muscles of the involved myotomes. Gunn emphasizes to assess trophic changes in the paraspinal regions segmentally corresponding to the area of dysfunction. Trophic changes may include orange peel skin (peau d'orange), dermatomal hair loss, differences in skin folds, and moisture levels (dry vs. moist skin).³⁴

Unfortunately, Gunn's radiculopathy model as a hypothesis to explain chronic musculoskeletal pain has not really been developed beyond its initial inception in 1973. Although Gunn has published numerous interesting case reports and review articles restating his opinions, most components of the model have not been subjected to scientific investigations and verification. In fact, many of Gunn's underlying assumptions are contradicted by more recent research findings. For example, Gunn's notion that persistent nociceptive input is uncommon contradicts many recent neurophysiological studies confirming that persistent and even relative brief nociceptive input can result in pain producing plastic dorsal horn changes.

The major contributions of Gunn to the field of MPS and dry needling are the emphasis on segmental dysfunction and the suggestion that neuropathy may be a possible cause of myofascial dysfunction. Certainly with regard to motor dysfunction associated with MPS, the combined impact of the primary anterior and posterior rami is an important consideration. For example, from a segmental perspective, it would be likely to see dysfunction of the C5-C6 paraspinal muscles when MTrPs are present in the more peripheral infraspinatus muscle.

The Spinal Segmental Sensitization Model

The Spinal Segmental Sensitization Model is developed by Dr. Andrew Fischer and combines aspects of Travell and Simons' trigger point model and Gunn's radiculopathy model.³⁵ Fischer proposes that the "pen-

tad of the vicious cycle of discopathy, paraspinal muscle spasm and radiculopathy” consists of paraspinal muscle spasm frequently responsible for compression of the nerve root, narrowing of the foraminal space, and a sprain of the supraspinous ligament with radicular involvement. Fischer advocates a comprehensive medical evaluation. According to Fischer, the most effective methods for relief of musculoskeletal pain include preinjection blocks, needle and infiltration of tender spots and trigger points, somatic blocks, spray and stretch methods, and relaxation exercises. Based on empirical observations, Fischer routinely infiltrates the supraspinous ligament, which “inactivates tender spots/trigger points in the corresponding myotome, relaxing the taut bands, and increasing the pressure pain thresholds as documented by algometry.” The MTrP injections with Fischer’s needling and infiltration technique are thought to “mechanically break up abnormal tissue” and “a layer of edema.” The main differences between Fischer’s and Gunn’s approach are the extent of the physical examination, the use of injection needles by Fischer, and acupuncture needles by Gunn. Fischer’s recognition of the importance of MTrPs, and the infiltration of the supraspinous ligament. Furthermore, Fischer’s model seems more dynamic. He has integrated many new research findings into his approach; for example, Fischer acknowledges that central sensitization is often due to ongoing peripheral nociceptive input. Fischer’s proposed interventions use multiple injection techniques and are therefore not that useful for physical therapists. As far as is known, the Maryland Board of Physical Therapy Examiners is the only physical therapy board that has ruled that physical therapists may perform MTrP injections.

MECHANISMS OF DRY NEEDLING

Although muscle needling techniques have been used for thousands of years in the practice of acupuncture, there is still much uncertainty about their underlying mechanisms. The acupuncture literature may provide some answers, however, due to its metaphysical and philosophical nature, it is difficult to apply traditional acupuncture principles to the practice of using acupuncture needles in the treatment of MPS.

Mechanical Effects

Dry needling of an MTrP may mechanically disrupt the integrity of the dysfunc-

tional motor end plates. From a mechanical point of view, needling of MTrPs may be related to the extremely shortened sarcomeres. It is plausible that an accurately placed needle provides a localized stretch to the contracted cytoskeletal structures, which may disentangle the myosin filaments from the titin gel at the Z-band. This would allow the sarcomere to resume its resting length by reducing the degree of overlap between actin and myosin filaments.

If indeed a needle can mechanically stretch the local muscle fiber, it would be beneficial to rotate the needle during insertion. Rotating the needle results in winding of connective tissue around the needle, which clinically is experienced as a ‘needle grasp.’ Comparisons between the orientation of collagen following needle insertions with and without needle rotation demonstrated that the collagen bundles were straighter and more nearly parallel to each other after needle rotation.³⁶ Langevin and colleagues report that brief mechanical stimulation can induce actin cytoskeleton reorganization and increases in proto-oncogenes expression, including cFos and tumor necrosis factor and interleukins.³⁶ Moving the needle up and down as is done with needling of a MTrP may be sufficient to cause a needle grasp and a resultant LTR. As a result of mechanical stimulation, group II fibers will register a change in total fiber length, which may activate the gate control system by blocking nociceptive input from the MTrP and hence cause alleviation of pain.³²

The mechanical pressure exerted via the needle also may electrically polarize the connective tissue and muscle. A physical characteristic of collagen fibers is their intrinsic piezoelectricity, a property that allows tissues to transform mechanical stress into electrical activity necessary for tissue remodeling, possibly contributing to the LTR.³⁷

Neurophysiologic Effects

In his arguments in favor of neurophysiological explanations of the effects of dry needling, Baldry concludes that with the superficial dry needling technique, A-delta nerve fibers (group III) will be stimulated for as long as 72 hours after needle insertion. Prolonged stimulation of the sensory afferent A-delta nerve fibers may activate the enkephalinergic inhibitory dorsal horn interneurons, which would imply that superficial dry

needling causes opioid mediated pain suppression.³²

Another possible mechanism of superficial dry needling is the activation of the serotonergic and noradrenergic descending inhibitory systems, which would block any incoming noxious stimulus into the dorsal horn. The activation of the enkephalinergic, serotonergic, and noradrenergic descending inhibitory systems occurs with dry needle stimulation of A-delta nerve fibers anywhere in the body.³² Skin and muscle needle stimulation of A-delta and C-(group IV) afferent fibers in anesthetized rats was capable of producing an increase in cortical cerebral blood flow, which was thought to be due to a reflex response of the afferent pathway, including group II and IV afferent nerves and the efferent intrinsic nerve pathway, including cholinergic vasodilators.³⁸ Superficial needling of certain acupuncture points in patients with chronic pain showed similar changes in cerebral blood flow.³⁹

Gunn’s and Fischer’s techniques of needling both the paraspinal muscles and peripheral muscles belonging to the same myotome, appear to be supported by several animal studies. For example, Takeshige and Sato determined that both direct needling into the gastrocnemius muscle and into the ipsilateral L5 paraspinal muscles of a guinea pig resulted in significant recovery of the circulation, after ischemia was introduced to the muscle using tetanic muscle stimulation.⁴⁰ They also confirmed that needling of acupuncture points and non-acupuncture points involved the descending pain inhibitory system, although the actual afferent pathways were distinctly different. Acupuncture analgesia involved the medial hypothalamic arcuate nucleus of the descending pain inhibitory system, while non-acupuncture analgesia involved the anterior part of the hypothalamic arcuate nucleus. In both kinds of needle stimulation, the posterior hypothalamic arcuate nucleus was involved. There is no research to date that clarifies the role of the descending pain inhibitory system with needling of MTrPs.

Chemical Effects

The studies by Shah and colleagues demonstrated that the increased levels of various chemicals, such as bradykinin, CGRP, substance P, and others, at MTrPs are immediately corrected by eliciting a LTR with an acupuncture needle. Although it is not known what happens

to these chemicals when a needle is inserted into the MTRP, there is now strong albeit unpublished data that suggest that eliciting a LTR is essential.¹³

STATUTORY CONSIDERATIONS

Whether from a legal or statutory perspective, physical therapists can perform dry needling techniques, has not been considered in most states. However, the physical therapy state boards of Maryland, New Mexico, New Hampshire, and Virginia have officially determined that dry needling falls within the scope of physical therapy practice in those states.

Dry needling by physical therapists must be regulated by state boards of physical therapy and not by state boards of acupuncture or oriental medicine. Dry needling is not equivalent to acupuncture and should not be considered a form of acupuncture. For example, the New Mexico Acupuncture and Oriental Medicine Practice Act^a defines acupuncture as “the use of needles inserted into and removed from the human body and the use of other devices, modalities and procedures at specific locations on the body for the prevention, cure or correction of any disease, illness, injury, pain, or other condition by controlling and regulating the flow and balance of energy and functioning of the person to restore and maintain health.”

Obviously, dry needling involves the use of needles inserted into and removed from the human body; however, that is the only similarity between dry needling and acupuncture. Similarly, if a hammer is associated with carpenters, do plumbers become carpenters every time they use a hammer? The objective of dry needling is not to control and regulate the flow and balance of energy and is not based on Eastern esoteric and metaphysical concepts. The fact that needles are being used in the practice of dry needling does not imply that an acupuncture board would automatically have jurisdiction over such practice. If so, physicians and nurses would also need to conform to the statutes of acupuncture, as they also “insert and remove needles.”

Many boards of physical therapy in the United States have adopted a variation of the “Model Practice Act for Physical Therapy” developed by the Federation of State Boards of Physical Therapy (<http://www.fsbt.org>). Neither the Model Practice Act or any of the actual state practice acts address whether dry needling falls within the scope of physical

therapy practice. However, based on the definitions of physical therapy practice, dry needling may well fall within the scope of practice in nearly all states. The respective statutes commonly include statements like “the practice of physical therapy means administering treatment by mechanical devices,” “mechanical modalities,” or “mechanical stimulation.” Exclusions to the practice of physical therapy are frequently defined as “the use of roentgen rays and radioactive materials for diagnosis and therapeutic purposes, the use of electricity for surgical purposes, and the diagnosis of disease.” Most state physical therapy acts do not specifically prohibit the use of needles.

Whether physical therapists are legally allowed to penetrate the skin has been addressed in few statutes and usually only in the context of performing electromyography and nerve conduction tests. The Model Practice Act does include “electro-diagnostic and electrophysiologic tests and measures.” For example, the Missouri Revised Statutes^b indicate that “physical therapy [...] does not include the use of invasive tests,” yet, the statutes state specifically “physical therapists may perform electromyography and nerve conduction test” even though they “may not interpret the results.” The California Physical Therapy Act^c does address the issue of “tissue penetration:” “A physical therapist may, upon specified authorization of a physician and surgeon, perform tissue penetration for the purpose of evaluating neuromuscular performance as part of the practice of physical therapy [...] provided the physical therapist is certified by the board to perform tissue pen-

etration and provided the physical therapist does not develop or make diagnostic or prognostic interpretations of the data obtained.” It is not clear whether the California practice act would allow dry needling at this time. In any case, it appears that physical therapists would need to be certified by the board to perform tissue perforation.

The definition of physical therapy practice in the 2004 Florida Statutes^d includes “the performance of acupuncture only upon compliance with the criteria set forth by the Board of Medicine, when no penetration of the skin occurs.” The Florida board does not indicate how acupuncture or for that matter, dry needling, would be performed without penetrating the skin and this remains a mystery. Interestingly, the physical therapy practice act in Florida does include “the performance of electromyography as an aid to the diagnosis of any human condition.”

In order to practice dry needling, physical therapists would have to be able to demonstrate competency or adequate training in the examination and treatment of persons with MPS and in the technique of dry needling. Many statutes address the issue of competency by including language like “a physical therapist shall not perform any procedure or function for which he is by virtue of education or training not competent to perform.” Obviously, physical therapists employing dry needling must have excellent knowledge of anatomy and be very familiar with the indications, contraindications, and precautions.

In summary, most physical therapy practice acts may allow dry needling, according to the various definitions of “practice of physical therapy.” Whether individual state boards would interpret their statutes in a similar fashion as the Maryland, New Mexico, New Hampshire, and Virginia physical therapy state boards have, remains to be seen.

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^b Missouri Revised Statutes, Chapter 334, Physicians and Surgeons – Therapists – Athletic Trainers, Section 334.500, Definitions

^c California Business and Professions Code, Division 2, Healing Arts, Chapter 5.7, Physical Therapy, Section 2620.5

^d The 2003 Florida Statutes, Title XXXII, Regulation of Professions and Occupations, Chapter 486, Physical Therapy Act, Section 486.021, Definitions, 11, Practice of Physical Therapy

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