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MYOFASCIAL PAIN AND TREATMENT: Editorial

Myofascial pain and treatment: Editorial a critical overview of the current myofascial pain literature – August 2019

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A B S T R A C T

This quarter's overview of the myofascial pain literature includes quite a few basic research papers in addition to the usual high quantity of dry needling (DN) papers. Of particular interest are a study by Fischer and colleagues studying the role of mitochondrial functions in chronic trigger points (TrPs) (Fischer et al 2018), a study by Li and associates who conducted a quantitative proteomics analysis to identify biomarkers of chronic myofascial pain and therapeutic targets of dry needling in a rat model of TrPs (Li et al 2019), and a sonography study by Mitchell et al. looking into the distances from the skin to the pleura in the context of DN (Mitchell et al 2019). A total of 33 papers are included in this overview article.

We welcome Dr. Jacob Thorp to our team of authors. Dr. Thorp is a US-based physical therapist. He is Professor and Founding Director of the Physical Therapy Program at Charleston Southern University in North Charleston, SC.

1. Basic research

Fischer MJ, Horvath G, Krismer M, Gnaiger E, Goebel G, Pesta DH. 2018. Evaluation of mitochondrial function in chronic myofascial trigger points - a prospective cohort pilot study using high-resolution respirometry. BMC Musculoskeletal Disorders, 30;19(1):388. DOI: 10.1186/s12891-018-2307-0.

In this pilot study, German authors analyzed a muscle biopsy in active TrPs to evaluate mitochondrial function and oxygen consumption. Consistent with the Integrated TrP Hypothesis and its embedded "energy crisis theory," mitochondrial dysfunction and hypoxia are often assumed to be core elements of the TrP etiology (Dommerholt et al., 2019). Twenty males, aged 18–45 years old, diagnosed with myofascial pain less than 12 months earlier, with TrPs in either the shoulder-neck or lumbo-gluteal region, were included in this study. Participants were excluded if they had a history of respiratory tract, neurological, cardiovascular system, or musculoskeletal system disorders. All participants received a muscle biopsy of the vastus lateralis to be used as the control, and dependent upon the TrP location, another biopsy of either the upper trapezius or gluteus medius muscle. High resolution respirometry was used to measure oxygen consumption within the sample tissue.

The researchers did not observe a difference in mitochondrial function between any of the three biopsied muscles and they concluded that abnormal mitochondria function does not seem to play a role in the development of TrPs. Yet, studies by Reitinger and Windish showed the presence of ragged red fibers near TrPs (Reitinger et al., 1996; Windisch et al., 1999), which are indicative of an impaired oxidative metabolism. While these studies have been criticized as the tissue samples were taken from cadavers, others found differences in mitochondrial and lipid droplet morphology in female office workers with trapezius myalgia with a significantly higher percentage of intermyofibrillar lipid droplets touching the mitochondria in the patient group compared to the control group (De Meulemeester et al., 2019). In other words, it may be a bit premature to completely rule out dysfunctional mitochondria in the etiology of myofascial pain and the formation of TrPs. In the current study, researchers used the vastus medialis as a control region, but no healthy subjects were included for a true control group. Additionally, this study excluded participants who had a diagnosis of myofascial pain greater than 12 months.

Hong SW, Lee JK, Kang JH. 2019. Relationship among cervical spine degeneration, head and neck postures, and myofascial pain in masticatory and cervical muscles in elderly with temporomandibular disorder. Archives of Gerontology and Geriatrics, 81:119–128. DOI: 10.1016/j.archger.2018.12.004.

Temporomandibular disorder (TMD) is a collection of conditions that affect the temporomandibular joints, masticatory muscles and the surrounding structures. Strong associations exist between the masticatory and cervical systems owing to their neurological and biomechanical interactions, so an integrated approach for both systems is necessary for the proper management of cervical spine disorders as a comorbidity of TMD.

Korean researchers Hong et al. conducted a cross sectional study using the clinical and radiographic records to verify associations between degenerative changes in the cervical spine, head and neck postures, and myofascial pain in the craniocervical musculature

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1360-8592/

in elderly with myofascial TMDs. A total of 120 participants were included: 45 participants had no signs of orofacial or cervical pain, 26 participants had myofascial TMD only (mTMD), and 49 participants had both myofascial TMD and cervical pain (cerTMD). Subjects in the cerTMD group presented with a higher number of active TrPs in the masticatory and cervical muscles, greater forward head posture, and more severe degenerative changes in the cervical spine than subjects in the mTMD group. The degenerative changes of each level of the cervical spine had complex interactions with head postures. Cervical degeneration, particularly at the level of C2 to C3, showed significant relevance with the number of active TrPs in the masticatory and cervical muscles.

An increased forward inclination of the upper cervical spine in TMD patients has been reported previously. Excessive stretching of the capsular ligaments beyond their biophysical limitations as a result of forward head posture (FHP) could potentially decrease the threshold of nerve endings and activate proprioceptors in facet joint capsules developing cervical muscle pain. The results of this study demonstrated that degenerative changes in the cervical spine were related to altered head postures and the development of active TrPs in the craniocervical musculature in elderly with myofascial TMD. The exact mechanisms and nature of the correlations need to be examined in future studies.

Kuć J, Szarejko KD, Sierpińska T. 2019. Evaluation of orofacial and general pain location in patients with temporomandibular joint disorder-myofascial pain with referral. Frontiers in Neurology, 29;10:546. DOI: 10.3389/fneur.2019.00546.

Fifty random patients diagnosed with myofascial pain with referral using the Diagnostic Criteria for Temporomandibular Disorders (available at https://ubwp.buffalo.edu/rdc-tmdinternational) participated in this study. The researchers assessed the regions of orofacial and body pain using body charts. Patients reported as many as 40 different areas of the body affected by pain with one individual identifying 17 different areas. Seventy percent of the patients suffered from pain within the right masseter muscle. Sixty-eight percent reported pain of the left masseter muscle and pain in the left temporomandibular joint. Cervical dysfunction was reported by 56% of the subjects. Pain of the right temporomandibular joint was seen in 54% of the patients. In summary, patients with myofascial pain with referral suffered from significant dysfunction of different regions of the body. The study was conducted in Poland.

Li LH, Huang QM, Barbero M, Liu L, Nguyen TT, Beretta-Piccoli M, Xu AL, Ji, LJ, 2019. Quantitative proteomics analysis to identify biomarkers of chronic myofascial pain and therapeutic targets of dry needling in a rat model of myofascial trigger points. Journal of Pain Research, 12, 283–298. DOI: 10.2147/JPR.S185916.

Myofascial pain is one of the most common types of chronic musculoskeletal pain. Currently, the diagnosis of TrPs and research into the possible mechanisms of treatment modalities, such as DN, are based mainly on clinical examination, histopathology, and electromyography. Few proteins or other biomarkers specific to TrPs have been identified. In 2016, Hsieh et al. found changes in the levels of enkephalin and β-endorphin in the serum, spinal cord, dorsal root ganglion, and muscles following acupuncture at distant TrPs in rabbits, which suggested that the endogenous opioid system could be a potential analgesic mechanism underlying TrP pain management (Hsieh et al., 2016). Recently, proteomics technology shows increased reliability regarding disease diagnosis compared to traditional single gene or protein study, and more accurately, it can reflect changes related to certain biological processes. Applied to TrPs, proteomics analysis may provide important information regarding the pathogenesis of chronic myofascial pain and the treatment effects mechanisms of dry needling for TrPs.

Huang and colleagues from China, Switzerland and Vietnam conducted an in vivo study based on proteomics technology using a rat model of TrPs. They tried to discover the potential pathogenesis of myofascial pain and the therapeutic mechanism underlying DN at the molecular level. They used both clinical examination (tender spot in taut band with palpable or visible LTRs) and objective endplate measurements (SEA) to identify active TrPs in a rat model. Tandem mass tag (TMT) labeling technology based on nanoscale liquid chromatography-tandem mass spectrometry was used. Three candidate biomarker proteins were verified using parallel reaction monitoring and Western blot analysis to validate the TMT results. Hierarchical clustering, gene ontology (GO) analysis, Kyoto Encyclopedia of Genes and Genomes (KEGG) analysis, and protein–protein interaction network analysis were performed to characterize the proteins.

In this study, the authors found three enriched pathways between the controls and TrP groups, including glycolysis/gluconeogenesis, glucagon signaling pathway, and hypoxia-inducible factor (HIF)–1 signaling pathway. They concluded that especially the glycolysis/gluconeogenesis pathways played dominant roles in the pathogenesis of chronic myofascial pain. As the authors explain, glycolysis is the process that converts glucose into pyruvate, which produces small amounts of ATP (energy) and NADH (reducing power), which subsequently, can be oxidized through oxidative phosphorylation (OXPHO) to produce more ATP. Gluconeogenesis is a synthesis pathway for glucose from non-carbohydrate precursors, which is essentially a reversal of glycolysis, with minor variations in the pathway.

Of interest is the previous research by Moraska et al., (2013), which showed a significant increase in the dialysate lactate concentration in the TrP region. Lactate is metabolized from glucose via the glycolysis pathway. In other words, lactate levels appear to increase continually at the site of a TrP until oxidative systems fully oxidize the lactate and glucose (if no treatment is administered). The pathway is in accordance with the integrated hypothesis by Simons et al., which proposes that the TrP zone is ischemic, leading to hypoxia and a shortage of glucose required for metabolism (Gerwin et al., 2004). Three candidate biomarker proteins, the pyruvate kinase muscle isozyme (pyruvate kinase PKM), the muscle isoform of glycogen phosphorylase (PYGM), and myozenin 2 (MYOZ 2) were selected to be analyzed based on their biological functions and their high fold changes.

Pyruvate kinase PKM was significantly downregulated in the TrP muscle region compared with the healthy muscle tissue and upregulated after DN of TrPs. An upregulation of pyruvate kinase PKM after DN suggests an increased energy requirement to support restored muscle activity. PYGM was downregulated in TrPs and its expression was reversed in non-TrPs and upregulated after DN of TrPs, with no significant expression change after DN of non-MTrPs. The significance of the upregulation after DN is not yet known. MYOZ 2 was significantly upregulated in the TrP model and downregulated following DN treatment. The decrease of MYOZ 2 might be considered as a potential therapeutic biomarker of the effects of pain reduction after DN. Although the three candidate proteins selected might not be the optimum targets, the proteomics data may provide valuable clues to better understand the pathogenesis associated with myofascial pain in order to improve diagnosis and treatment. This is an important new direction in TrP research, and we are looking forward to more studies along these lines.

Linde, LD, Kumbhare, DA, Joshi, M & Srbely, JZ, 2018. The relationship between rate of algometer application and pain pressure threshold in the assessment of myofascial trigger point sensitivity. Pain Practice, 18, 224–229. DOI: 10.1111/papr.12597.

Pressure algometry has been used for the assessment of both regional and widespread musculoskeletal pain, like MPS and fibromyalgia for more than 30 years, however, the relationship between the rate of pressure application (RoA) and pain pressure threshold (PPT) remains poorly understood. Linde and colleagues from Canada conducted a study to test the relationship in young heathy subjects with TrPs in the infraspinatus muscle. All TrP loci were clinically identified, and the pressure algometer was aligned perpendicularly to the TrP site with consistent increased pressure. Participants pressed the hand-held button as soon as the sensation of pressure became painful. The RoA for baseline trials was maintained at 30 N/s, followed by six additional trials using a low (15 N/s), medium (35 N/s), and high (55 N/s) RoA.

Data analysis showed that the RoA was very consistent both within and between participants throughout the trials. Pearson's correlation coefficient between RoA and PPT showed a strong positive, linear relationship and the slope of the linear regressions across all participants was low. The results support the authors' hypothesis that a significant, positive linear relationship exists between RoA and PPT outcome during pressure algometry of the infraspinatus muscle.

Subcutaneous tissue thickness and depth of the palpated trigger point may potentially contribute to variability in the raw PPT measures between subjects. As the current findings are limited to young healthy subjects, future research is needed to include chronic musculoskeletal pain populations.

Mitchell UH, Johnson AW, Larson RE, Seamons CT. 2018. Positional changes in distance to the pleura and in muscle thickness for dry needling. Physiotherapy, 105(3):362–369. DOI: 10.1016/j.physio.2018.08.002.

With the increased use of DN throughout the world, paying close attention to potential adverse events is necessary. Although DN is generally considered to be a safe procedure (Brady et al., 2014; Halle and Halle, 2016), especially when DN is performed of the rhomboid major and minor, levator scapulae and the upper trapezius muscles, the risk of causing a pneumothorax or hemothorax is well recognized. To facilitate retraction of the scapula and to gain better access to these muscles, clinicians may place a bolster or towels underneath the shoulder. In this study from the US, the researchers determined the distance between the skin and lung and between the skin and rib cage with and without a bolster. Sixty subjects were allocated to three different groups based on their body mass index. Measurements were performed in random order with the subjects in the prone position using a sonography unit with a 6–15 MHz multi linear array transducer or a 5 MHz curvilinear transducer.

The authors reported excellent repeat reliability of the measurements. They did not observe any differences between the distances from the skin to the pleura, first rib and second rib on the dominant vs. non-dominant side. A bolster underneath the shoulder significantly increased the distance between the skin and pleura for all subjects and for all muscles. Not surprisingly, the thickness of the ribs did not change, but body composition did change the distance from skin to pleura. On average, the distance increased 0.8 cm for men and 0.5 cm for women. While these distances should not be used as an indication for safe needling, they do support using a bolster when needling these higher risk muscles. This is a much-needed study and we hope that similar studies will be conducted of other body regions, such as the abdominal region and the iliacus muscles.

Zhang CS, Zhang GS, Xu S, Li B, Zhang AL, Xue CC4, Xie YM. Examination of needle surface corrosion in electroacupuncture. 2018. Acupuncture in Medicine, 36(6):367–376. DOI 10.1136/acupmed-2017-011542.

Electroacupuncture (EA) involves combining traditional acupuncture with electrotherapy. The purpose of this Australian based study was to determine if EA resulted in needle corrosion. After two healthy participants received four session of EA, the needle surfaces were inspected immediately by a scanning electron microscope (SEM). Experimental group 1 received electrical stimulation at 2 Hz in acupuncture points on the lower leg for 30 minutes. This process was repeated on the contralateral leg at 100 Hz (experimental group 2). Control group 1 received acupuncture, without electrical stimulation, in the upper arm. Unused needles were steam sterilized and placed in a container to be analyzed later (control group 2). Additional needles were taken directly from the package and analyzed (control group 3). This study assessed unused acupuncture needles as well as needles that did not concurrently were used for electrical stimulation.

A total of 32 needles were assessed using SEM. There was no evidence of corrosion following any of the 30-min treatments. The authors identified "dark flat areas", most prominent in control group 3, which they theorized were representative of silicone oil. They also identified burrs in control group 1 and experimental groups 1 and 2, which could have been dried human body fluid or an accumulation of silicone oil. The authors did not identify a difference in number of burrs between subjects, needling technique, or electrical stimulation parameters. While the authors were not blinded to needle assignment, this was still a well-designed, controlled study. The authors confirmed the low risk of corrosion associated with EA.

2. Reviews

Hall ML, Mackie AC, Ribeiro DC. 2018. Effects of dry needling trigger point therapy in the shoulder region on patients with upper extremity pain and dysfunction: a systematic review with meta-analysis. Physiotherapy, 104(2):167–177. DOI: 10.1016/j.physio.2017.08.001.

New Zealand-based authors used the Preferred Reporting Item for Systematic Reviews and Meta-Analyses (PRISMA) recommendations to report outcome findings of TrP DN of muscles of the shoulder region. In addition to the effectiveness of TrP DN, the authors also searched for the frequency and severity of adverse effects of this intervention when treating UE pain and dysfunction. The literature review included a variety of search engines, including Medline, Cochrane Central Register of Controlled Trials, PEDro, and CINAHL to locate articles published on or before August 31, 2016. The search criteria included randomized control trials of patients with shoulder or UE pain that assessed the outcomes of DN on at least one TrP in the shoulder region on shoulder or UE pain or dysfunction. Studies were included that compared TrP DN with at least one other intervention. Studies were excluded if they were not written in English or combined other forms of acupuncture or needling techniques. This review also eliminated studies that combined neck and shoulder pathologies as cervical involvement can contribute to a variety of referred pain patterns.

The initial search identified 307 titles and abstracts that met the authors' search criteria. A total of 11 randomized control trials with 496 participants met all criteria and were included in the final systematic review with meta-analysis. Studies with a PEDro score equal or greater than six were considered to be a high-quality study with a low author bias. Seven of the studies had a PEDro score of 6/10 or higher (studies ranged 4 to 8). The outcomes assessed in this systematic review were pain or dysfunction, ROM, strength, PPT, self-rated recovery, and other valid outcomes measures. A total of nine studies looked at pain and seven of these showed significant improvement supporting TDN; however, only three studies were high quality. Two of the three studies, that assessed upper extremity function, reported improvement. Strength and ROM were each assessed in four studies with two and three of the studies, respectively, reporting improvement. All eight studies that assessed pain pressure threshold, reported improvement at both the local and distal sites of initial pain.

Only two studies reported any adverse effects. One study identified 60% of participants experienced post-treatment soreness with a maximum timeframe of 36 hours later. Another study found soreness both during and after needling and 2 people had transient fall in blood pressure with a loss of consciousness for a few seconds. In a prospective study by Brady et al. (2014), it was identified that mild adverse events were commonly reported but no significant adverse reactions were reported. Mild events include burning, bleeding, and pain during and after treatment (Brady et al., 2014).

Due to the heterogeneity in study design and outcome assessments it was not possible to conduct a meta-analysis with many of the studies. The authors identified a range of comparative treatments, study designs, and final assessments ranging from immediately following intervention to 15 weeks. Additionally, none of the studies included instructions to practitioners and patient information and explanation. Most of studies had missing information about treatment and control intervention. The authors concluded that due to the high risk of bias in the studies and the low strength and quality of evidence, there is very low evidence to support TrP DN of the shoulder region to impact UE pain and dysfunction.

Hortz BV, Falsone S, Tulimieri D. 2019. Current athletic training educational preparation for dry needling. Journal of Sports Medicine and Allied Health Sciences, 4(3):Article 5. DOI: 10.25035/jsmahs.04.03.05.

Dry needling is becoming common practice across many disciplines, including physiotherapy, acupuncture, chiropractic, myotherapy (Australia), remedial massage (Australia), medicine, veterinary medicine, dentistry, and more recently, occupational therapy and athletic training. State practice acts vary on certain clinicians performing DN. The objective of this review was to determine the degree to which the current athletic training educational competencies and standards prepare practitioners for the performance of DN tasks. A few years ago, the US Federation of State Boards of Physical Therapy (FSBPT) commissioned an independent research institute to conduct a similar study of physical therapists, which concluded that “86% of the knowledge requirements needed to be competent in dry needling is acquired during the course of PT entry-level education, including knowledge related to evaluation, assessment, diagnosis and plan of care development, documentation, safety, and professional responsibilities” (Caramagno et al., 2015). The authors of the current paper aimed to determine whether the 123 tasks outlined in the FSBPT report are covered within the 2020 Standards for Accreditation of Professional Athletic Training Programs and the Athletic Training Education Competencies - 5th Edition (Commission on Accreditation of Athletic Training Education, 2018; National Athletic Trainers' Association, 2011). After an initial matching of the physical therapy competencies with the athletic trainers’ standards and competencies, 18 identified experts, including nine athletic training DN experts and nine program directors, were approached to evaluate the matched competencies. Sixteen experts (88% response rate) completed the assessment. Agreement was set on 80%. The experts concluded that 110 of the 123 competencies were provided through entry-level education, which equates to 89%. The authors concluded that DN could be added to the clinical practice of athletic trainers. They did not address whether athletic trainers who qualified prior to the current competencies were initiated would also qualify. One potential concern with this paper is that one of the authors provides continuing education courses in DN, which was not listed as a potential conflict of interest.

Kalichman L, Menahem I, Treger I. 2019. Myofascial component of cancer pain review. Journal of Bodywork and Movement Therapies, 23(2):311–315. DOI: 10.1016/j.jbmt.2019.02.011.

Myofascial pain syndrome (MPS) has been shown to have a high incidence rate in cancer patients. Investigators from Israel conducted a literature review to estimate the prevalence of MPS in cancer patients and to examine the efficacy of current treatment options in this patient population. Thirteen studies that examined any diagnosis of breast, head, or neck cancer and the evaluation or treatment of MPS were included in this review. The reported MPS prevalence varied between 11.9% in patients with head and neck cancer, and 44.8% in a study of patients with breast cancer. In patients with head or neck cancer the muscles most commonly affected were the pectoralis major, infraspinatus, upper trapezius, and the sternocleidomastoid. Patients with breast cancer had an increased prevalence of MPS in the latissimus dorsi, serratus anterior, pectoralis major, infraspinatus, and upper trapezius muscles.

The authors also reported on the efficiency of treatment of MPS in cancer patients. The clinical studies included in this review reported on the use of myofascial release techniques, needling, ultrasound-guided trigger point injection, and physical activity with conflicting results. Four interventional studies found that treatments aimed at MPS may reduce the prevalence of active TrPs and thereby decreasing the pain intensity, sensitivity, and improve shoulder range of motion. However, two randomized controlled trials reported that manual pressure release of TrPs provided no additional beneficial effects to a standard physical therapy program for upper limb pain and function following breast cancer surgery. In 2017, Hasuo et al. reported that TrPs in advanced cancer patients are more commonly observed together with cancer pain rather than independently (Hasuo et al., 2017). This review highlights the importance of a comprehensive evaluation that includes the presence of MPS in patients presenting with a history of either head and neck cancer or breast cancer.

Tuckey C, Kohut S, Edgar DW. 2019. Efficacy of acupuncture in treating scars following tissue trauma. Scars, Burns & Healing, 5: 1–12. DOI: 10.1177/2059513119831911.

This systematic literature review from Australia and New Zealand aimed to assess the current level of evidence for the use of acupuncture for treating abnormal scars, including hypertrophic or other symptomatic scars. They used the search strategy following guidelines from the Joanna Briggs Institute to locate published and unpublished studies and searched databases including CINAHL, Medline, SportDiscus, Dentistry & Oral Sciences, Web of Science, Cochrane, Scopus, AMED, and PEDro. To rate the quality of the included randomized controlled trials, the authors used the Oregon CONSORT STRICTA Instrument. The authors found initially only one clinical trial and two case reports. After they expanded the search, they identified a total of three clinical trials, one cohort study, one retrospective review, and five case reports. Unfortunately, the clinical trials and majority of published case studies were of very low quality, providing insufficient evidence to support the use of acupuncture for scar tissue.

3. Dry needling, acupuncture, and injections

Abdelraouf M, Salah M, Waheb M, Elshall. 2019. Suboccipital muscles injection for management of post-dural puncture headache after cesarean delivery: a randomized-controlled trial. Journal of Medical Sciences, https://doi.org/10.3889/oamjms.2019.105.

Post-dural puncture headache (PDPH) following cesarean section under spinal anaesthesia is a common complication. The exact cause is not clearly understood. It is commonly associated with neck stiffness and muscle spasm over the frontal and the occipital region with nausea, vomiting, hearing loss. Local anaesthetic injection in neck muscles has been reported to relieve some types of chronic headache, but no one has tried to use this technique in the treatment of PDPH. Researchers from Egypt conducted a prospective double-blind randomized controlled trial to see whether a intramuscular injection into the suboccipital neck muscle with a local anesthetic-steroid combination could improve both neck muscles spasm and subsequently PDPH. Visual Analog Scores (VAS) for headache, neck muscle spasm, nausea and the need for rescue analgesia were recorded and analyzed.

They reported that an injection into the suboccipital muscles resulted in relaxation of these muscles, which successfully improved the PDPH after cesarean delivery. The authors suggested that this simple, cost-effective, and less invasive intervention may be preferable over the traditional methods for management of PDPH such as an epidural blood patch. As the authors did not compare the two treatment options, further studies are needed to substantiate their assumption. The authors provided no further information about how to decide which suboccipital muscle (rectus capitis posterior major, rectus capitis posterior minor and the capital inferior) was selected to be injected, and what dosage was used. Further studies, possibly with ultrasound-guided injections of a dexamethasone-lidocaine mixture in suboccipital muscles are needed with more reliable outcome assessments. The other question is whether targeted DN of TrPs in the suboccipital muscles would have similar results in PDPH (Fernández de las Peñas et al., 2006).

Berrigan WA, Whitehair CL, Zorowitz RD. 2019. Acute spinal epidural hematoma as a complication of dry needling: a case report. PM R, 11(3):313–316. DOI: 10.1016/j.pmrj.2018.07.009.

Although serious adverse events following DN are relatively rare (Brady et al., 2014), clinicians must always be aware that DN should only be utilized against the background of outstanding knowledge of three-dimensional anatomy. Severe complications include pneumothorax (Cummings et al., 2014; Uzar et al., 2018), infection (Kim et al., 2018), and epidural hematoma (Lee et al., 2011). In this case report from Washington DC, USA, the authors describe a 62-year old female who as part of her physiotherapy program was treated with DN of TrPs in the right infraspinatus, rhomboids, trapezius, and bilateral C3–C4 and C4–C5 multifidus muscles. During the 4th session of DN, the patient felt an immediate warm sensation throughout her body when one of the needles was inserted. A short time later, she developed a stiff neck with limited cervical range of motion and severe burning pain down her entire spinal column. She was prescribed oxycodone, diazepam, and cyclobenzaprine, which did not help. Three days later she was admitted via ambulance with altered mental status. While she did not have focal neurological deficits other than neuropathic pain, magnetic resonance imaging (MRI) of the cervical and thoracic spine showed a complex epidural hematoma from C2-T2. The diagnosis was confirmed with conventional spinal and cerebral angiography. Fortunately, she did not a laminectimony require surgery, which is fairly unusual as in other similar cases, multiple level laminectomies were indicated (Chen et al., 2006; Domenicucci et al., 2017; Lee et al., 2011). A month later, the MRI was normal and slowly her neuropathic symptoms resolved. The authors suggested that when needling near the spine, ultrasound-guided needling may be indicated. From the perspective of the authors of this column, outstanding knowledge of anatomy is probably more important. When DN near the spine is dictated by anatomy, such injuries can easily be avoided (Peuker and Gronemeyer, 2001; Brady et al., 2014).

Dalewski B, Kamińska A, Szydłowski M, Kozak M, Sobolewska E. 2019. Comparison of early effectiveness of three different intervention methods in patients with chronic orofacial pain: a randomized, controlled clinical trial. Pain Research & Management, 11:7954291. DOI 10.1155/2019/7954291.

The authors, from Pomeranian Medical University in Poland, assessed 3 options for the management of patients with orofacial pain. A total of 90 participants were randomized to one of the following groups: occlusal therapy with a non-steroidal anti-inflammatory drug (NSAID), occlusal therapy with DN, or occlusal therapy alone. The DN group received 3 sessions of dry needling, each 7 days apart. In all groups, the occlusal splint was to be worn only at night. All participants completed the visual analog scale (VAS) and the Sleep and Pain Activity Scale (SPAQ) initially and 3 weeks following the start of the study. A single examiner completed the initial exam, fabricated the oral appliances, and performed the DN. A second examiner, blinded to group assignment, recorded the data throughout the study. Participants were excluded if they reported bilateral pre-auricular pain, systemic disease, or undergoing orthodontic treatment. Additionally, patients signed consent to avoid other prescribed or self-treatments throughout the duration of the study.

The group that received occlusal therapy with the NSAID achieved significant results in both VAS and SPAQ scores compared with the other groups. While the occlusal therapy plus DN group improved relative to the occlusal group alone, the results were not statistically significant. In this study the authors elected to use the NSAID Nimesulide. This cox inhibiting medication has both anti-inflammatory and analgesic capabilities. As was done in this study, Nimesulide is typically taken twice a day. This study supports the use of NSAIDs in combination with occlusal therapy for short-term improvement in patients with temporomandibular dysfunction. Before the reader neglects the potential benefits of DN, it is important to consider this study lacked in the description of this procedure. The authors provided a picture for the location of needle placement and reported each needling session lasted approximately 30 minutes. It was not stated whether the authors used a TrP or superficial approach. Future studies should also include other objective assessments including maximal mouth opening which can be important for patient perceived function.

Etminan Z, Razeghi M, Nezhad FG. 2019. The effect of dry needling of trigger points in forearm's extensor muscles on the grip force, pain and function of athletes with chronic tennis elbow. Journal of Rehabilitation Sciences and Research, 6:27–33. DOI: 10.30476/JRSR.2019.44736.

The aim of this randomized control trial was to determine if DN would improve grip strength and function and decrease pain and treatment cost in 44 athletes diagnosed with chronic lateral epicondylitis and pain greater than three months. The athletes were randomized in two groups. They primarily used their upper extremity during their sport (tennis, volleyball, basketball). The first group receive physical therapy, consisting of ultrasound, deep friction massage, and muscle stretching and strengthening. The second group also received physical therapy with the addition of DN at the common extensor origin of the involved elbow. Participants were excluded if they had a history of shoulder or elbow surgery in the past six months, shoulder or elbow fracture in the past year, or trypanophobia. All participants were treated three times a week for three weeks. Grip strength, pain, and the Patient Rated Elbow Evaluation Questionnaire (PREE) were assessed initially, at visits 4, 7, and 9, and one week following the completion of the study.

This study, completed in Iran, reported that both groups achieved significant improvement at each of the follow-up timeframes compared with initial assessment ($p < .0001$). Moreover, at visits 7, 9, and one week following study, the DN group reported significant better results in pain and the PREE scores when compared with the PT only group ($p < .01$). The authors hypothesized this could lead to decreased treatment costs. While grip strength significantly improved, there was no difference between the groups ($p = .09$). Future studies should include a single blinded component to decrease examiner bias. The authors did not provide enough detail to replicate their DN treatment. It would have been beneficial to know the frequency of the needling and the rationale for their needle placement. The authors did not appear to target either a trigger point or twitch response as they described the needling technique as "the needle entered the tendon parallel to skin position and toward the radius bone at the origin of common extensor muscles, and was kept for 15 minutes." Other than in the title of the paper and in a few cited studies, they did not mention TrPs being part of the current study.

Fernández-Rodríguez T, Fernández-Rolle Á, Truyols-Domínguez S, Benítez-Martínez JC, Casaña-Granell J. 2018. Prospective randomized trial of electrolysis for chronic plantar heel pain. Foot & Ankle International, 39(9):1039–1046. DOI: 10.1177/1071100718773998.

Investigators from Spain conducted a prospective randomized trial of ultrasound-guided percutaneous needle electrolysis (PNE) for the treatment of chronic plantar heel pain (CPHP). Inclusion criteria included unilateral heel pain for at least 3 months and a diagnosis of CPHP by physical examination and ultrasonography as described by Lemont et al., (2003) with the plantar fascia being thicker than 4 mm measured at the anterior aspect of the inferior calcaneal border and a decrease in echogenicity. Eighty subjects were enrolled in this study and were randomly assigned to either study group, of which 38 subjects in the experimental group and 29 subjects in the control group completed the study. Subjects in the experimental group received ultrasound-guided PNE with an acupuncture needle (0.35×40mm) with 28 mC of cathodal PNE administered into the plantar fascia. Placebo treatment was administered using the same protocol without administering an electrical current. Treatments were repeated once a week for five weeks. Subjects in both groups performed a high-load plantar flexion strength-training program following each injection (Rathleff and Thorborg, 2015). Outcome measurements for pain using Visual Analog Scale (VAS), Foot and Ankle Ability Measure (FAAM) questionnaire, and fascia thickness as measured by ultrasound were assessed at 1, 12, and 24 weeks post-treatment.

The findings of this study indicate the experimental group exhibited significantly greater decreases in all outcome measures at 1, 12, and 24 weeks post-treatment as compared to the control group. This study does have several limitations including a small sample size and the authors did not note the chronicity of symptoms for the subjects. However, this study does demonstrate the potential benefit of galvanic current in the treatment of patients with CPHP. Further studies with a larger sample size and longer follow-up are warranted to further assess the outcomes of this technique.

Ghaffari MS, Shariat A, Honarpishe R, Hakakzadeh A, Cleland JA, Haghighi S, Seif-Barghi T. 2019. Concurrent effects of dry needling and electrical stimulation in the management of upper extremity hemiparesis. Journal of Acupuncture and Meridian Studies, 12(3):90–94, DOI: 10.1016/j.jams.2019.04.004.

This Iranian case report describes a 49-year-old female patient with a 5-year history of right upper extremity hemiparesis after stroke who was treated with DN and electrotherapy. Prior to these interventions, she had received 20 sessions of physiotherapy with no improvement in right hand function. Dry needling was performed with a fast-in and fast out cone shape technique for 1-min on the Hegu acupuncture point, aka LI-4. Following the DN procedure, the patient was treated with electro-therapy applied to the wrist extensors of the right hand at a frequency of 35 Hz, a pulse width 400 ms, an amplitude of 30 MA, and a 2-s interval for a total of 15 minutes. A day later, strength of the wrist extensor muscles had increased from a grade 1 to a grade 3 on the Medical Research Council Manual Muscle Testing scale. Her score on the Brunnstrom hand functional recovery stage increased from 4 to 6, while the score on the Modified Modified Ashworth Scale improved from one to zero, which correlates to "slight increase in muscle tone" to "no increase in muscle tone," respectively. Of course, little can be concluded from a case report of one patient, that does not include any long-term outcomes. As the authors mentioned, the results of this case report may lead to randomized clinical trials with a proper control group and long-term outcomes.

Gildir S, Tüzün EH, Eroğlu G, Eker L. 2019. A randomized trial of trigger point dry needling versus sham needling for chronic tension-type headache. Medicine (Baltimore), 98(8):e14520.

This Turkish study allocated 168 patients with chronic tension-type headache into two groups for DN and sham DN to explore the effectiveness of TrP DN on reducing headache frequency, intensity and duration, and improvement of health-related quality of life. In the end, 160 patients completed the study. The primary outcome measure was headache intensity. Frequency, duration and quality of life were secondary outcome measures. Quality of life was assessed with the Turkish version of Short Form-36 (SF-36). All assessments were performed by a physiotherapist blinded to group allocation, but the therapist who performed the TrP DN was not blinded. Only active TrPs in the upper trapezius, masseter, temporalis, frontalis, splenius cervicis and capitis, and sub-occipital muscles were treated. Of interest is that the subjects were treated in the seated position for all muscles. The authors claimed that all suboccipital muscles were treated, including the rectus capitis posterior major and minor, and oblique capitis inferior and superior. DN treatments were administered three times per week for 2 weeks. Subjects in the sham DN group received superficial needling in adipose tissue (superficial fascia) away from TrPs.

The authors concluded that DN in patients with chronic tension-type headaches is a safe and effective procedure to reduce headache frequency, intensity and duration. DN also increased the quality of life. Measurements were assessed up to one month post-treatment. While this study is overall very well executed, we do question why the authors opted to treat the subjects in the seated position. From the perspective of the authors of this column, the seated position is not recommended due to an increased risk of significant adverse events. We maintain that it is impossible to palpate TrPs in the rectus capitis posterior major and minor and oblique capitis superior. These muscles are entirely covered by a thick layer of the more superficial neck muscles. We recommend not to use DN for these muscles, due to their close proximity to the foramen magnum and vertebral artery (Miyamoto et al., 2010).

Gilmartin S. 2018 Dry needling: A critical commentary of its effectiveness and safety profile. Physiotherapy Practice and Research, 39;155–159. DOI:10.3233/PPR-180118.

Stephen Gilmartin, from Ireland, prepared a critical review of the current status of DN in which he summarized several conflicting DN issues, such as the lack of high-quality studies demonstrating long-term outcomes and studies demonstrating superiority of DN over other treatment options. The author questions the validity of an adverse event study by Brady et al., (2014) for not reaching the target level of patient interactions required to witness a serious adverse event. Unfortunately, this is a misinterpretation of the study. In the Brady et al. study, the researchers (which included Jan Dommerholt, the primary author of this column) use the Henley Rule of Three, which was used because the target of 10,000 treatments had not been reached. In the study only 7629 treatments were included, but the trend clearly did not suggest any major changes. Gilmartin also compared the rate of adverse events in acupuncture and the Brady et al. study and erroneously reports a lower rate in acupuncture, which is an unfortunate example of comparing two studies that based on their methodology cannot be compared. The acupuncture study (Witt et al., 2009) was a retroactive review based on insurance data, while the Brady et al. study was a prospective study of DN. Brady et al. did acknowledge that the study may have suffered from a reporting bias as Gilmartin did point out.

The author focused mainly on pneumothorax as a possible serious adverse event, but he failed to mention the much more serious risk of causing a subdural hematoma (Lee et al., 2011). He also suggested that anticoagulant therapy would constitute an absolute contraindication. There is, however, no evidence that antithrombotic therapies are a contraindication to DN. The author stated that his main focus is patient safety and doing no harm. While we agree with these objectives, the commentary failed in providing any new information and omitted some serious potential adverse events.

Liporaci FM, Mourani MM, Riberto M. 2019. The myofascial component of the pain in the painful shoulder of the hemiplegic patient. Clinics (Sao Paulo), 2019;74:e905. DOI: 10.6061/clinics/2019/e905.

This case series enrolled 21 patients with poststroke shoulder pain (PSSP) who were being treated at an outpatient clinic in Sao Paulo, Brazil. Eighteen patients met the following inclusion criteria: greater than 18 years old and diagnosed with spastic upper limb weakness due to ischemic or hemorrhagic stroke. Participants were excluded if they had previous shoulder pain on the hemiplegic side of body, reflex sympathetic dystrophy, the presence of pain of central origin, impaired cognition, a history of adverse reaction to lidocaine, or structural joint deformity. The mean time since the stroke was 9 months at the time of the evaluation.

The purpose of this study was to assess the pain and ROM outcomes in patients with PSSP following TrP blocks with a 1% lidocaine solution. A total of 11 muscles were palpated in each participant. The subscapularis, upper trapezius, and pectoralis major muscles were the most frequently injected. All patients received injections at the initial visit and for three consecutive weeks if they reported pain in excess of 5 on an 11-point Visual Analog Scale (VAS). Outcomes of pain and both active and passive ROM of shoulder abduction and external rotation were assessed initially, at one and three weeks, and four months. Patients, who after the 1st week reported at least a 4-point improvement on the VAS, were "good responders" and others were classified as "no response." As a group, PROM (abduction) increased at the end of the first and third weeks; however, minimal or no changes were observed in active abduction and active and passive external rotation. Participants in the good responder group achieved continuous improvement in passive abduction but statistical significance was only identified at the four-month assessment. For all participants, the mean initial pain assessment was 7.6 and this changed to 5.8 ($p = .05$), 5.2 ($p = .05$), and 6.6 ($p = .11$) at one week, three weeks, and four-month assessments, respectively. The participants in the good responder group reported significantly less pain at the 3-week ($p = .05$) and 4-month ($p = .05$) appointments when compared with the no response group.

While this case series reported favorable outcomes for patients with PSSP, the reader needs to remember that no control group was used in this study. Additionally, the only determining factor in patients to be considered good responders was a significant pain reduction after one injection, which may not be the most objective and valid criterion. Future studies should determine whether a logistic regression equation could better predict those participants that will have a favorable response with TrP block to improve their shoulder pain and mobility.

Okada-Ogawa A, Sekine N, Watanabe K, Kohashi R, Asano S, Iwata K, Imamura Y. 2019. Change in muscle hardness after trigger point injection and physiotherapy for myofascial pain syndrome. Journal of Oral Science, 28;61(1):36–44. D: OI10.2334/josnusd.17–0453.

This study, conducted in a Japanese outpatient pain clinic, examined the effects of muscle hardness and its usefulness in the assessment for masticatory muscle pain (MMP). A total of 40 participants were enrolled, including 20 healthy controls and 20 assigned to receive either a TrP injection (TPI) or stretching and massage (SM). All experimental group participants reported unilateral temporomandibular joint pain (TMJ) lasting greater than 3 months and excluded those with disc displacement or deformity, effusion, or bone changes identified during imaging. Participants were asked to rate their pain during rest and mastication on a 100-point Visual Analog Scale (VAS). Additionally, muscle hardness in the masseter and trapezius was assessed using an electronic solenoid hardness meter. Muscle hardness in the control group was assessed at the belly of the master and temporalis muscles. The experimental group received muscle hardness assessment at two locations for each region, including a taut band on the painful side and a corresponding location on the contralateral muscle (non-taut band). The experimental group was assessed for muscle hardness and the VAS initially and at 2-weeks follow up. Muscle hardness was only assessed at the initial visit in the control group. The TPI group received injections for two weeks (initial, week 1, week 2). A range of 1–6 TrPs were injected with a 1% lidocaine solution. The SM group received education on exercise and massage at the initial visit. Participation was confirmed at week 1. The SM group was instructed to stretch and massage the masseter, temporalis, sternocleidomastoid, and trapezius muscles five times a day.

At the beginning of the study, hardness in TrPs of the masseter muscles was significantly greater in the taut band versus the control group ($p < .05$); however, the non-taut band and control point hardness were not significantly different ($p < .1$). There was no significant difference in hardness in the taut band or control area of the trapezius between the experimental and control groups as the start of the study ($p < .2$ and $p < .07$, respectively). The TPI and SM groups significantly improved ($p < .05$ and $p < .01$, respectively) in resting and masticatory pain. This well-designed study included both a control group (no pain) and a control point within the experimental group. The examiners, however, were not blinded to group assignment. Future studies should also include a validated patient outcome questionnaire to assess a possible correlation with muscle hardness and improved function.

Parthasarathy S, Sundar S, Mishra G. 2019. Assessment of predisposing factors in myofascial pain syndrome and the analgesic effect of trigger point injections - A primary therapeutic interventional clinical trial. Indian Journal of Anaesthesia, 63(4):300–303. DOI: 10.4103/ija.IJA_6_19.

Investigators from India evaluated the effects of a lignocaine injection in a TrP in a group of 100 subjects presenting with MPS. Inclusion criteria for this study were subjects over 18 years old with persisting neck or shoulder pain greater than four on a Visual Analog Scale (VAS) after 6 weeks of prior physical therapy (PT), and TrPs in one or more of the following muscles: upper trapezius, infraspinatus, and levator scapulae. The researchers also examined three influencing factors relative to MPS causing biomechanical imbalance including keeping the palm under the head during sleep, cervical sidebending and rotation when talking on phone, and sleeping without pillows.

Each subject received a 2 ml 2% lignocaine injection using a 23G needle into a TrP identified by the examiner. The VAS was assessed immediately after the injection (VAS 2) and 1 month (VAS 3) following the injection via a phone call. Subjects were also advised to take Tramadol 50 mg in case of pain and return for repeat TP injections. The authors reported the mean VAS reduced significantly both immediately and 1 month following injection (8.57 ± 0.77, 2.67 ± 1.43, and 2.82 ± 1.4). Five subjects took tramadol as a rescue analgesic, with four of these returning for a repeat TP injection. The authors noted 71 subjects placed their palm under the head during sleep, whereas 20 subjects had an abnormal posture with cell phone usage.

This study has several limitations including no description of the therapeutic interventions the subjects were offered before failing PT, no control or placebo group, and the inclusion of activity and postural education in conjunction with TrP injection treatment. The lack of a control or placebo group is always problematic in scientific studies and we wonder why researchers would go through the trouble of setting up and executing research studies without a control group? A control group does not only control for variables in the study design, but also allows researchers to determine the magnitude of an intervention. One even wonders why an institutional review board would even approve studies without a control group. The lack of a control group completely undermines the value and impact of this study. Further studies comparing the effects of TrP lignocaine versus postural education are encouraged to better assess the outcomes of these treatment approaches.

Tavakol Z, Shariat A, Ghannadi S, Noormohammadpour P, Honarpishe R, Cleland JA, Ansari NN, Moghimi E. 2019. The effect of dry needling on upper and lower limb spasticity in a patient with a brain tumor. Acupuncture in Medicine, 37(2):133–135. DOI: 10.1177/0964528419830401.

This case study involved a 29-year old male with left hemiplegia as a result of a brain tumor. He had left leg monoplegia for three years and evolved to left-sided hemiplegia and spasticity during the past ten months. He received deep DN during three visits of three muscles of the upper extremity and one muscle of the leg. There was a 48-h interval between sessions. The patient was assessed initially and 2 hours after the last session. The authors reported improvement in all measured variables, including spasticity, passive and active ankle dorsiflexion and wrist extension, the box and block test, the Timed Up and Go test (TUG), 10- minute walk, and single leg stance.

While it is encouraging that this patient experienced improvements in many aspects, the paper is an example of a rather poorly described case report, for example, the authors did not include any measures or comments about clinical significance. It is not clear why the outcome measures were taken only during the initial assessment and 2 hours after the last visit. There is no information about whether the improvements lasted beyond the two-hour window. If DN for spasticity is only temporarily effective, the intervention may not be all that impressive. Nevertheless, case reports do serve a purpose in the literature; hopefully, the authors will expand upon the current paper with more substantive contributions about DN for spasticity as a result of brain tumors.

Walsh R, Kinsella S, McEvoy J. 2019. The effects of dry needling and radial extracorporeal shockwave therapy on latent trigger point sensitivity in the quadriceps: A randomized control pilot study. Journal of Bodywork and Movement Therapies, 23(1):82–88. DOI: 10.1016/j.jbmt.2018.02.010.

Dry needling has been used to treat active and latent TrPs. For some patients, post-needling soreness may be problematic especially in competitive sports or during periods of physical training. Radial extracorporeal shockwave therapy (rESWT) offers a non-invasive treatment strategy which could be used as an alternative to DN without causing post-treatment soreness. Irish researchers Walsh et al. conducted a study to determine the effects of DN and rESWT on the severity of latent TrPs in the vastus lateralis (VL) and vastus medialis (VM). They found a significant improvement ($p < .05$) in the PPT for both the DN and the rESWT group, but subjects in the rESWT group did not show any post-treatment soreness during the treatment phase. There was no difference in the PPT in the control group during any session. The steady, gradual decrease in the sensitivity of the PPT in subjects in the rESWT group suggests that rESWT does not produce post-treatment soreness and may be used on patients who have highly sensitive TrPs or who may have needle phobias or anxieties.

In clinical application, DN has been shown to improve PPT in TrPs in the VL and VM with a temporary adverse effect, post-needling soreness, which can last up to three days. Radial ESWT also improved PPT without the transient adverse effect of DN. The authors suggested that rESWT may be an alternative treatment for TrPs in athletes who cannot afford to reduce their training load or who are preparing for a major competition. Future studies should include treating multiple TrPs in the lower kinetic chain as well as measuring muscle activation and joint function, and optimum timing and longer follow-up periods of such interventions should be explored.

4. Manual therapy

Beier Z, Earp I, Korak JA. 2019. Self-myofascial release does not improve back squat range of motion, alter muscle activation, or aid in perceived recovery 24-h following lower body resistance training. International Journal of Exercise Science 1;12(3):839–846. DOI: 10.1519/JSC.0000000000003196.

Researchers from the University of St. Thomas in St. Paul, MN, USA investigated the use of self-myofascial release (SMR) to measure its effects on muscle activation, knee range of motion (ROM), and perceived recovery compared to a dynamic warm-up session. Eleven subjects with a minimum of 6 months lifting experience were enrolled in this study. Subjects completed four sessions with sessions 1 and 3 designed to induce muscle fatigue as the subject performed back squats, box jumps, lunges, and hip extensions. During sessions 2 and 4 the subjects performed either a dynamic standardized warm-up or an SMR warm-up. The dynamic warm-up consisted of bike, squats, and hip extension. The SMR was performed for 2 minutes using “heavy pressure” by the researchers on the rectus femoris (RF) and gluteus maximus (GM). The subjects were divided into 2 groups with half receiving the SMR treatment in session 2 and the other half receiving SMR treatment during session 4. Testing was performed in session 2 and 4 and consisted of peak and mean muscle activation via surface electromyography (EMG) of the RF and GM, knee joint ROM via electric goniometer as the subjects performed 1 set of 10 repetitions at 70% repetition maximum (RM) back squat. Maximum Voluntary Isometric Contractions (MVICs) were also recorded for the RF and GM via 3-s standard muscle test.

The authors reported no significant differences between the dynamic warm-up and SMR warm-up for muscle activation, knee ROM, and participants perceived recovery. The authors recommend the utilization of either SMR or dynamic warm-up as no differences were noted in recovery, muscle activation, or squat depth. This study has several design flaws including the use of experienced weightlifters, which could minimize altered biomechanical and EMG activity as a result of their prior training experience. The authors did not report or account for any potential home self-recovery techniques utilized by the subjects. Additionally, the subjects' level of fatigue or muscle soreness was not recorded prior to session 2 and 4, therefore potential influences of SMR would not be expected in subjects not experiencing post-exercise muscle fatigue prior to the initiation of testing sessions.

Esparza D, Aladro-Gonzalvo AR, Rybarczyk Y. 2019. Effects of local ischemic compression on upper limb latent myofascial trigger points: a study of subjective pain and linear motor performance. Rehabilitation Research and Practice, 4;2019:5360924. DOI: 10.1155/2019/5360924.

In this study, researchers from Ecuador examined the impact of latent TrPs on motor performance, assuming that a painful TrP would cause alterations in the movement pattern of the kinetic chain and elimination of the TrP would improve the kinetic performance. Twenty subjects were allocated to a latent TrP group or a healthy control group. Subjects in both groups were asked to perform an adapted version of the "Plate Tapping Test" to assess the upper limb linear motor performance. The subjects' pain pressure threshold was determined with a manual ischemic compression test, which is a bit surprising as it lacks any kind of objectivity. Instead, the authors applied Fitts' Law, which is a universal empirical model for characterizing human motor performance. It provides a mathematical motor control model, that predicts the movement time according to a certain index of difficulty.

Subjects in the patient group reported significantly less pain than subjects in the control group. The authors concluded that latent TrPs did alter motor performance, but following the intervention, the patient group did not reach the level of the control group. Patients with latent TrPs may exhibit more fatigability (Ge and Arendt-Nielsen, 2011) and the reduction of pain does not necessarily restore normal muscle recruitment patterns. The experimental conditions did not permit to test Fitts' Law with different indexes of complexity. A reduction of pain did not necessarily improve the quality of life and functional joint range of motion. It is conceivable that compression altered the activity of the autonomic nervous system through the prefontral cortex (Morikawa et al., 2017). The authors argue that in addition to inactivating TrPs, clinicians should include novel motor-skill training relevant for treating patients with musculoskeletal pain (Boudreau et al., 2010). In conclusion, this is an excellent study that contributes to a better understanding and offers clinically relevant information.

Gurudut P, Welling A, Gayatri Kudchadkar G. 2019. Combined effect of gross and focused myofascial release technique on trigger points and mobility in subjects with frozen shoulder-a pilot study. International Journal of Health Sciences & Research, 9(4):52–61.

Indian researchers differentiated "gross myofascial release techniques," such as an arm pull, from "focused myofascial release techniques," which address local impairments within a myofascial unit. In the current study, they combined the two approaches into a "combined release technique" to study its effects on pain pressure threshold, mobility and function in patients diagnosed with a frozen shoulder. Eighteen patients with a frozen shoulder were allocated to an experimental group or a control group. All subjects received five consecutive treatments during one week with a moist hot pack, Maitland mobilization and Interferential therapy, while the patients in the experimental group were also treated with combined release techniques. Outcome measures included Pain Pressure Threshold assessments using an algometer, Apleys Scratch Test to determine shoulder flexibility, and the Shoulder Pain and Disability Scale (SPADI scale).

The authors found that subjects in both groups improved, but the addition of combined release techniques was more beneficial. Shortcomings of this pilot study include very small sample sizes, a lack of a true control group receiving no intervention, and short-term outcomes only.

Kameda M, Tanimae H. 2019. Effectiveness of active soft tissue release and trigger point block for the diagnosis and treatment of low back and leg pain of predominantly gluteus medius origin: a report of 115 cases. Journal of Physical Therapy Science, 31: 141–148. DOI: 10.1589/jpts.31.141.

In the vast majority of patients with back pain, the cause of pain is not known (Koes et al., 2006). Low back and leg pain are frequently associated with MPS. An accurately diagnosis of MPS and identification of which specific muscles may be involved in a patient's pain symptoms are important for the treatment of patients with MPS. Japanese researchers Kameda and Tanimae studied how commonly low back and leg pain is associated with MPS and what the prevalence is of specific TrP locations. Furthermore, they aimed to assess the effectiveness of active soft tissue release (ASTR) and trigger point blocks (TPB) in the treatment of patients with MPS. ASTR is a type of manual therapy directed at muscle fascia. It is used as a diagnostic treatment for low back and leg pain and it may be useful for diagnosing the location of TrPs. One-hundred and fifteen patients were divided into three diagnostic groups. MPS was diagnosed in 73.4% (36/49) in the low back pain group, 50% (16/32) in the leg pain group, and 85.3% (29/34) in the low back pain with leg pain group. Relevant TrPs were most commonly found in the gluteus medius muscle.

After identifying relevant TrPs, each patient was treated with either ASTR or with ASTR and TPB once during a 1 to 3-week period. The duration of treatment was based on the degree of pain relief. A clinician applied pressure on a slightly contracted muscle, after which the muscle was stretched passively. A mixture of 20 ml 0.25% lidocaine and 1.8 units of neurotropin diluted in saline was injected into a TrP using a 22-gauge needle, when patients still experienced pain after having been treated with ASTR, if they were unable to tolerate the treatment, or if the effects of ASTR were inadequate. The combination of ASTR and traditional TPBs was effective for the diagnosis and treatment of patients with low back and leg pain. MPS is major cause of low back pain and leg pain, predominantly in the gluteus medius. The authors suggested that ASTR can be considered an effective first-line treatment option especially for patients with non-chronic low back or leg pain as well as a viable treatment option when injections are not preferable.

There were some limitations such as small and uneven sample sizes, and questionable interrater reliability issues. The accuracy of determining TrPs locations cannot really be verified as this was a retrospective study using data extracted from medical records. Frequently, medical records have insufficient data, which may have skewed the findings. It is impossible to determine whether TPBs are as effective as ASTR or whether ASTR alone might have been effective over the longer term. A larger, randomized study with a proper control group is necessary to confirm the effects and to rule out placebo effects. Comparing the effectiveness of ASTR to other interventions, such as exercise and cognitive behavioral therapy, or in combination with ASTR may be of value to provide sustained pain relief and shorten the treatment duration.

Saadat Z, Hemmati L, Pirouzi S, Ataollahi M, Ali-Mohammadi F. 2018. Effects of integrated neuromuscular inhibition technique on pain threshold and pain intensity in patients with upper trapezius trigger points. Journal of Bodywork and Movement Therapies, 22(4):937–940 DOI: 10.1016/j.jbmt.2018.01.002.

This single blind randomized control trial from Iran assigned 32 females with upper trapezius active TrPs to either an intervention or control (no treatment group). Participants were excluded if they had a history of neck or shoulder surgery, moderate to severe cervical, thoracic and shoulder degenerative pathology, cervical radiculopathy, or fibromyalgia. The intervention group received one session of Integrated Neuromuscular Inhibition Technique (INIT) which included ischemic compression applied to a TrP for 90 seconds for 3–5 repetitions, strain-counterstrain by maintaining position 20–30 seconds repeated 3 times, and muscle energy with a 7–10 second hold followed by stretching in the opposite direction for 30 seconds. Muscle energy was also repeated 3–5 times. Total treatment time was 15–20 minutes. The Pain Pressure Threshold (PPT) and Numeric Pain Scale (NPS) were assessed before treatment, immediately after, and 24 hours later.

The authors performed an independent *t*-test to compare the effect of time between the groups and reported that the intervention group reported significant improvement in their NPS both immediately following the intervention ($p = .01$) and 24 hours later ($p = .009$). However, no difference was identified in PPT ($p = .95$). While this study supported the use of INIT to decrease pain in patients with active TrPs in their upper trapezius muscles, caution should be used when generalizing to this population. This study only provided one treatment session and did not follow up beyond 24 hours. Additionally, the study did not report post-treatment variables of pain and PPT. Future studies should also include cervical and/or shoulder range of motion assessments as well as standardized patient functional outcome measures such as the Neck Disability Index.

Wilke J, Vogt L, Banzer W. 2018. Immediate effects of self-myofascial release on latent trigger point sensitivity: a randomized, placebo-controlled trial. Biology of Sport, 35(4):349–354. DOI:

Latent TrPs have been linked to several impairments of muscle function, including accelerated muscle fatigability, increased risk of muscle cramps, and altered muscular activation patterns. Therefore, inactivating latent TrPs may be indicated to optimize muscle function and prevent the development of chronic pain syndromes. In recent years, self-myofascial release (SMR) approaches, which are usually applied in a home-based setting, are becoming more popular (Cheatham et al., 2015). Patients can use SMR by applying self-massage with rigid foam rollers and other small handheld tools. Researchers from Germany conducted a single-blind, randomized, placebo-controlled, parallel group study to examine whether a single bout of self-myofascial release using a foam roller is effective in reducing the sensitivity of TrPs in the lateral gastrocnemius muscle. Fifty healthy, pain-free subjects (26.8 ± 6 years, 21 men) with latent MTrP in the lateral gastrocnemius muscle were included in the study.

Placebo and dynamic self-myofascial release did not change the TrP sensitivity, but static compression of TrPs increased their pressure pain threshold. Static self-myofascial release using a foam roller might represent an alternative to reduce pressure pain of latent TrPs. Patients and athletes who would like to treat their own myofascial pain conditions or reduce TrP-related impairments of muscle function, static compression with a foam roller may be a potentially effective treatment modality. The suggested mechanism may be analogous to manual TrP compression in decreasing latent TrP sensitivity and enhancing muscle function.

5. Other clinical studies

Altindiş T, Güngörmüş M. 2019. Thermographic evaluation of occlusal splint and low level laser therapy in myofascial pain syndrome. Complementary Therapies in Medicine, 44:277–281. DOI: 10.1016/j.ctim.2019.05.006.

Myofascial pain is common in patients presenting with temporomandibular disorders (TMD). Conservative methods to reduce the pain associated with TMD include both stabilization splints and low-level laser therapy (LLLT). Investigators from Turkey conducted this study to compare the effects of occlusal splint and LLLT in a group of 20 female subjects. Volunteers were randomly assigned to each group and were assessed for pain intensity, muscle sensitivity of the temporal, masseter, sternocleidomastoid, and inferior lateral pterygoid muscles via palpation graded on a 0–3 scale (0 = no tenderness, 1 = slight tenderness, 2 = moderate tenderness, 3 = severe tenderness). Thermographic measurements were also evaluated for both the masseter and anterior temporal muscles using an infrared camera.

The subjects were re-assessed at a 3-month follow-up and both test groups had a significant decrease in pain intensity, muscle sensitivity, and temperature values, particularly in the masseter muscle ($p < .05$). A between group comparison noted the LLLT group had statistically significantly lower thermographic readings in bilateral superior masseter muscle regions and the right middle masseter muscle region. There was however no statistical difference between groups in pain intensity or muscle sensitivity.

This article has several limitations including: The authors did not report on the chronicity of TMD for each subject; small sample size; muscle sensitivity was measured via manual palpation; insufficient examiner blinding to exclude study bias. Although the authors noted a statistically significant difference in thermographic measurements, there was no difference in pain intensity or muscle sensitivity. Further studies are warranted to examine the differences in these treatment techniques, to include a larger sample size and using an algometer to objectively assess muscle sensitivity.

Diego IMA, Fernández-Carnero J, Val SL, Cano-de-la-Cuerda R, Calvo-Lobo C, Piédrola RM, Oliva LCL, Rueda FM. 2019. Analgesic effects of a capacitive-resistive monopolar radiofrequency in patients with myofascial chronic neck pain: a pilot randomized controlled trial. Revista da Associacão Médica Brasileira (1992), 65(2):156–164. DOI: 10.1590/1806–9282.65.2.156.

Researchers from Spain conducted a randomized, double-blinded, placebo-controlled pilot study to examine the effects of capacitive-resistive monopolar radiofrequency (MCRRF) in patients with chronic myofascial neck pain. Twenty-four subjects between the ages of 18 and 60 with symptoms lasting longer than 6 months and having at least one active TrP in the upper trapezius muscle were included in this study. Subjects were randomly assigned to either the MCRRF or placebo (PG) group. Subjects in the experimental group received MCRRF treatment for 12 minutes, two times a week for four weeks directed at the most hyperalgesic TrP in the upper trapezius muscle while skin temperature was monitored for comfort. Placebo treatment was performed using the same parameters with the device in the off position. The subjects in the PG were informed that the treatment did not produce heat. Subjects' were evaluated for pain using a Visual Analog Scale (VAS), the Neck Disability Index (NDI), and cervical range of motion (CROM) for flexion, extension, side bending, and rotation prior to treatment, after the first session, and following the eighth session.

The authors reported that the experimental group showed a statically significant decrease in VAS between baseline, following the first session, and after the eighth session. No significant differences were noted in the PG group or between group comparisons of VAS for any of the test sessions. The NDI improved significantly in both groups; however, no differences were noted between groups. CROM measurements revealed a significant increase in only right cervical rotation, which was present in both groups following the eighth session.

This study has several limitations including a small sample size. The treatment was only directed on the more painful side in subjects presenting with bilateral neck pain and only the upper trapezius muscle was treated. The results are very short-term as no long-term follow-up was conducted. Lastly, there was no evaluation of psychological or emotional factors. Although the authors reported that MCRRF could have a potential effect on pain intensity even when there were no differences between test groups, the findings of this study do not warrant that statement. Although it is possible that a larger sample size and changes in the methods used could allow for improved data collection; however, based upon the results of this pilot study MCRRF does not demonstrate improvement over placebo treatment for TrPs in the upper trapezius in patients with chronic myofascial neck pain.

Kim Y, Hong Y, Park HS. 2019. A soft massage tool is advantageous for compressing deep soft tissue with low muscle tension: Therapeutic evidence for self-myofascial release. Complementary Therapies in Medicine, 43:312–318. doi: 10.1016/j.ctim.2019.01.001.

Researchers from South Korea performed an experimental study on the effects of a soft inflatable rubber ball (SIRB) and a hard massage ball (HRB) to examine the amount of deep tissue pressure and muscle tension in a group of subjects with neck pain. Thirty participants with a history of neck pain for at least once a week, lasting for more than 30 days during the last year, with a pain intensity of a 2 on a numeric rating scale from 0 to 10 were enrolled in this study. Subjects were placed in a supine position as an examiner placed either the SIRB or HRB at the suboccipital region. Participants were asked to relax and take slow, deep breaths. Lateral radiographs were taken at the C2 vertebra level to evaluate the depth of soft tissue compression at the suboccipital region. Electromyography (EMG) was recorded using surface electrodes on both sternocleidomastoid (SCM) and upper trapezius (UT) muscles.

The authors reported the compressed soft tissue thickness in the SIRB condition was significantly lower than that in the HMB condition. EMG data revealed the right SCM muscle activity was significantly higher than at baseline and with SIRB conditions. Pain intensity was also significantly higher in HMB testing as compared to SIRB (0.2 ± 0.5 and 5.2 ± 1.4, respectively). Although this study did not determine the optimal hardness of a therapeutic ball for performing self-myofascial release nor did the authors take into consideration the weight of the head and neck of each participant, it did demonstrate the increased depth of compressive pressure and increased patient tolerance using lighter pressure. Suboccipital release techniques, whether manual or via therapeutic tools, are commonly utilized in patients presenting with pain and dysfunction in the suboccipital region. This study aids in the clinical insight on the amount of pressure or firmness applied during treatment.

Disclosure statement

No potential conflict of interest was reported by the authors. Drs. Dommerholt and Thorpe and Mr. Hooks are affiliated with Myopain Seminars, LLC, Bethesda, MD, USA, an organization that promotes the recognition and treatment of individuals with myofascial pain. Dr. Dommerholt receives royalties from published books.

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Jan Dommerholt*
Bethesda Physiocare, Bethesda, MD, USA

Myopain Seminars, Bethesda, MD, USA

Li-Wei Chou
China Medical University, Taichung, Taiwan
E-mail address: chouliwe@gmail.com.

Todd Hooks
New Orleans Pelicans, New Orleans, LA, USA

Myopain Seminars, Bethesda, MD, USA
E-mail address: trhooks@hotmail.com.

Jacob N. Thorp
Myopain Seminars, Bethesda, MD, USA

Charleston Southern University, North Charleston, SC, USA
E-mail address: jthorp@csuniv.edu.

* Corresponding author. 4405 East West Highway, Suite 403, Bethesda, MD, 20814-4535, USA.
E-mail address: jan@bpcemail.com (J. Dommerholt).

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