Trigger-Point Dry Needling for the SOF Medic

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ABSTRACT

We propose that trigger-point dry needle (TrP-DN) therapy is an effective low-risk treatment for pain associated with myofascial trigger points (MTrP), and should be incorporated into the Special Operations Forces (SOF) Medic's scope of practice. Furthermore, TrP-DN therapy can be used as a treatment adjunct on the SOF continuum of care, providing analgesia and increased tolerance for rehabilitative therapy, thereby facilitating improved patient outcomes and faster return to operational readiness. The incidence of musculoskeletal injuries in the SOF community is discussed, as are available treatment options TrP-DN methods, a case study of a Soldier deployed to Afghanistan, the science behind the subject of MTrP and TrP-DN, and the risks associated with TrP-DN and how we can mitigate them effectively. Caution should be used in the interpretation of a body of literature based largely on case studies. Although the amount of published evidence in support of the potential benefits of TrP-DN is growing, larger, randomized, placebo-controlled trials and studies that evaluate the effects of TrP-DN in a methodologically rigorous and statistically significant way are needed. Based on anecdotal evidence of and personal experience with the success of the therapy, as well as its growing use within both civilian and military medicine, the possible therapeutic benefit of TrP-DN is relevant for the SOF community.

KEYWORDS: *myofascial trigger points; myofascial pain syndrome; military; case study*

Introduction

After over 14 years of back-to-back deployments, the average Special Operations unit is filled with individuals who have chronic injuries. Given a high operational tempo in austere locations, Special Operations Forces (SOF) are often unable to access the specialty and rehabilitative care they need to address many common musculoskeletal injuries. Additionally, SOF Medics are limited to basic rehabilitative exercises, stretching, rest, and pharmacologic therapy to treat these complex issues.

Trigger-point dry needle therapy (TrP-DN), a minimally invasive needle treatment for musculoskeletal pain, targets myofascial trigger points (MTrPs) that are believed to contribute significantly to chronic pain associated with musculoskeletal injuries.[1–4] We propose that TrP-DN therapy is an effective, low-risk treatment for musculoskeletal pain associated with MTrPs, and that it should be incorporated into the SOF Medic's scope of practice. Furthermore, TrP-DN therapy can be used as a treatment adjunct on the SOF continuum of care. TrP-DN may provide decreased pain and increased tolerance for rehabilitative therapy, thereby facilitating better patient outcomes and a faster return to operational readiness.

Although this therapy is available in garrison through our Tactical Human Optimization, Rapid Rehabilitation and Reconditioning (THOR3) physical therapists and other providers, many SOF personnel spend a majority of the year deployed, away from these therapists. Throughout Operation Iraqi Freedom and Operation Enduring Freedom, the Army has attempted to maintain an average dwell ratio, or the proportion of time deployed to the time at home, of nearly 1:1; however, SOF has historically exceeded this.[5] In 2010, for example, the average US Army Special Forces Command dwell ratio was 1:0.63.[6]

Here, we discuss the incidence of musculoskeletal injuries in the SOF community and treatment options available. We provide an explanation of TrP-DN methods. We use the case study of a Soldier deployed to Afghanistan to provide anecdotal evidence of the treatment's effectiveness. Last, we introduce the science behind the subject of MTrP and TrP-DN, the current gaps in research trials, and discuss the risks associated with TrP-DN and how we can mitigate them effectively.

SOF Musculoskeletal Injuries

As SOF Medics, we see a wide range of musculoskeletal injuries daily. Many of these are minor and can be easily resolved with basic treatments such as rest, ice, compression, elevation, simple stretching and exercise regimens,

and even medications, when appropriate. However, because of our operational tempo and a culture of fighting through injuries to complete the mission, even these minor injuries often lead to chronic musculoskeletal issues. An MTrP is defined as a hyperirritable palpable nodule located in taut bands of skeletal muscle fibers that may commonly demonstrate a referred pain pattern.[7] This pain may directly limit a patient's tolerance for rehabilitation and, ultimately, recovery. Nearly 10% of the US civilian population suffers from various forms of chronic musculoskeletal disorders.[7] A study conducted in 2006 revealed that 62.8% of military personnel suffered from musculoskeletal injuries annually, which totaled almost 1.6 million injuries per year.[8]

Acute trauma and repetitive stress injuries may lead to the development of an MTrP.[7] Furthermore, prolonged poor posture, sleep deficiencies, vitamin deficiencies, and joint problems may predispose a patient to the stress injuries associated with trigger-point development.[7] Physical activities that cause repetitive musculoskeletal stress are a key factor in the development of myofascial stress and trigger-point formation.[7] These risk factors are all part of the SOF lifestyle, whether on a combat deployment or in a training environment.

The development of chronic pain syndromes is often due to inadequate treatment resources and poor patient compliance. Many limitations and constraints are placed on SOF Medics because we are constantly deployed to remote locations throughout the world. In these austere environments, the SOF Medic is typically the only medical provider available. Moreover, because many SOF Medics are deployed more than they are in garrison, they have a limited arsenal with which to combat these more serious musculoskeletal injuries and chronic pain syndromes.

Dispelling Myths

Although many people consider TrP-DN a form of acupuncture, TrP-DN does not incorporate the same philosophy. In fact, the only real factor the two methods have in common is that they both use thin, filiform, solid needles commonly referred to as acupuncture needles. Although Dr Chan Gunn, a pioneer of dry needling, did refer to TrP-DN as a form of acupuncture, Gunn promoted targeting motor points rather than established acupuncture points.[1] His thinking was built on rigorously scientific neurologic concepts and not the energy meridians of Chinese acupuncture. Chinese acupuncture links specific anatomic locations to physiologic changes; however, there is no link between MTrP locations and acupuncture points. In fact, there is no research, to our knowledge, that supports the idea that MTrPs have any distinct positions besides simply being close to motor endplate zones in muscle fibers.[1] This distinction is important not only for the provider but also in explaining the treatment to patients who might doubt the efficacy of the treatment or equate it to traditional Chinese acupuncture.

Trigger-Point Dry Needling

TrP-DN Compared With Similar Methods

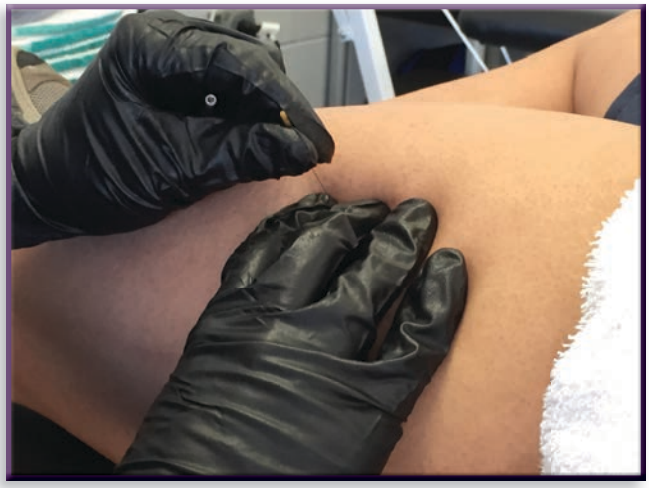
Within the realm of invasive stimulation of MTrPs, TrP-DN is often compared with other therapies such as intramuscular electrical stimulation, ultrasound guided mini-scalpel release, laser therapy, and injection therapy using anesthetic agents. Although the most closely related therapy might be considered injection therapy, there are significant procedural differences. Dry needling is distinct from the injection form of MTrP treatment whereby local anesthetics are injected into the tissue surrounding the trigger point.[1] Additionally, some authors suggest that although dry needling may provide as much analgesia as injection therapy using lidocaine, it leads to more post-therapy soreness; however, they most often refer to a study by Dr Chang-Zern Hong, who compared the effects of TrP-DN using a syringe, not an acupuncture needle, to the effects of lidocaine injections.[1]

In current practice, TrP-DN is performed with an acupuncture needle. Given the current treatment procedures and lack of comparative research, it cannot be reasoned that acupuncture needles cause more soreness than lidocaine injections.[1] Additionally, in a systematic review conducted by the British Medical Acupuncture Society of 23 studies, it was observed that when using injection therapy, the injected substance had no determinable effect on the outcome and that injection therapy was not therapeutically superior to TrP-DN.[1] Other methods, such as electric stimulation, laser therapy, and mini-scalpel release, may be useful in certain scenarios; however, the equipment and training required to perform these treatments preclude them from consideration here (Figure 1).

Treatment Method

Common indications to perform TrP-DN include symptomatic and active MTrPs, either with or without referred pain. Contraindications to TrP-DN are similar to those of most other percutaneous interventions and include systemic and local infection, trauma at the site, coagulation disorders, immune system suppression, and the current use of anticoagulants. Considerations also must be made for patients with recent surgical histories involving tissues that communicate with involved joints. The clinical decision to include TrP-DN as part of the patient's treatment plan is based on a thorough history, physical examination, and assessment.

Figure 1 *Trigger-point dry needle therapy applied with an acupuncture needle.*



The location of the pain producing the trigger point is first found via palpation. A high probability of locating the MTrP is associated with the suspected trigger point having either a nodular or bundle-like consistency upon palpation and perpendicular compression.[9] The active trigger point causes pain and discomfort at rest, elicits a response that reproduces the patient's chief complaint, and generally follows a characteristic zone of radiating pain.[10–12] On the other hand, the latent trigger point will generally not cause pain at rest, nor will it elicit a reproducible pain consistent with the patient's chief complaint. The latent trigger point will restrict range of movement and cause weakness; these signs and symptoms are easily exacerbated upon palpation and compression of the trigger point.[7,12,13]

After correct identification and ensuring standard precautions are taken, the trigger point's location may be designated by a surgical marking pen. Specifics of the technique are as follows:

1. Ready needle in the treatment hand and palpate tissue, with the palpation hand bracketing the tissue to be treated. Note that the needle size will always vary depending on the body part and the patient's size.
2. Tap the needle end firmly with your index finger.
3. Remove the guide tube slowly, being careful to only grasp the needle's handle.
4. Only touch the handle when needling a patient.
5. Hold the needle sheath between fingers or the palms of your hands.
6. Resheath the needle as required by inserting the handle first into guide tube.
7. Repeat as indicated.

The depth to which the needle is inserted depends on the trigger point's anatomic location. There are various techniques to needle insertion, including "pistoning," whereby the needle is moved in and out repeatedly; and "winding and unwinding," whereby the needle is inserted and twisted clockwise and counter-clockwise. Each technique is performed with the goal of eliciting a local twitch response (LTR). This fasciculation is thought to be directly correlated to decreases in pain levels.[2] Treatment for the specific trigger point may be stopped and deemed adequate once the LTR has subsided or the knot-like consistency of the trigger-point tissue has disappeared.[9]

After needle withdrawal, a simple bandage is placed. As part of a comprehensive clinical evaluation, immediate post-treatment reassessments should include active and passive range of motion (ROM) with attention to pain provocation. Patients should be instructed to avoid strenuous activity involving the treated muscle for at least 2–3 days.[9]

SOF Case Study

A 35-year-old Special Operator complains of recalcitrant lower back pain and associated right upper leg pain while deployed to a remote location in Afghanistan. The Soldier states that the pain limits his operational potential and is significant near the end of lengthy missions. The Soldier states that this back pain has never fully subsided since the blast he was involved in 4 years ago.

In that blast, the Soldier's vehicle was struck by an improvised explosive device and he was ejected. The explosion and subsequent ejection resulted in a myriad of devastating injuries including moderate traumatic brain injury; frontal skull fracture; bilateral mandible fractures; compound fracture of the right humerus; right-side, distal radial head fracture; two broken ribs; T3–6 compression fracture; level 2 liver laceration; level 1 spleen laceration; open-book pelvic fracture, right patella fracture; and right posterior cruciate ligament, medial collateral ligament, and lateral collateral ligament tears. After numerous operations and a lengthy rehabilitation process, the Soldier exhausted nearly all treatment methods to manage his lower back pain, except dry needling. Before and after getting medically cleared to return to duty, the Soldier continued to use the THOR3 physical therapists daily. At these appointments, the physical therapists would provide dry-needling therapy. The Soldier stated that if he missed an appointment due to temporary duty training or a family emergency, his lower back and leg pain would return.

At this point in the deployment, the Soldier had relied on stretches, exercises, heat pads, and COX-2 selective inhibitor nonsteroidal anti-inflammatory drugs to control his pain, without much effect. After coordinating with a physical therapist to visit our site, the Soldier received two rounds of TrP-DN 2 days apart. (Being able to have a physical therapist visit our site is a luxury very rare in

the context of SOF deployments). Each session lasted 45 minutes and consisted of deep dry needling with electrical stimulation to the lumbar musculature. The dry needling to the patient's right upper leg was without electrical stimulation. Following 1–2 days of soreness in the area that was treated, the Soldier's pain was unnoticeable. This pain-free period lasted approximately 3–4 weeks, at which point the pain gradually reappeared.

Scientific Research

SOF personnel are subject to physically stressful job requirements, often consisting of repetitive movements. Moving long distances under heavy load and remaining completely stationary for days on end are both necessary SOF skills and cause an extreme amount of physical stress on the body. There is a consensus that muscle overuse or direct trauma to the muscle can cause the formation of MTrPs.[14] Myofascial pain syndrome (MPS) is a common complication of musculoskeletal injuries.[1–4] MPS is characterized by regional pain and the presence of MTrPs.[14] These MTrP nodules are hyperirritable, are located in taut bands of skeletal muscle fibers, and contain contraction knots theorized to be caused by excessive acetylcholine (ACh) and other biochemical markers at the motor endplate.[1,2] MTrPs can be further subdivided into latent and active MTrPs. Latent MTrPs do not cause spontaneous pain but may cause unfamiliar pain and inhibit full ROM or strength, whereas active MTrPs cause familiar pain or local and referred pain at rest. Evidence suggests that these referred pain patterns may be characteristic of specific muscles and not any anatomic location of the MTrP.[1]

The goal of TrP-DN is to elicit an LTR, which is a spinal reflex that causes an involuntary spasm of the taut muscle fibers.[15] It is believed that the LTR is the primary therapeutic effect of TrP-DN and that it resolves the MTrP; although the mechanism is still largely theoretical.[2] Evidence has shown that "LTRs can normalize the chemical environment of active MTrPs and diminish endplate noise associated with MTrPs in rabbits nearly instantaneously"[1]; however, more research is needed to fully understand both the physiology behind MTrPs and the mechanism of TrP-DN effectiveness.[1] It is also conjectured that an effectively placed needle may stretch the contracted sarcomeres and allow them to resume their resting length by reducing the actin and myosin filament overlap.[1]

A study conducted at the Department of Physical therapy at Hungkuang University, Taiwan, used TrP-DN on 14 patients with bilateral shoulder pain and active MTrPs. A single shoulder was dry needled, and the shoulder pain intensity, ROM, and pressure pain threshold of the MTrPs were measured before and after treatment. There were significant improvements in pain levels and ROMs in the treated shoulder compared with the untreated shoulder. Patients had remarkably reduced pain on the treated side and little or no change in pain levels on the untreated side.[4] These subjective changes in pain levels are further supported by changes in regional biochemical factors around MTrPs.

Much of the current literature on TrP-DN is based on case studies and even many of the randomized placebo-controlled trials are considered to have inadequate placebo controls or sample size too small for verifiable quantitative results. The number of published studies of the effectiveness of TrP-DN, therefore, are limited. Although our study, too, is case-based, we believe that SOF could also potentially be a driver of a large randomized controlled trial, given the common use of TrP-DN among THOR3 physical therapists. Furthermore, there is growing evidence in support of the hypothetical pathophysiology of MTrPs, as well as the physiologic effect of TrP-DN therapy, by using ultrasound shear-wave elastography and invasive analysis of inflammatory markers in soft tissue.

In a study conducted at the National Institutes of Health, researchers were able to invasively monitor inflammatory markers and the biochemical environment surrounding MTrPs before and after an LTR. The study used microanalysis of needle insertions around active and latent MTrPs, as well as areas determined to be normal in the upper trapezius muscle, to explore the biochemical environment of MTrPs before treatment, during the treatment and the LTR, and after TrP-DN was performed. They found statistically significant changes in the biochemical environment of MTrPs, including changes in levels of inflammatory markers, catecholamines, neuropeptides, and cytokines. These chemicals were viewed in patients with active and latent MTrPs, as well as those without MTrPs. This study "confirmed that biochemicals associated with pain and inflammation are elevated in soft tissue in the vicinity of active MTPs."[2]

The contracted sarcomeres involved in an MTrP create local hypoxia and ischemia from compromised circulation and an increased metabolic demand.[2] This would explain the increased concentrations of these inflammatory and pain-sensitizing chemicals near MTrPs.[2] The increased levels of inflammatory markers and other biochemicals around an MTrP create the chronic nature of the MTrP life cycle as it develops from latent to active. After treatment, these biochemical levels decrease as a result of either direct nerve stimulation or a local increase in blood flow.[2]

These findings reinforce the theories of another pioneer of TrP-DN, David G. Simons. Simons created the "integrated hypothesis of MTrP," which postulates that the

combination of excessive ACh release, sarcomere contraction, and the release of inflammatory markers and sensitizing biochemicals aggravates the taut band of an MTrP, which creates an "energy crisis."[3] This energy crisis consists of increased metabolism, local ischemia, and hypoxia due to the prolonged contracted state that causes an increase in the release of sensitizing elements, causing further pain and increased ACh release.[3] This vicious cycle is thus the foundation of the chronic nature of an MTrP.

Further scientific evidence from an ultrasound study of musculature with MTrPs supports the therapeutic effect of TrP-DN.[16] Recent advancements in ultrasound shear-wave imaging technology allowed researchers to calculate the shear modulus or level of stiffness in a certain material—in this case, soft tissue—by transmitting high-intensity pulses through the tissue, the speed of which was tracked and used to determine tissue elasticity.[16] In this study, conducted at the Department of Physical Therapy at the University of North Georgia, ultrasound shear-wave elastography was used to study changes in muscle stiffness in the trapezius muscle before and after TrP-DN therapy. The results indicated that the shear modulus in the muscle was reduced after TrP-DN. The study further compared findings in the prone and sitting positions, as well as palpable stiffness changes. Their findings indicated that dry needling, as well as a patient's posture, affected the shear modulus of tissue surrounding MTrPs.[16] In addition to sonographic elastography, MTrPs can be visualized by magnetic resonance imaging, which reveals that active MTrPs are larger than latent MTrPs, and are characterized by reduced blood flow.[15] This research is limited, however; thus, many providers and patients remain skeptical of TrP-DN.

Mitigating Risk

SOF Medics perform many advanced procedures with high risk for severe complication; these range from surgical cricothyroidotomy to myoplastic amputation. Given this advanced scope of practice and the nature of TrP-DN therapy, the risks associated with TrP-DN are minimal. Local soft-tissue damage due to excessive needle manipulation may cause ecchymosis, swelling, and, in extreme cases, vessel damage. Additionally, local infection could occur; however, the minimally invasive acupuncture needle carries a very low risk for infection if proper aseptic technique is used. For example, battlefield auricular acupuncture generally uses acupuncture stud needles that remain in place for a long time and is taught to SOF Medics across the force. The battlefield setting is generally considered to be an extremely dirty environment. In contrast, TrP-DN would be performed in the controlled environment of an aid station or team house. Additionally, postprocedure pain and swelling in the treated site is possible; however, damage caused from a small, single, solid filament needle is minimal. The size of acupuncture needles is actually quite small. Acupuncture needles have a diameter of 160µm to 300µm when compared to that of muscle fibers, which ranges from 10µm to 100µm.[1] This would not pose a significant risk for scar tissue formation or any form of long-term soft-tissue damage.[1]

When dry needling is performed in the thoracic region, there is risk for tension pneumothorax. Again, proper regard for the anatomy of the thoracic region and a conservative approach to needling shallow tissues in the chest and back, with proper training and technique, could easily mitigate this very rare occurrence. An adequate understanding of the anatomy coupled with clean procedures and use of the small-diameter acupuncture needles would minimize any local tissue damage or risk for infection.

Minimizing Narcotic Dependence

By using TrP-DN to control musculoskeletal pain disorders, we can minimize the use of pain medication given to our Soldiers. Ultimately, medication may provide temporary relief of symptoms but does not address the source of the pain.[2] SOF Soldiers who are given long-term narcotic treatment for pain are at high risk for complications. The military's rate of complications from prescription medication addiction has been labeled a public health crisis, with numbers consistently growing each year.[17,18] The incidence of dependence on prescription and narcotic medication in the military is twice that of the civilian population. Soldiers with chronic injuries and who may be assigned to special units for rehabilitation have a 25%–35% rate of dependence.[17,18] This complication rate is significant when compared with the low rate of serious adverse outcomes associated with TrP-DN.

The most common adverse events are mild instances of bleeding, bruising, and pain. The most significant adverse event, tension pneumothorax, was documented as very rare, occurring in 0.01 of 10,000 treatments. The analgesic effect of TrP-DN could help minimize the SOF Medic's dependence on narcotic treatments and even non-narcotic analgesic treatments for severe musculoskeletal pain.

Conclusion

There is significant stigma surrounding TrP-DN. This is because little research has been done and there is poor understanding of the physiology behind the treatment. Due to the nature of the needle insertion of TrP-DN,

it is difficult to conduct effective placebo studies. Even when practitioners use placebo or sham needling, there is evidence that even minimal palpation may have some stimulating effect on the mechanoreceptors and the pain associated with an MTrP.[1] Caution should be used in interpreting literature that is largely case based. Although the published evidence in support of the potential benefits of TrP-DN is growing, randomized placebo controlled trials of larger sample size and studies that evaluate the effects of TrP-DN in a methodologically rigorous and statistically significant way are needed. Although the research presented here is limited, being based on anecdotal evidence of and personal experience with the success of the therapy and its growing use within civilian and military medicine, we think its potential therapeutic benefit is relevant for the SOF community.

The introduction of TrP-DN into the SOF Medic's scope of practice would be a step forward in providing the comprehensive care that the SOF population needs. TrP-DN is a powerful adjunct that will allow patients to begin strengthening and stretching regimens to combat the source of the problem. This is not a panacea treatment designed to replace traditional physical therapy rehabilitation; rather, it is an important tool to facilitate a faster return to operational readiness. Because TrP-DN is an ongoing treatment method, the SOF Medic must be able to continue treatment when deployed to locations without physical therapists and physicians. Indeed, the Soldier's pain in the aforementioned case returned because the physical therapist was unable to return to the site.

To effectively minimize risk, there must be a standardized curriculum for all SOF Medics to follow, as well as strict treatment procedures. With the proper training, SOF Medics can be successful in providing this treatment. It is an easy-to-perform, low-risk, highly transportable treatment method. TrP-DN can be executed with a handful of acupuncture needles and alcohol swabs, costing essentially nothing when compared with the transportation costs of moving an SOF Operator requiring TrP-DN around a theater of operations to receive treatment, or even the loss of an Operator on a team because of injury.

The practice of TrP-DN by physical therapists only began in 1989 in the United States.[20] As of 2013, 26 states had authorized TrP-DN at the provider level, with several more on the way to accepting it as an effective and safe treatment.[20] Although TrP-DN is still not widely accepted in either the military or civilian medical world, we believe that as a community, we can be leaders in providing the effective treatment that our Operators need to maximize mission readiness, complete the mission, and maintain the long-term health of SOF Soldiers.

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