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Clinical Review Section**A Critical Overview of the Current Myofascial Pain Literature – January 2018****Jan Dommerholt, PT, DPT, DAIPM^{a,b,*}****Todd Hooks, PT, ATC, OCS, SCS, FAAOMPT^c****Li-Wei Chou, MD, PhD^d****Michelle Finnegan, PT, DPT, OCS, FAAOMPT^{a,b,}**

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Summary

The majority of papers included in the quarterly review discuss various aspects of dry needling (DN), which continues to be of interest to researchers and clinicians. A study by Liu et al is the first paper to examine the effects of DN of acetylcholine, esterase and receptors. The study provides support for the integrated trigger point hypothesis and for DN. A paper by Hightower and colleagues found an intriguing link between low magnesium levels in the drink water supply, vitamin D, and myofascial pain, cancer, tendon ruptures, and colon polyps. Contributions

originated in the Brazil, China, Germany, Iran, India, Poland, South Korea, Spain, Taiwan, Turkey, and the US,

KEYWORDS Myofascial pain syndrome; Trigger points; Dry needling; Manual therapy

1. Basic research

Hightower JM, Dalessandri KM, Pope K, Hernández GT. 2017. Low 25-hydroxyvitamin D and myofascial pain: association of cancer, colon polyps, and tendon rupture. Journal of the American College of Nutrition, 36(6):455-461

Myofascial pain that has been associated with cancer and increased risk of morbidity and mortality in cancer patients is intrinsically associated with low magnesium and low 25-hydroxy vitamin D. The objective of this study was to assess the association and prevalence of disease in individuals with myofascial pain and low vitamin D (25(OH)D) in a county with low magnesium in drinking water. The association between the exposure of low 25(OH)D levels and myofascial pain was compared to all cancers, colon polyps, and tendon ruptures. Logistic regressions examined the association between each of these outcomes using total serum 25(OH)D deficiency and tendon trigger point tenderness as exposure variables. In this retrospective cross-sectional American study, Hightower et al. found a significant association of myofascial pain and total serum 25(OH)D deficiency with cancer, adenomatous colon polyps, and tendon rupture, and the odds increase when both variables are present. Age and gender were found to confound the relationships and were included in the final analysis, whereas BMI did not and was excluded from further analysis. This is the first study to discuss the importance of both magnesium and vitamin D and their association to myofascial pain. It is also the first study to investigate a clinical population living in a US community with a low-magnesium drink water supply.

Hwang UJ, Kwon OY, Yi CH, Jeon HS, Weon JH, Ha SM. 2017. Predictors of upper trapezius pain with myofascial trigger points in food service workers: The STROBE study. Medicine (Baltimore), 96(26):e7252

Researchers from South Korea performed a cross-sectional study to assess predictors of upper trapezius (UT) pain in a group of food service workers (FSWs). Inclusion criteria for this study were a minimum of 6 month work history in food service, unilateral non-traumatic shoulder pain greater than two months, greater than two bouts of tenderness in the UT within the last week, latent trigger points (TrPs) in the UT, and a visual analog scale (VAS) score greater than 30mm. Seventeen variables were measured in 163 FSWs that presented with UT pain: VAS, age, sex, Borg rating of perceived exertion (BRPE) scale, Beck Depression Inventory, forward head posture angle, rounded shoulder angle (RSA), shoulder slope angle, scapular downward rotation ratio, cervical lateral-bending side difference angle, cervical rotation side difference angle, glenohumeral internal rotation angle, shoulder horizontal adduction angle, serratus anterior (SA) strength, lower trapezius (LT) strength, biceps strength, and glenohumeral external rotation strength.

The authors reported that SA strength, age, BRPE scale, LT strength, and RSA were significant predictors of UT pain in FSWs. SA strength showed significant correlation with VAS of the UT pain, accounting for 48.3% of the variance. While the authors performed extensive evaluation of each subject and did find deficits in this subject group; because this study was performed in a subject group that presented with TrPs in the UT it cannot be concluded that any of these variables attributed to or caused UT pain. It is therefore possible the deficits noted are a result of TrPs within the UT contributing to these findings. This study does highlight potential evaluation and treatment to focus care in this subject group to address contributing factors in this population group.

Jagdhari BS, Mukta M, Saket AG, Golhar AV. 2017. Therapeutic evaluation of cervical dysfunction in patients with myofascial pain dysfunction syndrome: a prospective study. Journal of Contemporary Dental Practice. 18(7):601-606

Researchers from India conducted a prospective study to investigate the therapeutic correlation between cervical dysfunction and myofascial pain dysfunction syndrome (MPDS) in patients with temporomandibular disorder (TMD). MPDS has been described as one of the most common causes of chronic pain in the orofacial region (1). The relationship between the cervical spine and the temporomandibular joint (TMJ) has been shown as changes in the craniocervical junction can alter the occlusion patterns and jaw position as a result of the interconnection between neuroanatomy and neurophysiology of these two regions (2).

Forty-six patients were equally divided into two groups: Group 1 (MPDS with cervical pain) and Group 2 (MPDS without cervical pain). All patients were randomly subdivided into three treatment groups. Subgroup I, performed exercises 30 days for the TMJ and subjects in Group 2 performed these TMJ exercises and strengthening activities for the cervical and scapular musculature. Subgroup II received laser therapy 3 times per week (10 total sessions) for 30 days. Subgroup III received both exercise and laser treatment as previously described. The patients were evaluated prior to initiation of the first treatment and upon completion of the study as well as during a 30-day follow-up. Subjects were assessed for pain using the visual analog scale (VAS) at rest and with jaw movement, muscle tenderness upon palpation, maximum mouth opening (MMO), as well as resistance and bitestick testing.

The authors reported that both VAS scores and muscle tenderness showed a statistically significant reduction in all three treatment modalities for both groups. When comparing subgroups, subjects in Subgroup III were noted to have a statistically significant greater reduction in VAS as compared to Subgroup I and II. Although a significant increase in MMO was noted in Group 1 in all three treatment modality subgroups, only subgroup III was it statistically significant. In Group 2, the subjects receiving only laser therapy had a statistically significant improvement in MMO. This study demonstrates both the relationship between MPDS and cervical pain and lends credence to both evaluation and treatment in patients presenting with TMD.

Liu QG, Liu L, Huang QM, Nguyen TT, Ma YT, Zhao JM. 2017. Decreased spontaneous electrical activity and acetylcholine at myofascial trigger spots after dry needling treatment: a pilot study. Evidence-based Complementary and Alternative Medicine, 3938191

In previous animal studies, Hsieh and her colleagues conducted electrophysiological studies of myofascial trigger spots (TrSs) in rabbit muscles, which in many aspects are similar to human TrPs (3, 4). They revealed that typical electromyographic (EMG) features of spontaneous electrical activity (SEA) change after dry needling (DN) of these TrSs. Needle EMG studies have shown that SEA is a combination of two bioelectrical signals, including endplate noise (EPN) and endplate spikes (EPS), that likely result from excessive acetylcholine (ACh) release in the motor endplate. Liu et al. from China conducted a new rat study to investigate the changes in SEAs and in ACh, acetylcholine receptor (AChR), and acetylcholine esterase (AChE) levels after DN of TrSs. They found that the amplitudes and frequencies of EPN and EPS significantly decreased after TrSs DN in the DN-M group when compared to DN of non-TrSs regions. Moreover, ACh and AChR levels significantly decreased, whereas AChE significantly increased after DN in the same group.

Despite a significant decrease in SEA amplitudes and frequencies in the DN-M group, the SEA still existed and did not completely disappear, which suggests that DN of TrSs requires more than one or two treatments. In addition to reductions in EPN and EPS, Liu et al. found significantly decreased ACh and AChR levels and significant increased levels of AChE levels in the DN-M group after DN. This implies that DN may play an important role in reducing myofascial contractures. This is the first study examining the effects of DN on ACh, AChE, and AChR levels. The findings offer physiological support for DN and confirm key elements of the integrated TrP hypothesis.

Panta P. 2017. The possible role of meditation in myofascial pain syndrome: a new hypothesis. Indian Journal of Palliative Care, 23(2):180-187

Myofascial pain syndrome (MPS) is the most common musculoskeletal pain disorder of the head and neck area. Chronic myofascial pain is usually a result and sometimes a product of,

both emotional influences and physical factors. Patients with MPS commonly experience depression, sleep disturbance, anger, fatigue, and altered mental function, and an interdisciplinary approach to address the many dimensions of the pain experience is needed. Meditation operates on a wide range of pain categories and can alleviate chronic pain in patients who do not respond to traditional medical care. The role of meditation in muscular pain disorders was identified early, but surprisingly no studies are available on its role in MPS. This review article explored the possible link between MPS and meditation. Several researchers have conducted clinical and animal studies to develop a possible hypothesis about meditation for MPS. They found that chronic pain, anger, anxiety, stress, and depression have a significant impact on certain areas of the brain and also on muscle fibers at a subcellular level leading to the progression of MPS. Meditation can reduce stress and psychological morbidity, and sympathetic tone stabilizing autonomic function, which may result in muscle relaxation as a byproduct of the meditation. As the author mentioned, the brain plays a fundamental role in generating and modulating myofascial pain. Functional neuroimaging studies have revealed a network of brain regions in the limbic system, insula, prefrontal cortex, and thalamus to be involved in the processing of pain information in general and especially myofascial nociceptive information (5, 6). Meditation increases the activity in the same regions in the brain that participate in MPS and as such, meditation can reduce the experience of pain and suffering by uncoupling sensory dimension from the intrinsic alarm response, which is a common emotional reaction to pain. Much more research, especially randomized controlled trials, are needed in this neglected, but fascinating area.

2. Reviews

Wieckiewicz M, Zietek M, Smardz J, Zenczak-Wieckiewicz D, Grychowska N. 2017. Mental status as a common factor for masticatory muscle pain: a systematic review. *Frontiers in Psychology*, 8:646

Authors from Poland performed a systematic review on mental status as a common factor for masticatory muscle pain (MMP). Their goal was to explain MMP and psychological disorders such as depression, anxiety, mood and stress-related disorders, as well as review and investigate the current literature accurately. The Pubmed database was searched for publications with their search criteria. After meeting the inclusion and exclusion criteria, a total of 38 studies were examined, of which, prospective cohort studies were the most common. Most studies showed a connection between MMP and a change in mental status. In regards to anxiety there was a moderate level of evidence in the 11 studies that showed a significant relationship between anxiety and MFP, whereas five showed no significant relationship. For depression, 24 studies showed a significant correlation with MFP, which had a moderate level of evidence, and only 6 showed no correlation with a low level of evidence. Ten studies showed a correlation with MFP, with 8 having a significant correlation and a moderate level of evidence and 2 showing no correlation but with a low level of evidence. For stress related disorders, eight examined the relationship with MFP, and only one did not find any relationship, and the quality of evidence for this was low. The authors did a nice job highlighting each of the psychological disorders with the quality of evidence as it relates to MFP. The quality of evidence in each of the areas varies from low to moderate but does suggest a co-occurrence between these disorders and muscle pain, however further research is still needed. A limitation of the paper is that the authors did not search multiple databases for articles to include in the review.

Xia P, Wang X, Lin Q, Cheng K, Li X. 2017. Effectiveness of ultrasound therapy for myofascial pain syndrome: a systematic review and meta-analysis. Journal of Pain Research, 10:545-555

Researchers from China performed a systematic review and meta-analysis of several databases on the effectiveness of ultrasound on patients with myofascial pain syndrome on pain and range of motion. The results showed that ultrasound significantly reduced the pain intensity and improved pain thresholds, but there was no effect on range of motion. Although the results showed significant improvements with pain measurements, the risk of bias in the studies was high. As a result, it is not clear or well supported that ultrasound is effective for pain or

improvement of range of motion in patients with myofascial pain. Despite several grammatical errors throughout the paper, the authors did a nice job reporting on the current evidence and performing a review on a subject that has not been examined yet.

3. Dry needling, acupuncture, and injections

Brennan KL, Allen BC, Maldonado YM. 2017. Dry needling versus cortisone injection in the treatment of greater trochanteric pain syndrome: a noninferiority randomized clinical trial. Journal of Orthopaedic and Sports Physical Therapy, 47(4):232-239

Greater trochanteric pain syndrome (GTPS) may include a number of disorders involving the lateral hip, such as bursitis, gluteal tears, snapping hip, and trigger points (TrP) in contractile tissue crossing the hip. Cortisone injection into the lateral hip, with the intention of injecting the bursa, has been a traditionally accepted treatment for this condition, but the effectiveness of injecting the bursa with steroids is increasingly being questioned. Brennan et al. conducted a study to investigate whether administration of dry needling (DN) is comparable to cortisone injection in reducing lateral hip pain and improving function in GTPS patients. The results indicated that there was no inferiority in the clinical outcomes of pain and function between cortisone injection and DN in patients with GTPS. So, they suggested that DN may be a viable treatment alternative to cortisone injection in this patient population under the observations of cortisone injection to the lateral hip for GTPS did not provide greater pain relief or reduction in functional limitations than DN.

In a Letter to the Editor, Kargela et al. expressed concerned that the significance of the study results had been overstated, including the benefits of corticosteroid injection and the value of DN (7). They felt that an unwarranted positive impression might drive clinicians to provide an ineffective treatment (DN) that is not significantly different from another equally ineffective treatment (cortisone injection). In the response to the Letter to the Editor, Brennan et al disagreed (8).

Calvo S, Navarro J, Herrero P, Del Moral R, De Diego C, Marijuán PC. 2017.

Electroencephalographic changes after application of dry needling [DNHS® Technique] in two patients with chronic stroke. MYOPAIN, Early Online: 1–6

Dry Needling for Hypertonia and Spasticity (DNHS®) is a technique specifically designed for the neurological patient and with clear-cut diagnostic and application criteria (9). Calvo and colleagues described the electroencephalographic changes found after the application of DNHS® in two patients with stroke. “Electroencephalographic cordance” has been developed recently and proposed as an indicator of regional brain wave activity, which appears to have a superior correlation with regional blood circulation or brain perfusion. In comparison with other quantitative electroencephalographic (QEEG) measures, such as absolute power (AP) or relative power (RP), cordance appears to have a superior correlation with regional blood circulation or brain perfusion. In both patients, the global value of cordance increased after the dry needling intervention, particularly in the frontal and prefrontal regions. A significant increase in the cordance of the non-injured hemisphere was observed, which is a positive indicator of the information processing associated with the cerebral activity. Besides, a decrease in scores on the Modified Ashworth Scale was found for both patients after treatment with DNHS®. The authors hypothesized that the increased brainwave coherence was due to the modification of new afferents from the treated muscles towards the sensory areas and towards the premotor areas of motor organization, which in turn, were coordinated from the prefrontal regions.

The DNHS® technique is a low-cost modality for the treatment of spasticity, with no documented adverse effects. Although applied as a peripheral treatment, it had a positive effect on regional brain activity. In this paper, the authors presented a new possibility for providing more objective assessments of therapies such as dry needling, although further studies are needed to demonstrate the scientific evidence and underlying mechanisms regarding this technique.

Cross KM, McMurray M. 2017. Dry needling increases muscle thickness in a subject with persistent muscle dysfunction: a case report. International Journal of Sports Physical Therapy, 12(3):468-475

Injuries to the musculoskeletal system can produce dysfunctions including pain, loss of range of motion, and strength impairments. This case report describes the treatment of a 22 year-old competitive gymnast presenting to physical therapy seven months following posterior labral repair with complaints of limited shoulder mobility and strength that affected her ability to reach overhead. The patient had been receiving prior therapy for six months that focused on range of motion (ROM) and standard strengthening exercises. The subject was seen for three weeks with treatment consisting of joint mobilization, instrumented soft tissue mobilization, trigger point (TrP) release, and manual stretching. Although the subject made improvements in both strength and ROM, the subject continued to have complaints of weakness at end ranges of motion, and stiffness and immobility that quickly returned following treatment. Dry needling (DN) to both active and latent TrPs of the infraspinatus was incorporated into the prior treatment program for three successive visits. The subject's strength using a hand held dynamometer as well as the thickness of the infraspinatus muscle using ultrasound imaging was assessed prior and following the initiation of the first DN session. The authors reported that immediately following DN, external rotation strength increased by approximately 30%, and ultrasound muscle thickness of the inferior infraspinatus increased by 25%. Muscle dysfunction is a common occurrence following musculoskeletal injuries and/or trauma that can cause pain and strength deficits. This case report demonstrates the effect TrP DN can have on muscle function as measured by muscle thickness and force production assessed by hand-held dynamometry. Because this is a case report, additional studies including larger sample size and long-term follow-up are warranted to further examine this relationship.

Eftekharsadat B, Babaei-Ghazani A, Zeinolabedinzadeh V. 2016. Dry needling in patients with chronic heel pain due to plantar fasciitis: A single-blinded randomized clinical trial. Medical Journal of the Islamic Republic of Iran, 23;30:401

In this Iranian study, researchers investigated the effect of dry needling (DN) on relieving plantar heel pain. A physical medicine and rehabilitation specialist with five years of experience in this field made the diagnosis. Outcome measures included plantar pain severity measured with a

modified visual analog scale, range of motion of the ankle joint in dorsiflexion and plantar extension, and the Foot Function Index. Measurements were taken at baseline, and after 4 and 8 weeks. The case group received dry needling of TPs in the gastrocnemius muscle, once per week for four consecutive weeks. The authors concluded that TrP DN improved the severity of heel pain, which is in line with other recent studies on the same subject. DN can be used as a good alternative option before proceeding to more invasive therapies of plantar fasciitis despite its insignificant effect on the range of motion of the ankle joint.

Fakhari Z, Ansari NN, Naghdi S, Mansouri K, Radinmehr H. 2017. A single group, pretest-posttest clinical trial for the effects of dry needling on wrist flexors spasticity after stroke. NeuroRehabilitation, 40(3):325-336

Spasticity is a common experience among stroke survivors, which leads to pain, contractures, and deformities that can cause functional disturbances, limitations in mobility and activities of daily living (ADL), and overall diminished quality of life. Fakhari and colleagues from Iran conducted a post-stroke case study to investigate the effects of dry needling (DN) on wrist flexor muscle spasticity. Spastic flexor carpi radialis, pronator teres, and flexor carpi ulnaris muscles on the affected side were treated by deep DN for one session, one minute per muscle. Patients with spasticity after stroke showed improvement in wrist flexor spasticity and alpha motor neuron excitability and experienced improvements in the wrist active and passive range of motion, wrist passive resistance force, and hand dexterity. The underlying mechanism of reducing spasticity with DN is currently unclear. It might be that mechanical sensory stimulation together with the needling pain through inhibitory control system results in neuromodulation of the spasticity (10).

After 1-hour the decreased spasticity and improved motor function persisted. The authors suggested that there may be a lasting effect on spasticity and motor function of the affected hand after DN. The lasting effects of DN may indicate that the immediate effects obtained using a single application of DN may enhance other physiotherapy techniques for CVA patients. Long-term follow-up studies are needed to assess the effects of DN on spasticity.

Fernandes AC, Duarte Moura DM, Da Silva LGD, De Almeida EO, Barbosa GAS. 2017. Acupuncture in temporomandibular disorder myofascial pain treatment: a systematic review. Journal of Oral & Facial Pain and Headache. 31(3):225-232

Researchers from Brazil performed a systematic review of acupuncture in the treatment of myofascial temporomandibular dysfunction (TMD). The authors searched several databases for articles in English, Spanish, and Portuguese. A total of 4 articles met the established inclusion and exclusion criteria. The methodological quality of these papers was assessed with the Jadad scale. Two of the studies were determined to be of high quality, while two were considered low quality. For treatment, two studies used traditional acupuncture, one used trigger point acupuncture, and one used laser acupuncture. For the control group, two studies used sham acupuncture, one used sham laser acupuncture, and one used two different control groups (occlusal splint therapy and no treatment). Interestingly, the authors concluded that acupuncture therapy appears to alleviate symptoms associated with myofascial TMD, despite the very limited number of high-quality studies with good methodological quality. The statement of the authors should be taken with caution. It is hard to draw any conclusions based on two high quality studies with small sample sizes and short follow up periods. It does not allow for generalizability to any population.

Halder GE, Scott L, Wyman A, Mora N, Miladinovic B, Bassaly R, Hoyte L. 2017. Botox combined with myofascial release physical therapy as a treatment for myofascial pelvic pain. Investigative and Clinical Urology, 58(2):134-139

Chronic pelvic pain (CPP) is a common condition affecting approximately 15% of women aged 18-50 years with myofascial pelvic pain (MFPP) being a major contributor to this condition (11). Researchers in the field of urology performed a retrospective case series on females presenting with CPP and MFPP upon examination who had failed at least one treatment modality, including outpatient physical therapy or oral analgesics. Fifty females were enrolled in this study

and were examined for the presence of trigger points (TrPs) in the iliococcygeus, puborectalis, obturator internus, and anterior rectus muscles as the subjects pain rating was recorded.

Subjects received a botulinum toxin injection (10 units per mL) followed by 0.25% bupivacaine hydrochloride into each TrP followed by transvaginal soft tissue myofascial release while the subjects were under general anesthesia. The subjects were seen 2-8 weeks post-treatment at which time a repeat pelvic examination was performed. A significant difference in average pelvic pain scores between pre- (6.4 ± 1.8) and post treatment (3.7 ± 4.0) was found and significantly fewer subjects had TrPs on pelvic examination (44% vs. 100%). Although not statistically significant, 58% of subjects self-reported an improvement in pelvic pain. The authors noted that subjects with a history of chronic bowel disorders were significantly more likely to not report improvement in pain. This case series has several limitations including small sample size, retrospective design, and a post treatment follow-up that varied from 2-8 weeks; however, it does show the consideration of combining botulinum toxin injections and soft tissue myofascial release therapy in the treatment of patient with CPP related to MFPP. A prospective study to evaluate the long-term benefit of this treatment approach warrants consideration in the treatment of this condition.

Haser C, Stöggel T, Kriner M, Mikoleit J, Wolfahrt B, Scherr J, Halle M, Pfab F. 2017. Effect of dry needling on thigh muscle strength and hip flexion in elite soccer players. Medicine and Science in Sports and Exercise, 49(2):378-383

Researchers from Germany evaluated the effects of dry needling (DN) performed once per week for 4 weeks in a group of semi-professional soccer players had on thigh muscle strength and hip flexion range of motion (ROM). Thirty healthy subjects were divided into three treatment groups that compared DN with water pressure massage to both Placebo-Laser (PL) with water pressure massage and a Control group (CO) that received no intervention.

The subjects were evaluated at baseline (M1), following four weeks of treatment (M2), and at a four-week follow-up to assess isometric knee extension and flexion strength, muscular endurance determined by an isokinetic assessment of 25 repetitions at 180°s of knee extension

and flexion were performed, and hip flexion ROM performed by passively flexing the knee in full extension until either trunk movement or end feel was noted. The subjects were followed throughout the season for lower extremity muscle injuries and the resultant days missed. The authors reported the DN group had significant improvement in muscular endurance of the knee extensors at M2 and M3 compared to M1 and knee flexors at M2 compared to M1 as well as hip flexion ROM. Compared to the PL and CO groups, the DN group had a significant increase in hip flexion at M3 compared to M1, the DN group also had significantly improved isometric knee extension at M3 compared to M1. Although the number of injuries between groups was not significantly different ($p=0.30$), only one player receiving DN had a lower extremity strain compared to four players in the PL group and three players in the CO group.

Muscle strength, endurance, and flexibility are important in elite athletes to both improve performance and decrease injuries. Therapies focused on both prevention and treatments are commonly performed in the population group. This study demonstrated the potential effects of inclusion of DN in elite soccer players, and therefore warrants consideration for clinicians working in this environment.

León-Hernández JV, Martín-Pintado-Zugasti A, Frutos LG, Alguacil-Diego IM, de la Llave-Rincón AI, Fernandez-Carnero J. 2016. Immediate and short-term effects of the combination of dry needling and percutaneous TENS on post-needling soreness in patients with chronic myofascial neck pain. Brazilian Journal of Physical Therapy, 20(5):422-431

Dry needling (DN) is an invasive technique that involves the introduction of a needle into the muscle, directed at trigger points (TrP). DN has been associated with secondary side effects, including post-needling soreness, which can vary from a few hours to 2-3 days. To reduce post-needling soreness, several strategies have been recommended following DN, such as an application of cold or heat, soft tissue mobilizations, and stretching. In this study, Spanish researchers investigated the immediate and short-term effects of the combination of DN and percutaneous electrical nerve stimulation (PENS) compared to DN alone on the active TrPs in the upper trapezius muscle.

Sixty-two patients successfully completed the study protocol, randomly assigned to the DN Group or the DN+PENS Group. A total of 30 subjects were analyzed in the DN Group and 29 subjects were analyzed in the DN+PENS Group. Post-needling soreness was measured at 24, 48, and 72 h post-treatment using a pain diary. Neck pain intensity was measured before DN, immediately after DN and at 72 h post-treatment. The degree of disability was registered before DN and at 72 h post treatment. PPT and CROM were assessed before DN, immediately after DN, and at 72 h post-treatment.

The application of PENS after DN showed higher hypoalgesic effects than DN alone, reducing post-needling soreness immediately and at the short-term follow-up. There was no difference in terms of disability. The combination of PENS and DN has an immediate hypoalgesic effect, reducing neck pain intensity in myofascial chronic neck pain patients; however, both DN and the combination of DN and PENS reduce neck pain in a short term follow-up. They concluded that PENS application after DN treatment is more effective than DN alone for decreasing soreness in the short term and improving neck pain intensity immediately in patients with myofascial chronic neck pain.

Martin BR. 2017. Multimodal care in the management of a patient with chronic tendinopathy of the biceps femoris: a case report. Journal of Chiropractic Medicine 16(2):156-162

This case report describes the treatment of a 30-year old female with an 18-month history of right biceps femoris muscle pain that began while training for a triathlon. The patient described the pain at its origin on the ischium ranging from 1 to 10 using the numeric pain scale (NPS). The subject's pain would begin during training, after running, or after cycling for a prolonged period and progressed to becoming more intense and constant during activity. The patient had previously received several different treatments that consisted of light cycling, stretching, and post-isometric relaxation, ultrasound and Graston instrument-assisted soft tissue mobilization to the biceps femoris tendon. The patient also had complaints of night sweats, insomnia, anxiety, tension, and constipation.

The patient was seen twice a week for 8 weeks and once a week for 3 additional weeks. Treatment consisted of auricular acupuncture at the kidney, liver, spleen, shen men, and the sympathetic point bilaterally, and the liver yang, ear apex, and hip unilateral on the right side. Dry needling was performed based upon palpation and typically differed for each treatment to the biceps femoris, semitendinosis, TFL and IT band, gluteus medius, and gluteus maximus muscles. In addition, the patient performed core strengthening exercises and light aerobic activity.

The patient reported alleviation of pain with full range of motion with hip extension, knee flexion, and standing biceps femoris stretch at the 11th, 16th, and 18th treatments respectively. At 12 weeks the patient had resolution of pain. In addition, the patient reported improvement in her complaints of night sweats, insomnia, anxiety, tension, and constipation.

This case report displays the concomitant use of auricular acupuncture and dry needling in conjunction with core exercises and light activity in the treatment of chronic tendinopathy. Although this is a case report and a multi-modal treatment approach was employed, it does demonstrate the utilization of various needle techniques and approaches in the care of a patient.

Shanmugam S, Mathias L. 2017. Immediate effects of paraspinal dry needling in patients with acute facet joint lock induced wry neck. Journal of Clinical and Diagnostic Research 11(6):YM01-YM03

Acute facet joint lock induced wry neck (AFJL-WN) is a sudden onset of ipsilateral cervical pain with contralateral side flexion of the cervical spine caused by abnormal facet joint articulation (12). Traditionally, physicians have prescribed analgesics and muscle relaxants, while physical therapists utilize stretching and spinal mobilizations to decrease pain and improve cervical mobility. Shanmugam and Mathias conducted this study to exam the affects of paraspinal dry needling (PSDN) in the treatment of AFJL-WN.

Twenty-one subjects, aged 18-40 years, with acute onset of ipsilateral neck pain with difficulty rotating and sidebending toward the painful side were included in this study. The mean VAS pain intensity was 73.47, range of motion (ROM) in the sagittal plane was 30.38°, 13.76° frontal plane, and 15.42° in the transverse plane. PSDN was performed for 12-15 minutes, as

needles were inserted 1 cm lateral to the respective cervical vertebra's spinous process into the cervical multifidi. Outcome measurements were taken immediately following PSDN, 24 hours, and one week following a single session of PSDN.

Immediately following treatment the mean VAS was reduced to 18.80, and mean cervical ROM improved to 95.33° of sagittal motion, 91.90° of rotational motion, and 88.28° of sagittal movement. Subsequent follow-ups at 24 hours and one week following treatment revealed continued improvements in both pain reduction and increased cervical ROM. As pointed out by the authors, further studies utilizing a control group is justified to allow for further evidence in this treatment approach.

Taçoğlu Ö, Şahin Onat Ş, Bölük H, Taçoğlu İ, Özgirgin N. 2017. Comparison of two different dry-needling techniques in the treatment of myofascial pain syndrome. Agri, 29(1):9-16

Researchers from Turkey assessed the difference between deep dry needling (DDN) with solid 0.25 x 40 mm filament needles to a peppering needle technique with a 22-gauge hypodermic needle on pain, depression, and activities of daily living (ADLs). Adverse events, if any, were also recorded. With DDN, the needle was inserted into a TrP and left in situ for 10 minutes, after which it was rotated clockwise and left in situ for another 10 minutes before being removed. The peppering technique was performed with a 22-gauge 32 mm long needle. The needle was manipulated 8-10 times targeting a TrP and also in the surrounding tissue. Extrapolating from a figure in the paper, it appears that several muscles were examined and treated in the neck and shoulder region 1x per week for 3 weeks. The authors did not provide a list of included muscles and markings on the figure did not provide enough specificity. Patients received a home program of upper trapezius stretching and isometric neck exercises.

Outcome measures were assessed before, and 1, 5 and 12 weeks after treatment. Pain was measured utilizing the Visual Analog Scale (VAS). The Nottingham Extended Activities of Daily Living Scale (NEADLS) was used to assess ADLs, and the Back Depression Inventory (BDI) for depression and anxiety. A total of 72 patients with myofascial pain were included in the study and evenly distributed between the two needling groups. Ten subjects dropped out of the

deep dry needling group and 8 dropped out of the peppering group, leaving a total of 26 and 28 subjects in each group respectively. Results of the study showed that both groups made improvements in pain, depression, and ADLs up to 12 weeks after treatment. DDN was less painful than the peppering technique. It is impossible to determine whether the differences between the two approaches are due to a different procedure or simply because of the different type of needle. The authors introduced two variables and the contribution of each variable is unknown. There are several other issues with the paper. The statistical analysis section did not clearly state when the student t-test and Mann-Whitney U test were used, other than that they were used where appropriate. The authors did not clarify whether the dropouts were excluded from the final analyses. Furthermore, it was not clear whether the groups were similar at baseline, which of course is important when comparing two groups. There was also no explanation why they included upper trapezius stretching and cervical isometrics for both groups. Information from this paper should be interpreted with caution.

Wang R, Li X, Zhou S, Zhang X, Yang K, Li X. 2017. Manual acupuncture for myofascial pain syndrome: a systematic review and meta-analysis. Acupuncture in Medicine, 35:241–250

This systematic review and meta-analysis was performed to assess the efficacy of manual acupuncture (MA) in the treatment of myofascial pain syndrome (MPS). The authors searched for randomized controlled trials (RCTs) comparing MA to either sham/placebo or no intervention in patients with MPS published in either English or Chinese prior to January 2016. A meta-analysis was performed on the 16 RCTs. Thirteen studies utilized sham needling as a control, one study chose placebo laser, and two studies chose no intervention.

Pain intensity was evaluated in twelve studies and showed a favorable effect of MA after stimulation of trigger points (TrPs) but not of traditional acupuncture points. These findings were noted following a single treatment and after a course of eight

sessions. Six studies measured pressure pain thresholds (PPT), of which three sham-controlled studies were combined in a meta-analysis that showed an increase in PPT with MA at TrPs. Two RCTs comparing MA with either no intervention or with placebo laser found no significant increase in PPT immediately following either one or 12 sessions. Range of motion (ROM) was assessed in three studies and MA was linked to a significant improvement in cervical ROM compared to no intervention. The authors concluded stimulation of TrPs using MA might be efficacious in providing pain relief and reducing muscle irritability in patients with MPS. The authors recommend further studies that include long-term efficacy of MA and include the utilization of outcome measures for health care profile as limited studies have included these measurement tools.

Wu JY, Zhang C, Xu YP, Yu YY, Peng L, Leng WD, Niu YM, Deng MH. 2017.

Acupuncture therapy in the management of the clinical outcomes for temporomandibular disorders: A PRISMA-compliant meta-analysis. Medicine (Baltimore). 96(9):e6064

Authors from China explored the effects of conventional acupuncture in the management of temporomandibular dysfunction (TMD). A total of 9 studies met the established inclusion and exclusion criteria. Results of the meta-analysis suggest that conventional acupuncture treatment is effective to reduce pain in patients with TMD, particularly those with myofascial involvement; however, it was not significant for improving maximum mouth opening. The authors did a nice job searching multiple databases for studies meeting their criteria; however it was not clear whether the reviewers were blinded to the authors and institutions who had conducted the studies. Additionally, the quality of each study in the meta-analysis was not included, therefore it makes it harder to interpret the information provided.

4. Other clinical studies and case reports

Brockman T. 2017. A case study utilizing myofascial release, acupressure and trigger point therapy to treat bilateral "Stringhalt" in a 12 year old Akhal-Teke horse. Journal of Bodywork & Movement Therapies 21;589-593

Stringhalt is a condition that causes one or both hind legs in horses to spasm when walking, trotting, or backing. The condition is thought to be a neurological reaction that arises from plant toxicity or peripheral nerve injury. The horse's quality of life and performance are affected in severe cases, with treatment recommendations consisting of surgically cutting the digital extensors, myotomectomy of the lateral digital extensor tendon, botulinum toxin injections to the extensor digitorum lateralis and lateral vastus muscles, anti-seizure medication, and potentially euthanizing the horse.

This case study describes the treatment of a 12-year-old mare that became caught in barbed wire overnight and sustained lacerations to the bone in her hind limbs. Following the injury the horse was placed in a stall for months with inadequate food and water, at which time she developed stringhalt. The horse had received prior treatment consisting of vitamin injections, and massage treatment (myofascial, acupressure, and trigger point release). Prior to initiation of treatment the stringhalt motion was reported and observed every 3-5 minutes with the hind limb maintained in a flexed position, touching the abdomen for approximately 5 seconds.

Six treatments were performed biweekly consisting of myofascial release at the cervical, sacrum, and ilia, acupressure of the bladder meridian, and trigger point release of the iliacus muscle. Following the 6 treatment sessions, the horse was able to stand with increased hind limb extension and the frequency and severity of the spasms had decreased to every 10-20 minutes. Additionally, the horse was able to run, which she had not been able to do since the injury. Although the subject in this article was a horse and therefore outcomes were limited to visual observation, the horse's owners were pleased in the progress made following 6 treatments especially considering the duration of symptoms of over 3 years. Stringhalt has been described as a neurological condition resulting from dietary or nerve injury; however, this case study outlined the potential influence of iliacus fascia tightness and TrPs as the contributing factor as a

result of the horse presumably violently flexing the hind limbs in an attempt to free from the barbed wire. The horse was then placed in a stall for consecutive months limiting movement that could have created the TrPs..

Segura-Pérez M, Hernández-Criado MT, Calvo-Lobo C, Vega-Piris L, Fernández-Martín R, Rodríguez-Sanz D. 2017. A multimodal approach for myofascial pain syndrome: a prospective study. Journal of Manipulative and Physiological Therapeutics 40:397-403

Myofascial pain (MPS) is a common condition with a prevalence ranging from 30% in primary care to 93% in specialized pain clinics (13). Invasive and conservative interventions have been recommended in the treatment of trigger points (TrPs). Therefore the authors of this study conducted a prospective study to analyze pain intensity in patients with MPS using a multimodal rehabilitation program. Between 2009 and 2013, 150 patients presenting with a medical diagnosis of MPS in any of the following regions were included in this study: cervicobrachial, lumbosacral, elbow, ankle and foot, and temporomandibular jaw. Patients were seen for four weeks (five sessions) using a multimodal approach that included TrP dry needling, spray and stretch, Kinesio taping, eccentric exercise, and patient education. Pain intensity using the visual analog scale (VAS) was assessed at the beginning of the study and 1 week following completion.

The authors found a statistically significant difference in pain intensity, a clinical relevant reduction (VAS \geq 30 mm) was obtained in 78.7% of the participants, and four treatment sessions reduced the VAS score by 10 mm in 83.55% of the subjects. Although this study did demonstrate promising reductions in VAS regardless of the body region, a control group was not incorporated into this study that would have allowed further comparisons of this treatment approach. While clinically a multimodal treatment approach is often utilized, a control group is important for clinical research to allow for a comparative analysis.

Soriano PK, Bhattarai M, Vogler CN, Hudali TH. 2017. A case of trigger-point injection-induced hypokalemic paralysis. American Journal of Case Reports, 18:454-457

Serious adverse effects after trigger-point injection (TPI) are rarely observed. The authors of this case report described a 39-year-old man who experienced severe, transient hypokalemic paralysis in the context of TPI therapy with methylprednisolone, bupivacaine, and epinephrine. The TPI targeted the left iliopsoas tendon and was administered using ultrasound guidance. The patient was successfully treated with electrolyte replacement in a closely monitored setting.

The exact mechanism underlying the hypokalemic paralysis is unclear in this case. The proposed mechanism is an exaggerated response to the epinephrine component of the TPI. Another hypothesis is that the increased stress of the procedure lead to an increase in epinephrine release. Transcellular shifting is a common cause of hypokalemia. Severe hypokalemic paralysis in the context of TPI is an incredibly rare occurrence. A high index of clinical suspicion and a systematic approach are required for prompt diagnosis and management of this obscure iatrogenic entity. As a more general note, there are no studies in support of injecting methylprednisolone, epinephrine, and long-acting anesthetics in TrPs, and perhaps the use of steroids and epinephrine should be discontinued for TPI.

5. Statement of interest

Jan Dommerholt, Michelle Finnegan and Todd Hooks are affiliated with Myopain Seminars, LLC, Bethesda, MD, USA, an organization that promotes the recognition and treatment of individuals with myofascial pain.

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