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MYOFASCIAL PAIN AND TREATMENT: Editorial

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A B S T R A C T

The first article featured in this quarter's overview deserves special attention. Margalef and colleagues developed the first viable animal model of trigger points (TrPs). They also provided evidence of glycosaminoglycans (GAGs) near TrPs, which is a new finding that deserves further scientific inquiry (Margalef et al 2019). In 2011, Stecco et al. already mentioned a possible role of hyaluronan, which constitutes a subgroup of GAGs, in the etiology of myofascial pain (Stecco et al 2011). Mayoral Del Moral and colleagues published an excellent study that showed very good inter-examiner reliability for identifying subjects with MPS for identifying specific muscles (Mayoral Del Moral et al 2018). Sollmann and colleagues described a new and objective method to identify TrPs, using T2 mapping with quantitative MRI-based techniques (Sollmann et al 2016). As usual, many new dry needling (DN) studies, reviews, manual TrP papers and case reports are included. Finally, we would like to thank Dr. Michelle Finnegan for her contributions to this overview paper during the past 5 years. Dr. Finnegan will be focusing on other professional endeavors and she will not return as a contributing author.

1. Basic research

Margalef R, Sisquella M, Bosque M, Romeu C, Mayoral O, Monterde S, Priego M, Guerra-Perez R, Ortiz N, Tomàs J, Santafe MM. 2018. Experimental myofascial trigger point creation in rodents. Journal of Applied Physiology (1985). 2019 Jan 1;126(1):160–169. doi: 10.1152/japplphysiol.00248.2018

In spite of years of research into the nature and characteristics of TrPs, there still is not a suitable and reliable animal model (Huang et al., 2013). Creating a TrP experimentally has been attempted by Mense et al., who demonstrated that inhibiting acetylcholinesterase at the motor endplate caused focal muscle fiber contractions, even though they were not located exactly near a motor endplate and had a different appearance than typical contraction knots (Mense et al., 2003). Huang and colleagues experimented with a rat model, and while they demonstrated an increased frequency of endplate noise and polyphasic spikes, they failed to record contraction knots (Huang et al 2013, 2015).

Researchers in Spain appear to have developed a solid animal model in a series of experiments. First, they administered an anticholinesterasic agent to muscles of a mouse, which triggered a sharp increase in neurotransmission in the levator auris longus muscle, a lower increase in the diaphragm muscle, and an increase in endplate noise in the gastrocnemius muscle. The endplate noise was associated with zones of neuromuscular contractions and increased levels of glycosaminoglycan near contraction knots.

During the second part of the study, rats were exposed to the anticholinesterase agent neostigmine and after 30 minutes, the researchers observed palpable taut bands, the echocardiographic presence of contraction knots and local twitch responses upon needle stimulation consistent with what is currently known about TrPs. This brief summary does not really do justice to the many steps involved in this study. The authors used a variety of staining techniques, histochemistry, electromyography, and sonography, among others. In addition to creating the first solid animal model of TrPs, the authors also established that glycosaminoglycan may play an important role in the TrP formation. The nodular nature of TrPs felt with palpation may at least in part be due to the presence of glycosaminoglycan (GAG), which are likely synthesized by fibroblasts. The authors did not specify which type of GAG they identified. GAGs can be categorized into four main groups, including heparin/heparan sulfate, chondroitin sulfate/dermatan sulfate, keratan sulfate, and hyaluronan (Zhang et al., 2009). They did describe that GAGs could partially explain the presence of nociceptive substances found at active TrPs (Hsieh et al., 2012; Shah et al., 2008). Since GAGs are hygroscopic and as such, can absorb and retain liquid, it is possible that manual TrP techniques may reduce the volume of palpable TrPs and remove nociceptive substances. This is an area that deserves further research.

The difference in response between the levator auris longus muscle (a fast twitch muscle) and the diaphragm (a slow twitch muscle) also needs to be studied in more detail. It is conceivable that the anticholinesterase agent neostigmine is more effective in phasic than in tonic muscles. Furthermore, the researchers confirmed that an increase in endplate noise and miniature endplate potentials, which have been described as part of the integrated TrP hypothesis. They also concluded that thousands of

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1360-8592/

fibers would be required to be able to palpate human TrPs. In conclusion, this is a very important and groundbreaking study. Not only did the researchers create a valid animal model of TrPs, they added several new aspects to the theoretical knowledge base of TrPs and their pathophysiology.

McDowell JM, Kohut SH, Betts D. 2019. Safe acupuncture and dry needling during pregnancy: New Zealand physiotherapists' opinion and practice. Journal of Integrative Medicine, 17(1):30–37. DOI: 10.1016/j.joim.2018.11.006

Compared to the DN situation in the US, physiotherapists in New Zealand operate in a very different environment. Whereas in the US, physical therapists and acupuncturists often maintain adversarial relationships, if any (Fan et al., 2016; Dommerholt and Stanborough 2016, 2017; Zhu and Most, 2016), in New Zealand DN has been taught primarily by the Physiotherapy Acupuncture Association of New Zealand (PAANZ). It is only recently that DN has been taught separately from acupuncture practice, which according to the authors of this article may be due to an influx of foreign practitioners. Physiotherapy acupuncturists tend to use considerable caution when treating pregnant women, which is likely to have contributed to a somewhat defensive practice. Whether DN practitioners assume the same cautious attitude toward treating pregnant women is unknown. In traditional acupuncture, the notion of "forbidden points" suggests that certain points on the body should be avoided during pregnancy as they could be abortifacient and needle stimulation could result in miscarriage or early labor. Although numerous studies have refuted the significance of forbidden points, the precautionary approach appears to persist (Carr, 2015; Betts and Budd, 2011; Cummings, 2011, Guerreiro Da Silva et al., 2011). Some conflicting papers maintain that needling may trigger preterm contractions, even though they acknowledge that in contemporary acupuncture practice the needles are much thinner and more refined than in the days of reusable needles (Dale, 1997; Mansu et al., 2016).

The authors conducted an electronic survey among New Zealand physiotherapists practicing acupuncture or DN to examine their practice and level of understanding in regard to safe needling during pregnancy. Of 124 practitioners, only 60 (48%) felt comfortable with conducting needling treatment in pregnant women and the majority of that group expressed safety concerns. It should be noted that only 4 respondents in this group had completed DN studies only, while 38% had completed the courses offered by PAANZ or its UK equivalent, which is likely to have skewed the results. It is also of interest to note that acupuncturists more commonly left the needles in situ, while dry needlers did not use needle retention as much. The authors concluded that some degree of caution is still warranted when treating pregnant women with acupuncture and DN even though negative defensive practice may potentially withhold treatment that otherwise would have been offered.

Mayoral Del Moral O, Torres Lacomba M, Russell IJ, Sánchez Méndez Ó, Sánchez Sánchez B. 2018. Validity and reliability of clinical examination in the diagnosis of myofascial pain syndrome and myofascial trigger points in upper quarter muscles. Pain Medicine, 19(10):2039–2050, DOI: 10.1093/pm/pnx315

Spanish researchers performed an interesting study to look at four factors: 1) to determine if two independent examiners can agree on the diagnosis of myofascial pain syndrome (MPS) when one examiner is blinded; 2) evaluate the inter-examiner reliability in identifying relevant TrPs in 10 muscles of the upper quarter; 3) evaluate the reliability of 10 specific clinical criteria for the diagnosis of MPS; and, 4) evaluate the validity of the clinical diagnostic criteria for the diagnosis of MPS. The sample size was calculated and determined that a total of 40 subjects were required, with 20 being in the MPS group and 20 in the normal healthy control (NHC) group. MPS subjects had to have at least one active TrP in one of the 10 muscles assessed: splenius capitis, sternocleidomastoid, upper trapezius, levator scapulae, infraspinatus, supraspinatus, anterior deltoid, latissimus dorsi, teres major, pectoralis major. Questionnaires completed by all subjects included the Visual Analog Scale (VAS) for pain intensity, body diagrams, and the SF-36 Health Survey for health-related quality of life. Pressure pain threshold testing was also assessed on each TrP with an analog algometer. The first examiner was not blinded to subjects in the study and was considered the reference standard for the second blinded examiner. The blinded examiner evaluated all subjects 3–4 days after the first examiner. Results of the study showed that there was very good inter-examiner reliability for identifying subjects with MPS. There was also very good inter-examiner reliability for identifying muscles leading to a diagnosis of MPS as well as high sensitivity and specificity values for most examination tests in all muscles, supporting the validity of diagnostic criteria for MPS. This paper was well written, organized and easy to follow. One issue with the diagnosis of MPS has always been validating to a gold standard and this paper makes a convincing step forward in validating the TrP examination.

Moraska AF, Hickner RC, Rzasa-Lynn R, Shah JP, Hebert JR, Kohrt WM. 2018. Increase in lactate without change in nutritive blood flow or glucose at active trigger points following massage: a randomized clinical trial. Archives of Physical Medicine and Rehabilitation, 99(11):2151–2159, DOI: 10.1016/j.apmr.2018.06.030

Investigators from Colorado, North Carolina and Maryland assessed whether performing a manual TrP release at an active TrP would change nutritive blood flow measured by microdialysis ethanol clearance, or dialysate glucose and lactate concentrations. Additionally, they also evaluated the level of discomfort from the study procedures experienced by the subjects. Subjects with tension type headache (TTH) and subjects with migraines and two or more TTH episodes a month were included in the study. All subjects also had to have an active TrP in the upper trapezius muscle. Twenty-five subjects were randomized into one of two groups: TrP release or sham ultrasound (US). A massage therapist with nine years of experience performed the assessment for TrPs in the upper trapezius muscle according to accepted published criteria from Barbero et al., (2012) and Simons et al., (1999), and the treatment for both groups. The authors used microdialysis to assess the interstitial fluid from the TrP before, during, and 60 minutes after the intervention. Outcome measures included patient discomfort at the time of probe placement, immediately after treatment, and after probe removal. Pressure pain threshold (PPT) testing was assessed with an algometer prior to and after probe removal.

The study revealed that there was no statistical interaction between blood flow and glucose concentrations; both treatment groups responded similarly. There was, however, a significant increase in lactate concentrations for subjects who received the manual TrP release. The manual TrP release group had a 22.2% increase in PPT, whereas the sham US group had a 32.6% decrease. It is not clear what would have triggered a decrease in the control group. Finally, pain from probe placement was low. This is an interesting and unique study looking at changes within a TrP before and after a single treatment. Although there were not many changes, as the authors discussed, the insertion of the probe into the TrP could have created changes in the interstitial fluid before the actual sample collection began.

Nikkuni Y, Nishiyama H, Hyayashi T. 2018. The relationship between masseter muscle pain and T2 values in temporomandibular joint disorders. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology, 126(4):349–354, DOI: 10.1016/j.oooo.2018.06.003

Researchers from Japan conducted a retrospective magnetic resonance imaging (MRI) study to examine the relationship between T2 values and the type of masseter muscle pain in patients with temporomandibular joint disorders (TMDs). One hundred and five patients diagnosed with TMD were divided into 6 groups based upon the type of masseter pain presentation. Subjects were divided into five types of masseter pain patterns: 22 patients reported masseter pain upon compression (1.5–2.0 kg/cm applied to muscle belly), 13 patients with pain only upon movement, 4 patients with spontaneous pain only, 14 patients with both compression pain and pain upon movement, and 2 patients with compression and spontaneous pain.

The authors reported significant differences between the painful and pain-free masseter muscle only in the group with pain upon compression ($P < .001$). No significant differences were found in the other test groups. The authors noted no significant difference in T2 values between the painful and pain-free side in patients experiencing myofascial pain (pain on movement and spontaneous pain). These findings suggest this pain is not a result of edematous changes. This study does have limitations that should be noted, as the entire masseter muscle was not analyzed and the inclusion of the entire muscle may have altered the amount and presentation of edema within the muscle.

Poluha RL, Grossmann E, Iwaki LCV, Uchimura TT, Santana RG, Iwaki Filho L. 2018. Myofascial trigger points in patients with temporomandibular joint disc displacement with reduction: a cross-sectional study. Journal of Applied Oral Science, 18;26:e20170578, DOI: 10.1590/1678-7757-2017-0578

Brazilian researchers performed a retrospective observational cross-sectional analytical study to assess the impact of TrPs in four muscles in patients with disc displacement with reduction (DDWR). They also studied which clinical variables are associated with the presence of DDWR and TrPs. A total of 130 records of subjects met the inclusion and exclusion criteria out of an initial 520 eligible candidates. A single examiner collected data on gender, age, pain duration, pain scores with the Visual Analog Scale (VAS), and maximal inter-incisal distance (MID) measured with a digital caliper. TrP data included their presence, quantity, location, and classification in the temporalis, sternocleidomastoid, masseter and upper trapezius muscles. The criteria used to determine the presence of a TrP were based on publications by Gerwin et al., (1997) and Simons et al., (1999) including the presence of a palpable band in the muscle, the presence of a hyperirritable spot within the taut band, a local twitch response created by snapping palpation, and the presence of referred pain with TrP compression. The records were divided into two groups: DDWR + TrPs ($n = 101$) and DDWR + no TrPs ($n = 29$) to determine the impact of TrPs in patients with DDWR. Results revealed that the group with DDWR + TrPs had statistically significant higher pain scores and smaller MID (Dommerholt et al., 2019) compared to the DDWR + no TrPs group. Additionally, the female gender, MID, and VAS pain scores were significantly associated with the presence of DDWR + TrPs.

This is an interesting study looking at the impact of TrPs on patients with DDWR. It is not surprising that the DDWR + TrPs group had higher pain scores than the group without TrPs, considering that TrPs contribute to local and referred pain (Dommerholt et al., 2019). What is more interesting is that they were able to actually find 29 patients without TrPs in any of the 4 assessed muscles. Part of this could be due to fact the authors included a local twitch response as one of the criteria, which has been shown to be less reliable than identifying a taut band or spot tenderness in the taut band (Gerwin et al., 1997; Al-Shenqiti and Oldham, 2005). Based on clinical experience, patients who have DDWR have TrPs in at least one, if not all four muscles described in this paper. It would be interesting to discover whether the authors would have been able to find subjects with DDWR but no TrPs if they had omitted the local twitch response as a criterion.

Sollmann N, Mathonia N, Weidlich D, Bonfert M, Schroeder SA, Badura KA, Renner T, Trepte-Freisleder F, Ganter C, Krieg SM, Zimmer C, Rummeny EJ, Karampinos DC, Baum T, Landgraf MN, Heinen F. 2019. Quantitative magnetic resonance imaging of the upper trapezius muscles - assessment of myofascial trigger points in patients with migraine. Journal of Headache and Pain. 18;20(1):8. DOI: 10.1186/s10194-019-0960-9

Migraines, the sixth most disabling disorder, are linked to peripheral nociceptive inputs referred to the brainstem and meninges. Trigger points are one of the possible peripheral nociceptive sources (Giamberardino et al., 2007) and identified through manual palpation (Donnelly, 2019). Other methods of TrP identification remain problematic and are generally unreliable, such as indwelling electromyography, sonography with or without elastography, and thermography, among others. In this study, German researchers explored whether new high-resolution, quantitative MRI-based techniques may be able to assess muscles more accurately and identify TrPs using T2 mapping. In addition, they determined whether there are quantitatively assessable signal alterations in the region of clinically detectable TrPs, which may not be picked up with more traditional qualitative image interpretation.

Ten subjects older than 18 years of age with migraine headaches with unilateral or bilateral TrPs in the upper trapezius muscle were examined manually for the presence of TrPs in the upper trapezius muscles. One active TrP was marked with two nitroglycerin capsules on the skin. Imaging was performed in supine with a 3T whole body MRI scanner in combination with a 16-channel anterior coil, a 12-channel posterior coil, and a 16-channel head coil. To prepare the T2 maps and to evaluate the data, the authors provided much technical detail beyond the scope of this overview article. The details will allow other researchers to duplicate the research methodology.

The researchers observed statistically significant differences when comparing T2 values derived from the trapezius muscles and T2 values of signal alterations attributed to TrPs. In other words, TrPs were identified even in the absence of qualitatively assessed signal alterations. T2 mapping provides as such an objective method of detecting active TrPs in subjects with migraine headaches. The authors concluded that their “approach might challenge the current gold-standard method of physical examination to detect TrPs,” which is an intriguing statement as the initial identification of TrPs in this study was performed with manual palpation. The authors did acknowledge that the current study does not support superiority over manual palpation. It is not immediate obvious that this technology will find a place in clinical practice any time soon, but the importance of this study goes beyond clinical applications. If the findings are consistent in future studies with larger cohorts and other patient populations, the authors have successfully described a new and objective method to identify TrPs, which may be useful in research and possibly in the clinic.

2. Reviews

Denneny D, Frawley HC, Petersen K, McLoughlin R, Brook S, Hassan S, Williams AC. 2019. Trigger point manual therapy for the treatment of chronic noncancer pain in adults: a systematic review and meta-analysis. Archives of Physical Medicine and Rehabilitation, 100(3):562–577, DOI: 10.1016/j.apmr.2018.06.019

The objective of this British study was to assess the effectiveness of manual TrP therapy on reducing chronic non-cancer pain in adults. Randomized controlled trials were identified and included in the analysis if subjects were older than 18 years of age with pain of 3 or more months. Outcome measures included pain, function, and patient-reported improvement. The authors used a narrative synthesis of the evidence using GRADE, the recommended method by the Cochrane Handbook for Systematic Reviews of Interventions, which differentiates studies into high, moderate, low, and very low quality studies (Guyatt et al., 2008). The authors excluded any studies that did not specifically address TrPs with ischemic compression techniques. In other words, any other manual TrP therapies were not considered, including transverse friction massage, muscle energy techniques, mobilization, massage, manipulations, and spray and stretch therapies. Yet, the title of the study suggests that the researchers included all forms of TrP manual therapy and as such, the title is rather misleading. Perhaps the title of the paper should have reflected the limited focus of the study, i.e., "trigger point ischemic compression therapy for the treatment of chronic noncancer pain in adults." Although the authors found some evidence of improvement in function and patient global assessment, they concluded that there was no evidence of consistent pain reduction with TrP manual therapy, and therefore, they did not recommend the use of TrP manual therapy as a standalone treatment of patients with chronic non-cancer pain, which again, was defined as TrP ischemic compression only. Interestingly, most clinicians would likely agree that limiting one's practice to TrP ischemic compression only would indeed not be recommended, as TrP manual therapy includes many other approaches and techniques, which have been shown to be effective in numerous studies (Chao et al., 2016; Fernandez-Lao et al., 2012; Grieve et al 2011, 2015; Hains et al 2010a, 2010b, 2015; Hains and Hains, 2010). As such, this study has limited value and contributes less to the literature as a first glance would suggest.

Hu HT, Gao H, Ma RJ, Zhao XF, Tian HF, Li L. 2018. Is dry needling effective for low back pain? A systematic review and PRISMA-compliant meta-analysis. Medicine (Baltimore), 97(26):1–10, DOI: 10.1097/MD.0000000000011225

Acupuncturists from China performed a systematic review and meta-analysis to examine the safety and efficacy of DN for treating patients with low back pain (LBP). A literature search was conducted for randomized controlled trials (RCTs) from inception to October 2017 with no language restriction. Inclusion criteria included adult patients (>18 years old) presenting with TrPs. Studies that included patients with LBP associated with pregnancy and parturition or caused by pathological entities such as infection, fractures, metastatic diseases, and neoplasm were excluded. The control groups included treatments with acupuncture, sham needling (i.e. sham acupuncture and sham DN), and other treatments commonly associated with LBP (oral medication, physiotherapy, behavioral therapy, or massage). Exclusion criteria included experimental groups that combined DN with acupuncture and studies that only compared the efficacy of two different types of DN (deep DN vs. superficial DN). Primary outcome measures included assessing pain intensity (Visual Analog Scale [VAS]), functional disability assessed by the Roland Morris Disability Questionnaire (RMQ) and the Oswestry Disability Index (ODI). Secondary outcomes included response rate.

Sixteen RCTs from China, Japan, Spain, United States, and Iran were included in this review. The risk of bias evaluation of these RCTs was reported to be "high" or "unclear" for most domains. Results of the meta-analysis suggest that post-intervention DN was more effective than acupuncture in alleviating pain intensity and functional disability, but follow-up assessments were equal. Dry needling was noted to be superior to sham needling in alleviating pain intensity at both post-intervention and at follow-up and functional disability measured post-intervention. Dry needling combined with acupuncture had a more significant effect on alleviating pain intensity post-intervention with a higher response rate than DN alone. Assessing outcomes of DN compared with other treatments (laser, physical therapy, etc.), it is uncertain whether the efficacy of DN is superior or equal because the results of the outcomes were mixed.

This systematic review highlights the lack of high-quality RCTs examining the efficacy of DN in the treatment of LBP. The studies utilized in this review had high/unclear risk of bias with randomization, allocation concealment, and blinding. Most RCTs were published as only brief reports; therefore, the completeness of the study information was low, resulting in "unclear" risk of bias. The sample size ranged in these included studies ranged from 9 subjects to 200, duration of symptoms ranged from 4.4 months to 10.2 years, treatment sessions ranged from 1 to 20, and lastly follow-up ranged from no follow-up (8 of the 16 studies) to 3 months. Additionally, only 7 of the 16 studies reported a local twitch response (LTR) during treatment. Dry needling treatment techniques do vary, and although a positive relationship has been shown with the presence of a LTR during treatment and clinical outcomes (Hong and Torigoe, 1994), methods and intent of treatment often differ between clinicians. This systemic review highlights the importance of well-designed, large scale RCTs that include long-term follow-up measured at multiple time frames following treatment in order to more thoroughly assess the outcome validity of the treatment for LBP not unlike the conclusions of a 2005 Cochrane Review (Furlan et al., 2005).

Mansfield C, VanEtten L, Willy R, Di Stasi S, Magnussen R, Briggs M. 2019. The effects of needling therapies on muscle force production: a systematic review and meta-analysis. Journal of Orthopaedic and Sports Physical Therapy, 49(3):154–170, DOI: 10.2519/jospt.2019.8270

Investigators from Ohio performed a systematic review with a broad search strategy to examine the effects of needling therapies (dry needling and acupuncture) on muscle force production. A total of 21 randomized controlled trials met the inclusion and exclusion criteria of the 4338 papers found. The Physiotherapy Evidence Database (PEDro) scale was used to determine the methodological quality of the papers. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool was used to assess the strength of the evidence when studies measured force production using the same method and individuals with similar conditions. Of the 21 studies, 9 were high quality with a PEDro score of 6/10, 11 were fair quality with a PEDro score of 5–6/10, and one was poor quality with a score of less than 5/10. Body regions were broken down into the cervical spine, shoulder, elbow/wrist/hand, knee/thigh and foot ankle. It was possible to perform meta-analyses on the papers included on the cervical spine, shoulder, and elbow/wrist/hand. For the cervical spine, 2 papers with a moderate strength of evidence and moderate effect sizes demonstrated that needling enhanced isometric force production in all planes when it was combined with stretching versus stretching alone. For the shoulder and elbow/wrist/hand there was very low strength of evidence of no effect on muscle force production. As a result of these findings there is little evidence to support that needling has an effect on muscle force production. If more of the studies were of high quality, perhaps further conclusions could be drawn. Overall, this is a well-designed paper that highlights that higher quality studies need to be performed to determine if needling has any effect on muscle force production in different regions of the body.

Roberson R, Tucker B, Kerna NA. 2019. A safe "opioid" – is dry needling an efficacious alternative to opioids? International Journal of Complementary & Alternative Medicine, 12(1):6–8, DOI: 10.15406/ijcam.2019.12.00440

A 2018 report stated that prescription of opioids in a US hospital emergency department was reduced by more than 50% when they started offering DN instead (Wang, 2018). This review paper discussed why DN and DN combined with electrotherapy may indeed be effective in reducing pain. In the USA, opioid consumption for chronic nonmalignant pain management has increased dramatically leading to over 70,000 deaths annually. Given this heavy toll and the many other potential side effects, opioids should not be considered as the first choice of treatment. There is some evidence that acupuncture, as a nonpharmacologic pain therapy, may increase the production of endogenous analgesic neurotransmitters, such as endorphins and adenosine (Deng and Mao, 2019). Similarly, DN and electric DN (EDN) may provide an endogenous pain relief effect by influencing central sensitization, which in turn is associated with peripheral and spinal hyperalgesia. With DN and EDN, eliciting analgesia is not limited to the periphery. DN/EDN may decrease second-order neuron hyperalgesia peripherally, spinally, and supraspinally via multiple pathways by arousing the hypothalamic-pituitary-adrenal axis, provoking immune cells, and prompting the supraoptic nucleus. As a result, DN/EDN may contribute to a decrease in the perception of pain.

Overdependence on opioids for pain management is a public health crisis, and it is important to encourage using alternative options including nonpharmacological interventions such as acupuncture, DN or EDN as safe and efficacious alternative options. Of course, there are multiple other options, including promoting exercise-induced pain reduction (Lima et al., 2019).

3. Dry needling, acupuncture, and injections

Arias-Buría JL, Martín-Saborido C, Cleland J, Koppenhaver SL, Plaza-Manzano G, Fernández-de-Las-Peñas C. 2018. Cost-effectiveness evaluation of the inclusion of dry needling into an exercise program for subacromial pain syndrome: evidence from a randomized clinical trial. Pain Medicine, 1;19(12):2336–2347, DOI: 10.1093/pm/pny021

Subacromial pain syndrome (SPS) is a common condition affecting up to 25% of the general population. It is a significant health problem associated with high health care costs and significant economic burden. This Spanish study was designed to investigate the cost-effectiveness of including TrP-DN into an exercise program in patients diagnosed with SPS. Fifty patients diagnosed with SPS presenting with unilateral nontraumatic shoulder pain of at least three months' duration and a pain rating of at least 4/10 were included in this study. Patients were randomly assigned to receive exercise only or exercise plus TrP-DN treatments. The exercise program targeted the supraspinatus and infraspinatus other scapular musculature. Subjects were instructed to perform the exercise program twice daily for five weeks with monitoring once a week throughout the five-week program. Subjects allocated to the TrP-DN group were instructed to follow the same exercise program with the inclusion of TrP-DN during the second and fourth treatment sessions targeted at the rotator cuff and deltoid muscles.

Forty-eight subjects were eligible for follow-up. The authors reported that subjects receiving TrP-DN utilized significantly fewer health care resources than the exercise only group with significant fewer indirect costs due to decreased work absenteeism and increased work productivity. Subjects in the TrP-DN group reported a significantly better quality of life than subjects in the exercise only group. The inclusion of TrP-DN is likely to be more cost-effective than an exercise program alone and should be considered in the multimodal management of patients with SPS. This study has several limitations such as the lack of a pure control group. Although this study highlighted the utilization of DN in the treatment of TrPs, a comparative study examining the effects of other treatment techniques for TrPs as compared to TrP-DN is warranted to compare various treatment approaches.

Aydin T, Dernek B, Sentürk Ege T, Karan A, Aksoy C. 2018. The effectiveness of dry needling and exercise therapy in patients with dizziness caused by cervical myofascial pain syndrome; prospective randomized clinical study. Pain Medicine, 1;20(1):153–160, DOI: 10.1093/pm/pny072

Cervicogenic dizziness is a nonspecific sensation of altered orientation in space and disequilibrium originating from abnormal afferent activity from the neck (Reiley et al., 2017). Since muscles in the cervical region, in particular the upper trapezius (UT) and sternocleidomastoid (SCM), serve to provide proprioceptive sensory input and spatial orientation (Giamberardino et al., 2011), myofascial pain syndrome (MPS) may disturb this proprioceptive input. As many as 35% of patients with MPS experience dizziness (Şahin et al., 2008). This prospective randomized clinical study from Turkey was conducted on 61 patients with complaints of dizziness and TrPs within the upper trapezius and clavicular portion of the SCM muscles. Patients were randomized into and exercise only group (Group 1, $n = 30$) and an exercise with DN group (Group 2, $n = 31$). Five patients in Group 1 and one patient in Group 2 dropped out of this study. Subjects were monitored for neck pain severity using a visual analog scale (VAS), pressure pain threshold (PPT) using an algometer, static posturography to measure the fall index, and the Dizziness Handicap Inventory (DHI) testing to measure quality of life. All subjects performed the exercises as a home exercise program (HEP) five days a week for four weeks. The HEP consisted of bilateral SCM and UT muscle stretching and cervical isometric strengthening exercises performed twice daily. Subjects in Group 2 received TrP-DN to the UT and SCM twice a week for four weeks in addition to the HEP.

The authors reported that subjects in both Group 1 and 2 showed significant improvements in neck pain, PPT, frequency and severity of dizziness attacks, fall index, and the DHI at the first and fourth month. Comparing the outcomes between each group, Group 2 had significantly better outcomes in all testing parameters except the fall index. A limitation of this study is that all subjects were female. Clinicians treating patients with cervical dysfunction and dizziness should consider DN as part of the treatment strategy.

Cruz-Montecinos C, Núñez-Cortés R, Bruna-Melo T, Tapia C, Becerra P, Pavez N, Pérez-Alenda S. 2018. Dry needling technique decreases spasticity and improves general functioning in incomplete spinal cord injury: A case report, The Journal of Spinal Cord Medicine, DOI: 10.1080/10790268.2018.1533316

Chronic pain and spasticity are common complications following spinal cord injury (SCI) that can significantly impair an individual's quality of life. Botulinum toxin is often used in the treatment of muscle spasticity, however, this treatment option is expensive and may not always be within reach (Chan et al., 2017). This case study, prepared by authors from Spain and Chile, outlines the treatment of a 47-year-old male who suffered a traumatic cervical disk herniation six months prior to the being seen for treatment. He had undergone prior cervical surgery. The patient presented with compromised functionality of the right upper and lower limbs as a result of increased spasticity, neuropathic pain, and difficulties performing independent gait. The subject received a single weekly session of DN for 10 weeks directed at the deltoid, biceps brachialis, wrist flexors and extensors, thenars, vastus medialis, gastrocnemius medialis, and tibialis anterior muscles. Following elicitation of a local twitch response (no more than three), the needle was left in situ for 15 minutes in each muscle.

Assessments were made before and following the first and last DN session measuring spasticity, gait stability, walking ability, self-independence, and pain. The authors reported that DN treatments resulted in immediate and short-term improvements of basal spasticity in the upper and lower limbs using the Modified Ashworth Scale (MAS). At the 10-week post-treatment assessment, upper and lower limb spasticity had reduced by a median of 2 points on the MAS, gait dynamic-stability had improved by 50% and gait speed (time to walk 20 m) had improved by 24.7s. Lastly, the Spinal Cord Independence Measure and pain score (Visual Analog Scale – VAS) improved by 12 and 4 points respectively. Although this report is a single case study, it highlights the utilization of DN in the treatment of a patient with an incomplete spinal cord injury. Further research is needed in a larger patient population to further understand the effects on DN for patients with spinal cord injuries.

Kamali F, Mohamadi M, Fakheri L, Mohammadnejad F. 2019. Dry needling versus friction massage to treat tension type headache: A randomized clinical trial. Journal of Bodywork and Movement Therapies, 23(1):89–93, DOI: 10.1016/j.jbmt.2018.01.009

Fourty-four subjects with tension-type headaches for at least 6 months with at least 3 TrPs were included in this Iranian study comparing dry needling to friction massage. Subjects were randomly assigned to 1 of 2 treatment groups. Subjects in one group received 3 sessions of DN during a week as described by Dommerholt and Fernández-de-las-Peñas (2013), while subjects in the other group were treated with friction massage. Both interventions targeted TrPs in the sub-occipital, temporalis, sternocleidomastoid, and upper trapezius muscles. Outcome measures included the frequency and intensity of headaches, the pressure pain threshold at the trigger point site, and cervical range of motion.

Both treatment methods reduced the headache frequency and intensity. Cervical range of motion improved only in extension following DN. One potential issue with the study is that the baseline measures were based on only one week, which may not be sufficient to identify true trends in the presentation of tension-type headaches. The authors did not describe the level of training in identifying TrPs and the experience of the evaluators.

Nitecka-Buchta A, Walczynska-Dragon K, Batko-Kapustecka J, Wieckiewicz M. 2018. Comparison between collagen and lidocaine intramuscular injections in terms of their efficiency in decreasing myofascial pain within masseter muscles: a randomized, single-blind controlled trial. Pain Research & Management, 3;2018:8261090, DOI: 10.1155/2018/8261090

The authors describe intramuscular collagen injections as a new treatment option for myofascial pain and compared its efficacy to lidocaine injections for pain relief in the masseter muscle. Using the Diagnostic Criteria for Temporomandibular Disorders (Peck et al., 2014), 43 subjects between 18 and 80 years of age diagnosed with myofascial masseter pain and TrPs in the muscle were randomly assigned to one of three groups. Subjects in group 1 received injections with 2 ml of collagen MD Muscle. Subjects in group 2 received 2% lidocaine injections and subjects in the third group served as controls. They received injections with 2 ml of saline (0.9% NaCl). All subjects received two injections with a 1-week interval targeting TrPs. The outcome measures included pain measured with a Visual Analog Scale (VAS) and surface electromyography (sEMG).

The results were rather interesting. Subjects in group 1 experienced a 53.75% reduction in pain and a 59.2% reduction in sEMG values, which was significantly more than observed in group 2 (VAS: 25%; sEMG: 39.3%) and group 3 (VAS: 20.1%; sEMG: 14%). As the authors mentioned, the observation period was short and perhaps the results would be different with more injections or longer observation periods. Nevertheless, the notion of tissue regeneration is a potentially meaningful approach to activate satellite cells involved in muscle cell generation and differentiation into myoblast cells. Under normal physiologic conditions, fibroblast produce collagen to form a collagen network essential for the extracellular matrix (ECM). Collagen, a major protein of the ECM, is involved in nerve cell myelination and muscle regeneration. The results of this Polish study from the Medical University of Silesia in Katowice and Wroclaw Medical University are very promising. It is to be hoped that the researchers will continue this exciting line of research.

Rajkannan P, Vijayaraghavan R. 2019. Dry needling in chronic abdominal wall pain of uncertain origin. Journal of Bodywork and Movement Therapies, 23(1):94–98, DOI: 10.1016/j.jbmt.2018.01.004

This case series from Bangaluru, India focused on the effects of DN on abdominal wall pain with an unknown etiology. Twelve patients with chronic abdominal wall pain were examined for the presence of TrPs in the abdominal muscles, which were identified in all patients. Next, they were treated with DN "using a standard technique," which resulted in a decrease of nearly 6 points (mean difference) on a numerical pain rating scale for 11 out of 12 patients at a 4-month follow up visit. Seven patients reported a complete resolution of their chronic abdominal pain, while some noticed improvements in other complaints including urinary frequency, constipation, and dysmenorrhea, which is consistent with other studies (Huang and Liu, 2014).

It is unfortunate that the authors opted for a case series rather than a randomized clinical trial, as the link between abdominal TrPs and abdominal pain had already been established (Çimen et al., 2004; Montenegro et al., 2009) and considering that few definitive conclusions can be drawn from case reports. Of interest is also that TrPs in the abdominal muscles have been linked to endometriosis (Jarrell, 2011) and visceral pain in general (Jarrell et al., 2011). Judging by the photograph of the DN approach in the article, it appears that the technique employed in this study is not without risk. With any needling into the abdominal wall, it is imperative to avoid needling into the peritoneal cavity and based on the image, it is not clear how the authors could possibly be sure that the needling procedure was indeed safe.

Sánchez-Romero EA, Pecos-Martín D, Calvo-Lobo C, Ochoa-Sáez V, Burgos-Caballero V, Fernández-Carnero J.2018. Effects of dry needling in an exercise program for older adults with knee osteoarthritis: A pilot clinical trial. Medicine (Baltimore). 97(26):e11255, DOI: 10.1097/MD.0000000000011255

Spanish researchers performed a double-blind pilot clinical trial with parallel groups to evaluate the short-term effects of adding DN to an exercise protocol in the treatment of older adults with knee osteoarthritis (OA). A total of 20 subjects met the inclusion and exclusion criteria out of the 27 eligible candidates. All subjects were required to have at least one active or latent TrP in either the tensor fascia late, adductors, hamstrings, quadriceps, gastrocnemius, or popliteus muscle. The criteria for determining the presence or absence of a TrP were consistent with Simons et al., (1999). Subjects were divided into two groups, DN + exercise (n = 11) or sham DN + exercise (n = 9). Outcome measures included pain intensity with the Numeric Pain Rating Scale (NPRS) and symptomatology and function with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) at baseline and after treatment. Dry needling was performed on all TrPs found on the symptomatic side with a fast in-out technique, 1x/week for the first 6 weeks of treatment. Needle sizes ranged from 0.30 × 40, 0.30 × 60, 0.30 × 75. For the sham DN, the park sham DONGBANG AcuPrime device was inserted only a few millimeters into the skin. The exercise in both groups was a one-hour group-based supervised session that occurred 2x/week for a total of 12 weeks.

Results of the study for pain intensity, total WOMAC, WOMAC pain, WOMAC stiffness, and WOMAC function revealed a significant difference in the time factor, but no significant difference in the group-time interaction was noted. Based on these findings the authors concluded that the addition of DN to an exercise program for older adults with knee OA is not more effective than sham DN. This is an interesting study that was overall well organized, however, there are a few points that merit consideration. Firstly, the sham DN was not truly a sham. Any needle that is being inserted into the skin, even for only a couple of millimeters, can induce a physiological effect, which could explain why both groups showed improvements. Additionally, it is not clear why the authors chose to include subjects with active or latent TrPs versus only active TrPs. The authors did cover the limitations of the study, one of which included not having a true control group performing exercise only. The small sample size limits drawing definitive conclusions. In future studies, a larger sample is needed.

Shanmugam S, Mathias L, Thakur A. 2018. Effect of dry-needling induced muscle soreness (DIMS) on the severity of pain post deep trigger point needling. Journal of Clinical and Diagnostic Research, 12(7): YF01-YF04, DOI: 10.7860/JCDR/2018/35141.11841

Investigators from India examined the correlation between deep DN induced muscle soreness (DIMS) and severity of pain at baseline and post needling. A total of 76 patients with persistent shoulder pain met the inclusion and exclusion criteria out of a total of 278 eligible patients. A physical therapist with more than six years of experience performed the DN on all subjects. Active TrPs in the upper trapezius, supraspinatus, levator scapulae, deltoid, infraspinatus, teres major, teres minor, latissimus dorsi, and pectoralis major were needled with 0.30 × 40 mm solid filament needles. After a local twitch response was elicited the needles were left in situ for 10–12 minutes. Outcome measures included shoulder pain intensity with the Visual Analog Scale (VAS) at baseline and 48 hours after needling. Post needling soreness was assessed based on personal experience of their soreness severity. Soreness was assessed immediately, 24 hours and 48 hours after dry needling using a scale from 0 to 3 with 0 being no soreness, 1 being mild, 2 being moderate, and 3 being severe soreness. Results of the study showed that the average number of active TrPs was 6, the median VAS pain score was 7/10, and the duration of shoulder pain was 6 weeks. Fifty-three of 76 patients had soreness immediately after DN, with 40 reporting mild soreness and 13 reporting moderate soreness. Twenty-four hours after DN, 74 patients reported soreness, with 30 being mild, 35 being moderate, and 9 being severe. At 48 hours after DN, 25 reported mild soreness; none reported moderate or severe soreness. There was no correlation between the patients' original pain severity and DN induced muscle soreness at 24 or 48 hours. Based on these findings, the authors concluded that there is no correlation between DN induced soreness and shoulder pain.

Despite this being an interesting concept to explore, there are several issues with the paper. First, it appears that English is not the primary language of the authors, as there are several grammatical issues throughout, especially in the introduction section, which made it challenging to follow and understand. More importantly, the criteria to determine an active TrP were not clearly described. The authors stated that “Manual muscle palpation (pincer/flat/snapping) was used to find out the hyperirritable spots with or without taut bands in the shoulder girdle muscles,” which is inconsistent with commonly accepted criteria. Typically, a hyperirritable spot is found within a taut band if a TrP is present (Simons et al., 1999). A generic overall statement without more detailed information about the palpation technique used for each muscle, makes it impossible to reproduce this study in the future. Additionally, it is not clear which muscles had active TrPs in each of the subjects. If the average number of active TrPs was 6, it follows that some muscles were not needled, but the authors provided no further information. Many other aspects of the study were underreported, such as the size of the needle, positioning of the patient, more detailed explanation of the needling procedures, among others, which makes it difficult to draw a lot of conclusions.

Vier C, Almeida MB, Neves ML, Santos A, Bracht, MA, 2019. The effectiveness of dry needling for patients with orofacial pain associated with temporomandibular dysfunction: a systematic review and meta-analysis. Brazilian Journal of Physical Therapy, 23, 3–11, DOI: 10.1016/j.bjpt.2018.08.008

Myofascial pain is the second most recurrent type of orofacial pain which affects the soft and bony tissue of the oral cavity and face. Orofacial pain of myofascial origin is often associated with temporomandibular joint dysfunction (TMD), and may affect chewing muscles, the periauricular area, and related structures, and may lead to functional limitations. The treatment of myofascial pain is often based on inactivating TrPs including DN. Although DN is being used worldwide, there is no conclusive evidence of its effectiveness for treating patients with orofacial pain. The authors from Brazil conducted a systematic review to investigate the effects of DN on orofacial pain of myofascial origin in patients with TMD.

The authors selected randomized controlled trials from eight databases, without publication date, published languages, subject ethnicity, age or sex restrictions. Seven trials were considered eligible, but discrepancies among DN treatment protocols were noted. Meta-analysis showed that DN was better than other interventions for reducing pain intensity and better than sham therapy for increasing pressure pain thresholds. They concluded that there is very low-quality evidence with a small effect size. Statistically, DN was not significantly different from other outcomes. They concluded that DN cannot be strongly recommended for the treatment of orofacial pain associated with TMD over sham therapy or other interventions due to the very low quality of evidence and insufficient data to draw any meaningful conclusions, which is in line with the conclusions by Machado and his colleagues (Machado et al., 2018). Both studies concluded that most of the studies had significant methodological limitations and biases that compromised the quality of the findings. Clearly, there is a need to conduct high-quality randomized clinical trials with larger samples and longer follow-up times to evaluate the real effectiveness of the technique and evaluated substances.

4. Manual therapy

Arguisuelas MD, Lisón JF, Doménech-Fernández J, Martínez-Hurtado I, Salvador Coloma P, Sánchez-Zuriaga D. 2019. Effects of myofascial release in erector spinae myoelectric activity and lumbar spine kinematics in non-specific chronic low back pain: Randomized controlled trial. Clinical Biomechanics 63:27-33, DOI: 10.1016/j.clinbiomech.2019.02.009

Researchers from Spain conducted a prospective, randomized controlled trial to compare the effects of myofascial release (MFR) on myoelectric activity and kinematics of the lumbar spine in subjects with chronic low back pain (CLBP). Thirty-six participants between the ages of 18 and 60 years with a minimum 3-month history of CLBP were randomly assigned to a MFR ($n = 18$) or sham group ($n = 18$). Subjects completed questionnaires regarding disability (Roland Morris Questionnaire, RMQ) and pain intensity (Short Form McGill Pain Questionnaire, SF-MPQ). Each subject performed a trunk flexion-extension task using a metronome for standardization as flexion was performed over a count of 4 seconds, paused for 1 second, and returned to upright position over 4 seconds to assess the flexion-relaxation phenomenon (FRP). In addition, each participant performed maximum trunk range of motion (ROM) for flexion, extension, right and left side bending. Erector spinae EMG activity was recorded during the flexion-extension movement, while the lumbar spine ROM was recorded during both tests. In healthy individuals the electromyographic (EMG) activity of the lumbar erector spinae muscles is reduced or silent when trunk flexion is near complete (Lalanne et al., 2009).

The MFR test subjects received four sessions of MFR (twice a week for two weeks) to the lumbar paravertebral muscles, thoracolumbar fascia, quadratus lumborum, and the psoas muscle. The sham group received sham MRF four sessions (twice a week for two weeks) by gently placing the hands over the same areas treated in the MFR group, but without sliding, just enough to maintain contract. The authors noted a bilateral reduction of the flexion relaxation ratio in subjects receiving MFR who did not show myoelectric silence at baseline. A significant reduction in pain and disability in the MFR group as compared to the control group was reported. No significant differences were noted for the kinematic variables. Although improvements were noted in pain, disability, and EMG activity of the MFR group in this study, it is important to take note of the weaknesses in this study. The study had no long-term follow-up assessments; therefore, results were recorded following the final treatment and these results could change with time. Secondly, a larger sample size is needed to further understand the results of this treatment approach.

Cathcart E, McSweeney T, Johnston R, Young H, Edwards DJ. 2019. Immediate biomechanical, systemic, and interoceptive effects of myofascial release on the thoracic spine: A randomised controlled trial. Journal of Bodywork & Movement Therapies 23:74-81, DOI: 10.1016/j.jbmt.2018.10.006

Researchers from Swansea University in Wales conducted a randomized, blinded, sham-controlled, crossover study to study the biomechanical, systemic, and interoceptive effects of myofascial release (MFR). Male and females subjects between 18 and 55 years of age were recruited for the study. Exclusion criteria included any systemic disease and long-term medications that could alter pain perception, recent or long-term spinal musculoskeletal injury/pathology, and any vigorous exercise or manual therapy two days prior to the study.

Twelve asymptomatic osteopathic students participated in this study. Each subject received experimental MFR intervention, sham intervention, and no intervention that was performed in a randomized pre-selected combination in order to neglect any order effects. The participants were subjected to all three testing procedures with a one-week period washout period in-between. The MFR intervention was performed with subjects in a prone position with MFR performed for 120 seconds to the thoracic erector spinae muscles between T6-T12. Sham intervention was performed with the subjects in a supine position and the clinician's hand placed on the anteriolateral ribs for 2 minutes. Lastly, each subject served as a control where no treatment was rendered and the subject was instructed to lay supine with the head on a pillow for 2 minutes. Subjects were assessed immediately before and following treatment for pain pressure threshold (PPT), range of motion (ROM) and interoceptive sensitivity (IS). PPT was assessed at the following bilateral landmarks: mid muscle belly of bilateral tibialis anterior, thoracic erector spinae at the T10 level, and the cervical erector spinae at C7. Inclinometer checkpoints were T6 and S2 spinous processes. The authors reported significant increases in ROM and PPT (both local and distal) following MFR treatment. A positive correlation was noted between baseline IS and post-MFR ROM, while a negative correlation for baseline IS and post-MFR PPT was found. No significant differences were noted with IS following MFR treatment.

There are several limitations to this study. The authors chose asymptomatic subjects, which makes it impossible to apply the findings to clinical patients. Only 12 subjects were included in this study. A larger study group would allow greater consistency in outcomes. Lastly, the authors chose first-year osteopathic students to participate in this study “as they were more naïve to the active interventions than more experienced students of later years.” While it is presumably true that first-year students are not as familiar with various MFR techniques, it is still plausible that a first-year student may perceive a technique variation between a MFR and a “disengaged balanced ligamentous tension technique” that was utilized as a sham technique.

Fidelis de Paula Gomes CA, Dibai-Filho AV, Politti F, de Oliveira Gonzalez T, Biasotto-Gonzalez DA. 2018. Combined use of diadynamic currents and manual therapy on myofascial trigger points in patients with shoulder impingement syndrome: a randomized controlled trial. Journal of Manipulative and Physiological Therapeutics, 41(6):475–482, 10.1016/j.jmpt.2017.10.017

Brazilian investigators performed a prospective registered 3-arm randomized controlled clinical trial examining the effect of manual therapy and diadynamic (DD) currents individually and combined on TrPs in the upper trapezius muscle in patients with shoulder impingement syndrome. A total of 81 subjects were recruited for the study but 21 did not meet the inclusion and exclusion criteria and 3 dropped out by the end of the study. The three treatment groups were manual therapy (MT) alone, DD alone, and a combination of MT and DD (MTDD). A physical therapist was assigned to each group to administer the treatments, however, because of this, the researchers and the patients could not be blinded. The treatments were performed over an 8-week period for a total of 16 sessions. For the MT group, positional release of the upper trapezius muscle was performed followed by ischemic compression. For the DD group, the negative electrode was placed on the TrPs in the upper trapezius muscle, while the positive electrode was placed in between the scapulae. For four minutes a fixed biphasic mode was used followed by two 4-min sessions of long and short periods. The first two intensities were at a sensory threshold, while the final one was at a motor threshold based on the patient's report. For the MTDD group, the MT was performed first followed by the DD. Outcome measures assessed included the Shoulder Pain and Disability Index (SPADI) and pain intensity with the Numeric Pain Rating Scale (NPRS), which were assessed before and after the treatment sessions.

This study demonstrated significant improvements in all outcomes (NPRS, SPADI-pain, SPADI-disability) in all three groups over time; however, the effect sizes were greater in the MTDD group. For the NPRS, there were clinically significant differences between the MTDD and MT group and the MTDD and DD group. Based on these findings the authors concluded that the combined treatments of MT and DD were more effective at reducing pain intensity, but not disability. It is interesting that the authors chose to use the upper trapezius muscle versus a muscle like the infraspinatus or supraspinatus for shoulder pain. They reportedly chose the upper trapezius muscle based on a study from Hidalgo-Lozano (Hidalgo-Lozano et al., 2010), however, this muscle was not the most commonly involved. Instead, the supraspinatus was the most commonly involved followed the infraspinatus muscle.

Massingill J, Jorgensen C, Dolata J, Sehgal AR. 2018. Myofascial massage for chronic pain and decreased upper extremity mobility after breast cancer surgery. International Journal of Therapeutic Massage and Bodywork. 5;11(3):4-9

Chronic localized pain and decreased upper extremity mobility are common following breast cancer surgery (Wang et al., 2018). Current treatments including pain medication and physical therapy are commonly utilized in the treatment of this condition. Twenty-one women with persistent pain and self-reported pain mobility limitations 3–18 months following breast cancer surgery, including biopsy, lumpectomy, mastectomy, or some type of reconstruction were enrolled in this study. Subjects were randomly allocated into a study group that received myofascial massage specific to the breast, chest, and shoulder of the affected side aimed at reducing pain, inflammation, tissue sensitivity, while increasing soft tissue mobility or to a control group that received Swedish relaxation massage which avoided the affected breast, chest, and shoulder area. Both groups received two 30-min massages per week (total 16 massages). Outcome measures included self-reported pain, self-reported mobility, and three quality-of-life questions.

The authors reported that following intervention the subject group had more favorable changes in pain (−10.7 vs. +0.4, $p < .001$), mobility (−14.5 vs. −0.8, $p < .001$), and general health (+29.5 vs. −2.5, $p = .002$). This study has several limitations that should be noted, including small sample size and study outcomes were self-reported with no objective measurements recorded in this study. In addition, pain was recorded on a 4-point Likert scale (none, mild, moderate, severe) versus an 11-point numerical pain rating scale, which compounded by the small sample could potentially augment the degree of pain reduction noted. In addition, the control group utilized in this study received relaxation massage techniques on other body parts not associated with the subject group. The authors should consider comparing myofascial massage techniques to Swedish massage on the breast, chest, and shoulder of the affected side to compare the outcomes of these techniques on the same body segments.

Silva DCCM, de Andrade Alexandre DJ, Silva JG. 2018. Immediate effect of myofascial release on range of motion, pain and biceps and rectus femoris muscle activity after total knee replacement. Journal of Bodywork and Movement Therapies, 22(4):930–936, DOI: 10.1016/j.jbmt.2017.12.003

Total knee arthroplasty (TKA) is a common orthopedic procedure for degenerative knee disorders. Although satisfactory outcomes are often obtained, stiffness following TKA is one of the most common complications with prevalence rates between 1.3% and 15% (Bonutti et al., 2008). This Brazilian study examined the effects of myofascial release on knee range of motion (KROM), pain, and rectus femoris muscle activity in subjects presenting with a minimum 5° flexion contracture following TKA. Subjects received a single session of myofascial release treatment directed at the gluteal fascia, posterior fascia lata, posterior crural fascia, and the plantar fascia. Pre- and post-treatment assessments were conducted to measure the total arc of knee extension and flexion range of motion, knee pain using a 100mm visual analog scale (VAS), and electromyography (EMG) activity of the biceps and rectus femoris during maximal voluntary isometric contractions.

The authors reported a significant increase in biceps femoris muscle activity following treatment, a significant mean gain in KROM from 54.7° to 60.4° (gain of 5.7°). Most subjects ($n = 22$) did not report pain prior to treatment, however eight subjects reported a 56.9% decrease in pain following treatment. Although this study does illustrate the use of a myofascial release technique for the treatment of subjects lacking KROM following TKA, the absence of a control group and results were only recorded immediately following treatment greatly diminish the results reported. This article does provide the reader with a possible alternative/additional treatment strategy, however, due to the lack of a comparative control group it is equally likely that outcomes equal to or better than those reported could be achieved from another treatment approach.

5. Other clinical studies

Hosseini L, Shariat A, Ghaffari MS, Honarpishe R, Cleland JA. 2018. The effect of exercise therapy, dry needling, and nonfunctional electrical stimulation on radicular pain: a case report. Journal of Exercise Rehabilitation, 14(5):864–869, DOI: 10.12965/jer.1836356.178

This case report from Iran details the treatment of a 43-year-old male with complaints of low back pain with radiculopathy into left lower extremity. The patient had a 1-year history of pain and numbness into his left lower extremity with increased symptoms for 2 months. The patient had undergone prior magnetic resonance imaging (MRI) revealing a L4-5 protruded disc. Following imaging, the patient was instructed to have complete bed rest for three days, received electro-acupuncture, and was instructed to ice 4 times per day. The patient reported increased symptoms following this treatment. He was instructed to remain on bed rest for 21 days and underwent physiotherapy and hydrotherapy treatment. A follow-up MRI revealed no changes in disc protrusion.

The patient was referred to the authors' clinic with painful but complete active lumbar flexion, a positive straight leg raise test, and TrPs in the left gluteus medius muscle. The patient also had difficulty heel walking, presented with 2 + deep tendon reflexes, without sensory deficits. The patient rated his pain as a "9" on the Numeric Rating Scale (NRS). The score on a 100 mm Visual Analog Scale was 90 mm. The Oswestry Disability Score was recorded at 60%. The patient received 4 treatment sessions consisting of exercises (prone on elbows, bridges, single leg bridge, and sitting core activation exercises on a Swiss ball. Trigger point DN was performed to the gluteus medius muscle, and finally electrical stimulation was applied to the lumbar spine.

Following the final session, the patient reported centralization of pain without radicular complaints, NRS at 2 and VAS was 30 mm. The patient had full, pain-free lumbar flexion, negative SLR testing, and Oswestry scores were recorded at 20%. The authors specifically mentioned that "no trigger points noted within the piriformis muscle," even though previously they only reported the presence of TrPs in the gluteus medius muscle.

Although the authors achieved clinically meaningful improvement following 4 sessions, no cause and effect relationship can be inferred, since this is just a case study. While the authors did demonstrate the benefits from a mulitimodal approach in the treatment of a patient with lumbar radiculopathy, further randomized studies with a proper control group are needed to further demonstrate this treatment strategy.

Moustafa IM, Diab AA, Hegazy F, Harrison DE. 2018. Does improvement towards a normal cervical sagittal configuration aid in the management of cervical myofascial pain syndrome: a 1- year randomized controlled trial. BMC Musculoskeletal Disorders, 19:396, DOI: 10.1186/s12891-018-2317-y

Altered sagittal plane alignment of the cervical spine can result in abnormal stresses and strains leading to premature and acceleration of degenerative changes in muscles, ligaments, bony structures, and neural elements in chronic myofascial pain syndrome (CMPS) patients. From Sharjah, UAE and Egypt, Moustafa and colleagues conducted a randomized controlled study to examine whether the short and long-term outcomes improved after restoring normal cervical sagittal alignment in CMPS patients whom had been assigned to a control or intervention group. Subjects in both groups received the integrated neuromuscular inhibition technique, ischemic compression, strain counterstrain, and muscle energy technique, while subjects in the intervention group also received a cervical traction device, that according to the authors may improve cervical lordosis and reducing anterior head displacement. However, the two references cited in support of this statement do not mention the particular device at all! The first reference is a validation study of the Neck Outcome Score, Neck Disability Index, and Short Form 36, while the second reference reviews the measurement properties of the Neck Disability Index (Juul et al., 2016, Macdermid et al., 2009).

Nevertheless, following 30 treatment sessions, the researchers found significant differences between the groups for sagittal posture alignment, cervical and shoulder angles, pain pressure thresholds, and all measures of cervical range of motion (CROM) favoring the intervention group. There were no differences in neck pain intensity and neck disability. At the 1-year follow-up, the between-group analysis identified a regression back to baseline values for the control group's neck pain and disability, while the intervention group's variables remained stable. All other measures showed statistically significant improvements favoring the intervention group.

The authors concluded that restoring a more normal cervical sagittal alignment with the traction device has a strong positive impact on pain, function, and ROM in patients with CMPS. Clinicians may need to add cervical spine alignment rehabilitation patients with myofascial pain and forward head posture. Fricton established in 1985 that forward head posture is common in patients with myofascial pain (Fricton et al., 1985). There were several potential limitations with this study, such as the lack of blinding of the participants and clinicians, and the lack of objective measurements including lateral cervical radiographs. One question that arises is how the authors determined that the cervical lordosis was indeed improved without some kind of objective scanning. In conclusion, this is an interesting study that appears to support correcting forward head posture, but more studies are required with objective pre- and post-measurements.

Disclosure statement

No potential conflict of interest was reported by the authors. Drs. Dommerholt and Finnegan 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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