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 practice[2-4]. 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 therapy[5].

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 skin[9].

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 skin[8]. 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 Travell[10]. 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 witness[7]. 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 stimulation[14-22]. 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 model[16-23].

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-DN[13]. 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 IMS[18-20]. 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 technique[30]. According to Gunn's web site, "hundreds of doctors and physiotherapists from all around the world" have been trained in the technique[31]. 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 impulses[32]. 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 supersensitive[30]. Gunn suggested that many common diagnoses, such as Achilles tendonitis, lateral epicondylitis, frozen shoulder, chrondromalacia patellae, headaches, plantar fasciitis, temporomandibular joint dysfunction, myofascial pain syndrome (MPS), and others, might in fact be the result of neuropathy[30]. 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].

Gunn[13] 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 injury[13].

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 pain[34], there also are no interrater reliability studies and no studies that support the idea that the described findings are indeed indicative of neuropathic pain[5]. 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 dysfunction[35]. 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 changes[36-42].

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 μV and intermittent high-amplitude discharges (up to 500 μV) in painful MTrPs[45-47]. 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 motion[48]. Simons, Travell, and Simons documented the referred pain patterns of MTrPs in 147 muscles[1], while Dejung et al[49] published slightly different

referred pain patterns based on their empirical findings. Several case reports and research studies have examined referred pain patterns from MTrPs[50-71]. 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 MTrPs[72-84]. 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 gastrocnemius[1].

The interrater reliability of identifying MTrPs has been studied by several researchers and was established in a small number of studies[85-87]. Gerwin et al[86] concluded that training is essential to reliably identify MTrPs, while Sciotti et al[87] 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 pain[85]. A recent study of the intrarater reliability of identifying MTrPs in patients with rotator cuff tendonitis reached perfect agreement (κ=1.0) for the taut band, spot tenderness, jump sign, and pain recognition, which the author attributed to methodological rigor[88]. 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 statistic[89].

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 syndromes[55]. 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 essential[95]. 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 lungs[25].

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 practice[25]. White et al[99] 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 galanin[104]. However, a study examining the effects of high- and low-frequency EA in pain after abdominal surgery found that both frequencies significantly reduced the pain[105]. Another study concluded that high-intensity levels were more effective than low-intensity stimulation[97]. 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 equipment[23].

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 alleviated[24]. 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 muscles[24]. He recommended inserting an acupuncture needle into the tissues overlying each MTrP to a depth of 5-10 mm for 30 seconds[24]. 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 stimulation[108]. Baldry suggested that weak responders might have excessive amounts of endogenous opioid peptide antagonists[24]. 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-DDN[24].

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 syndrome[29]. In a recent paper, Fu et al[28] applied their needling technique to MTrPs and examined whether the direction of the needle is relevant in that treatment. The needle

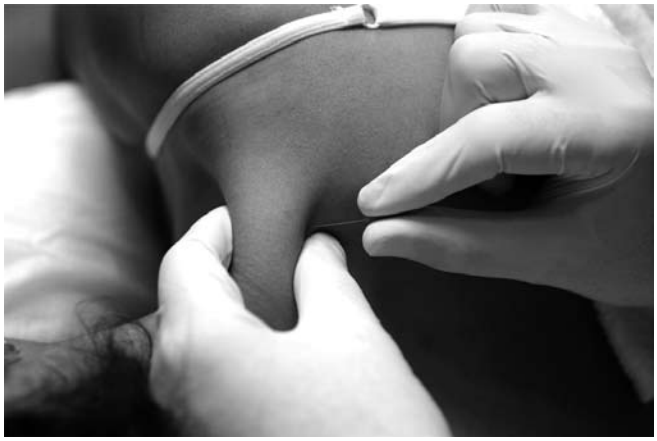

Fig. 1: Trigger point dry needling of the trapezius muscle

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

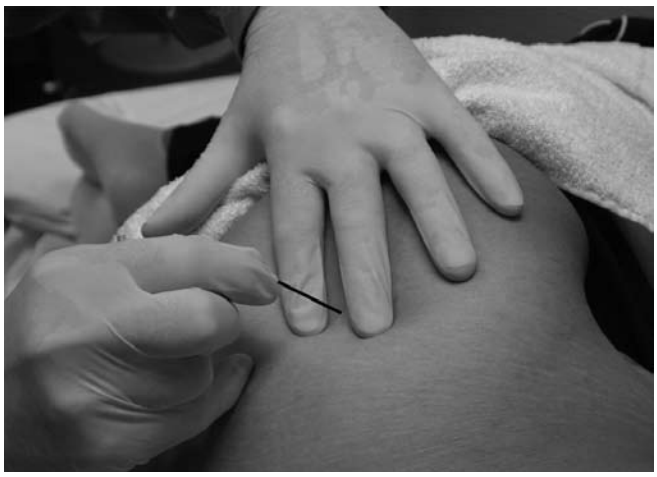

Fig. 3: Trigger point dry needling of the gluteus medius muscle

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 needle[28].

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 20–30^0 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 place[27-29]. 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 innervated[27-29]. 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. Noë[109] 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 perception[109]. 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 needle[25]. 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 it[25].

Considering the invasive nature of TrP-DN, it is very difficult to develop and implement double blind and randomized placebo-controlled studies[110-113]. 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 unpleasantness[114-117]. However, several case reports, review articles, and research studies have attested to the effectiveness of TrP-DN. Ingber[118] 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 strokes[118].

In 1979, Czech medical physician Karel Lewit published one of the first clinical reports on the subject[119]. 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 injectable[120]. 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 all[119].

Cummings[121] 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 hours[121]. 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 muscle[54].

Weiner and Schmader[64] 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 needed[64]. Only one previous report has described the relevance of MTrPs in the symptomatology of post-herpetic neuralgia[52].

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 groups[122]. 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 MTrPs[123].

Another Australian study considered the effects of latent MTrPs on muscle activation patterns in the shoulder region[48]. 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 patterns[48]. 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 sizes[124].

Recent research by Shah et al [125]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-α interleukin-1α serotonin, and norepinephrine in the immediate milieu of active MTrPs only[125]. 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 milieu[125]. Another study confirmed the importance of eliciting LTRs with TrP-DDN[126]. 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 al[127] 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 DDN[128-130]. Ceccherelli et al[128] 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 technique[128]. Another randomized controlled clinical study compared the efficacy of standard acupuncture, SDN, and DDN in the treatment of elderly patients with chronic low back pain[129]. 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 SDN[129]. 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, Baldry[24] 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 MTrP[95]. 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 Knowles[131] 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 blinded[131]. Macdonald et al[132] 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 placebo[132]. 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 groups[133].

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 elusive[5]. 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 Simons[1] 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 myofibers[136]. 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 days[138]. 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 process[138]. An accurately placed needle may also provide a localized stretch to the contractured cytoskeletal structures, which would allow the involved sarcomeres to resume their resting length by reducing the degree of overlap between actin and myosin filaments[5]. To provide ultra-localized stretch to the contractured structures, it may be beneficial to rotate the needle[139]. 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 remodeling[140].

TrP-SDN involves a very light stimulus aimed at minimizing pain responses[24]. 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]. Baldry[24] suggested that with TrP-SDN, the acupuncture needle stimulates Aδ 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 stimulus[143]. According to Baldry, Aδ nerve fibers are stimulated for as long as 72 hours after needle insertion. Prolonged stimulation of the sensory afferent Aδ nerve fibers may activate enkephalinergic, serotonergic, and noradrenergic inhibitory systems, which would imply that TrP-SDN could cause opioid-mediated pain suppression[144]. 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 Aδ fibers. As Millan has summarized in his comprehensive review[145], Aδ fibers are divided into two types: Type I Aδ fibers are high-threshold, rapidly conducting mechanoreceptors and are activated only by mechanical stimuli in the noxious range while type II Aδ 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 Aδ 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 Aδ 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 use[146].

Skin and muscle needle stimulation of Aδ 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 vasodilators[147]. Superficial needling of certain acupuncture points in patients with chronic pain showed similar changes in cerebral blood flow[148]. Takeshige et al[149] 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' expectations[154]. 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 MTrPs[155].

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 place[162]. 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 tissue[159]. 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 al[28] 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 antagonists[165-173]. There is no evidence that MTrP injections with steroids are superior to lidocaine injections[174]. 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 solution[169]. 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 injections[179].

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 Hong[95] 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 al[181] 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 White[190] 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 relief[193]. 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 injections[199].

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 acupuncture[200-202]. 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 approaches[205-211]. 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 MTrPs[205]. More recently, Dorsher[207] 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 points[212]. In part, the *Trigger Point Manuals* are to blame for suggesting that MTrPs have distinct locations[1,213]. Simons, Travell, and Simons[1] 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 observation[207] 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].

Birch[205] 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. Hong[209], as well as Audette and Binder[210], 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 effects[155]. 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 acupuncture[216-218]. 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 irrelevant[155].

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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