



Safety, effectiveness and impact of dry needling trigger points in athletes: a systematic review

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ABSTRACT

This research will systematically review the literature on the effect and impact of dry needling of myofascial trigger points (MTrPs), and the applications of this technique to the sporting community. For athletes, proper structure and function of skeletal muscle, and enhanced recovery from injury is vital to performance. In theory, every training session, event or competition results in microtrauma to muscles¹. Recovery from this muscle fiber damage is the basis of adaptation to training¹. Over time, however, this repetitive microtrauma can also lead to muscle shortening and the development of MTrPs². Shortened muscles and MTrPs decrease flexibility, range of motion, strength, circulation and conduction of nerve impulses³ ultimately increasing the risk for injury. The pain associated with some MTrPs can also affect sleep quality and quantity, the ability to train effectively, and the ability to perform activities of daily living³. Theoretically, proper diagnosis and treatment of trigger points in the athlete has the potential to decrease post-exercise pain, and improve athletic performance. Although there has yet to be a study reporting the number of athletes affected by myofascial pain due to trigger points, the pathology quite possibly plagues most athletes. For example, in world-class badminton players, 52 % suffer from shoulder pain, 37 % have had shoulder pain in the past, and 20 % have chronic shoulder pain⁴ and would likely benefit from myofascial treatments. Dry needling of trigger points with acupuncture needles is a practice used by some health care practitioners treating patients suffering from chronic musculoskeletal injuries, pain and dysfunction. The dry needling technique involves palpating for taut bands within the belly of the affected muscle, isolating the tender nodule, and inserting an acupuncture needle directly into the trigger point to cause a muscle twitch, and a reflexive relaxation and lengthening of the muscle⁵. Clinical research on the safety and effectiveness of the treatment will be shared with Sport Canada and therapists who practice trigger point therapy to ensure transfer of knowledge and ultimately improve performance of athletes across Canada.

BACKGROUND

In the realm of athletics, the ability to train, compete, and recover optimally plays a crucial role in the success of an athlete. During the 2004 Olympic Games in Athens, a survey of visits to the medical clinic in the Olympic Village found the most common presenting pathology to be myofascial pain/muscle spasm, at 32.5 %⁶. A study of elite badminton players found that 52 % suffer from shoulder pain, 37 % have had shoulder pain in the past, and 20 % have chronic shoulder pain⁴. It is probable that myofascial trigger points (MTrPs) are a major contributing factor to the pain in these athletes. Proper diagnosis and treatment would likely be beneficial to their performance, reduce pain, and improve overall quality of life. Dry needling of MTrPs, also known as trigger point acupuncture, is a simple and relatively non-invasive procedure that requires no pharmaceutical compounds. A better understanding of MTrPs and the efficacy of



dry needling is required, as this treatment may have considerable applications to the athletic population.

About myofascial trigger points

A MTrP is defined as a hyperirritable spot within a taut band in a skeletal muscle⁷. MTrPs can be either active or latent. Active MTrPs are always tender, prevent full lengthening of the muscle, decrease strength of muscle contraction, often has a predictable referred pain pattern when palpated, and will elicit a local twitch response when stimulated effectively⁷ above⁷. Latent MTrPs can have all of the same clinical presentations but are asymptomatic until palpated⁷. Aside from pain, MTrPs can result in autonomic dysfunctions in the affected areas, disruptions in motor coordination both local and distal to the MTrP, sleep interference, and limit the ability to carry out activities of daily living⁷. For athletes, it can affect their ability to train, perform, recover, and heal.

Formation of myofascial trigger points

According to Travell & Simons, MTrPs can be directly activated by acute trauma, or by muscles subjected to excessive repetitive contractions, or contractions sustained over a long period of time⁷. In a study of 15 healthy volunteers undergoing repetitive eccentric exercise unilaterally, MTrPs appeared on the exercised side on the second day, while the control side lacked the taut bands and tender points⁸. The MTrPs showed the sustained electrical activity consistent with other electrophysiological studies of trigger points^{8,9}. During training and competition, athletes regularly subject their muscles to sustained and/or repetitive contractions that lead to microtraumas within the muscles.

Trigger point pain physiology

MTrPs are postulated to cause pain by increasing the release of acetylcholine (ACh) at motor end plates, by way of mechanical, chemical or other injurious stimuli¹⁰. This results in persistent sarcomere shortening and contracture, increasing local metabolism while decreasing local circulation leading to an energy crisis, hypoxia, and local ischemia³. Neuroactive substances and inflammatory mediators including prostaglandins, bradykinins, cytokines, and histamines are released that sensitize the afferent nerve fibres within the muscle^{11,12}. This accounts for tenderness and pain of the MTrP and also stimulates the release of more ACh.

C fibres and A delta fibres within the muscles are responsible for localizing and discriminating types of pain, and sensing more diffuse aching pain, respectively⁷. The convergence of these fibres within the dorsal horn of the spinal cord supports the consistent patterns of pain referral from MTrPs⁷.

Treatments for myofascial pain

Conventional treatments for myofascial pain include the application of ice, heat, physiotherapy, manual myofascial treatments, and pharmaceutical interventions such as muscle relaxants/spasmolytics, analgesics, non-steroidal anti-inflammatory drugs, and cyclo-oxygenase-2 selective inhibitors¹³. These have their limitations including side effects that can interfere with an athlete's ability to train. For example, the over-the-counter NSAID ibuprofen can result in nausea, epigastric pain, heartburn, dizziness, and skin rashes in up to 9 % of patients¹⁴. Clinical trials for naproxen reported adverse effects in up to 9 % of participants including heartburn,



constipation, abdominal pain, nausea, headache, dizziness, drowsiness, dyspnea, peripheral edema, tinnitus, and skin complications¹⁴.

Needling MTrPs has a history dating back to the 7th Century AD, when Chinese physician Sun Ssu-Mo inserted needles into “a shi” points, local areas of muscle tenderness¹⁵. This is now referred to as dry needling of MTrPs. With the advancement of Western medicine and pharmacology, this technique has been altered from the use of acupuncture needles to the use of hypodermic needles and the injection of a local anaesthetic to decrease the pain of the injection itself, although many practitioners still use the dry needling technique. It is thought that needling directly into a MTrP relaxes the nodule by depolarizing muscle fibres, evoking small local twitches¹⁶. This leads to micro-stretch effects on the shortened sarcomeres and decreased traction on pain sensitive structures³. Needle insertion also inhibits nociceptors, releases endorphins and affects aforementioned spinal cord pathways³. A comprehensive review of the safety and effectiveness of this treatment for athletes will allow for a valid summation and evaluation of the evidence, which will ultimately benefit athletes, coaches, practitioners, and the sporting community.

OBJECTIVES

1. To determine the safety and effectiveness of dry needling MTrPs
2. To propose dry needling as a treatment for athletes suffering from acute and chronic myofascial pain

METHODS

Types of studies

Randomized controlled trials, clinical trials, meta-analyses, systematic reviews, and case studies were included in this review. The meta-analyses and systematic reviews were limited to the inclusion of dry needling of trigger points in comparison to another form of treatment. Studies published prior to 2000 were excluded for summary in this review.

Types of participants

Participants were limited to patients with active MTrPs in various muscles. Studies were excluded if the focal populations were too dissimilar to athletes, or if other pathologies were present. For example, those studying patients with osteoarthritis whose pain may not be solely due to MTrPs or elderly patients who may have other confounding factors associated with their pain. Articles focused on fibromyalgia were excluded as this disorder is complex, has a multifactorial and poorly understood etiology, and is not directly applicable to athletes.

Types of interventions

Dry needling of trigger points and dry needling compared to non-local acupuncture, sham treatments (acupuncture or other), wet needling with injectable substances, other active treatments, or no treatment/wait list were included in this review. Trials evaluating electro-acupuncture were not included in this review.

Types of outcome measures



Outcome measures included subjective, objective and functional scales; mainly visual analog scores (VAS), pain pressure threshold (PPT), and/or range of motion (ROM) or quality of life, respectively. Articles were excluded if the outcomes were not based on pain scores, quality of life, functionality or range of motion, as outcomes used in these studies area not applicable to athletes as a whole.

Search methods for identification of studies

A search of the National Library of Medicine database (PubMed) was undertaken using a variety of terms relating to the intervention and population to identify a comprehensive set of studies to assess for inclusion in this review. Search strings on PubMed included:

1. “trigger point” + athlete = 0
2. “trigger point” + athlete = 1 (no limits)
3. “trigger point” + needling = 21
4. Myofascial + athlete = 0
5. Myofascial + athlete = 5 (no limits)
6. Myofascial + needling = 37

Unless otherwise specified, limits were set to studies on humans that were clinical trials, randomized controlled trials, meta-analyses or reviews. Article selection was initially based on the target population of athletes. As the research on this particular population is limited, the selection was extended to presence of active trigger points in the study participants.

Selection of Studies

Titles and abstracts were examined. Irrelevant articles (not pertaining to the intervention or population) were excluded as well as those studies not meeting inclusion criteria.

Data collection and management

Data extracted included participants, interventions, outcome measures, results and main conclusions.

RESULTS

Description of studies

The studies meeting the aforementioned inclusion criteria were: 2 were systematic reviews (Cummings & White 2002, Furlan et al. 2005), one meta-analysis (Tough et al. 2008), one case summary (Ingber 2000), 4 randomized controlled clinical trials (Edwards & Knowles 2003, Irnich et al. 2002, Nabeta & Kawakita 2002, Itoh et al. 2007), and 2 clinical trials (Hsiesh et al. 2007, Kamanli et al. 2002)

Risk of bias in included studies

The main source of bias is the small sample size of the studies. The sample (n=10) may be too small to create statistically significant conclusion, which speaks to the need for more research done in this area. The other sources of biases include poor study design, lack of control groups, and lack of comparison to other forms of treatment such as physiotherapy. Articles with better study design and less risk of bias have been published; however the populations studied were quite dissimilar to athletes or had inapplicable outcome measures. As such, they were not included in this review.



Effects of interventions

Comparison 1: dry needling and dry needling vs placebo or no treatment

In a series of three case studies, Ingber found that 3 patients treated with dry needling experienced no pain or limitations in ROM in a 1-2 year follow-up period¹⁷. In a study of patients with bilateral infraspinatus MTrPs, where one side was treated and the other side acting as the control, no changes were noted on the untreated side²⁵. The treated side resulted in significant increases in active and passive ROM and pain threshold, and a significant reduction in subjective pain scales²⁵. Other studies have found dry needling to be more effective than no treatment or sham acupuncture, generally decreasing pain intensity and increasing quality of life^{18,19,20,23}. A study of the modified dry needling sparrow technique involves repeated insertion of the needle into the MTrP found the intervention to result in decreased pain on the VAS and increased PPT immediately after the treatment, as well as the following day when compared with sham acupuncture²¹. Improvements lasted longer after repeated treatments, but the effects subsided after 9 days²¹. Overall, dry needling was more beneficial than sham acupuncture or no treatment, and no safety concerns were reported.

Comparison 2: dry needling vs usual care

Most studies found no difference between dry needling and usual care such as physiotherapy or physical therapy education^{19,22,26}. In one study, dry needling was more effective than stretches at a 6-week follow-up, while no significant differences were found at the initial 3-week follow-up¹⁹, suggesting that subsequent dry needling treatments have a longer-lasting effect than stretching. Minimal safety issues or adverse effects were reported. The most recent meta-analysis found 2 studies with conflicting results, 4 placebo-controlled trials with no statistically significant differences but marked statistical heterogeneity and one where dry needling to be more effective than standardized care²². Based on the studies included in their analysis, the authors were unable to conclude that there was a statistically significant benefit to using dry needling compared to usual care.

Comparison 3: dry needling vs standard acupuncture

Some studies found dry needling to reduce pain, increase quality of life and increase ROM beyond standard acupuncture^{21,23}. A systematic review found both dry needling and standard acupuncture to be safe and more effective than sham acupuncture or no treatment, but was unable to identify the most effective type of acupuncture¹⁸.

Comparison 4: dry needling vs wet needling

A clinical trial found a significant reduction in pain for both dry and wet needling, but found injecting lidocaine or botox provided a greater improvement in symptoms²⁴. A systematic review found no difference between the two interventions²⁶. The majority of the studies in the review found wet needling to be effective regardless of the substance injected²⁶. There were no comments with respect to any safety concerns of wet and dry needling techniques for the general population.

DISCUSSION



Summary of main results

This literature review supports the possibility that dry needling of trigger points may have a beneficial effect and may be directly transferrable to athletes. The main limitation of the research is the number of high quality studies to provide valid evidence for athletic population. There are several case studies on athletes, however these studies do not have a control group, and therefore one cannot rule out placebo effect. The study by Hsiesh et al is the best example as patients had infraspinatus trigger points bilaterally, and only one side was treated²⁵. This study had a control group, being the untreated side; however, it did not compare dry needling to any other treatment²⁵. Nonetheless, athletes found a significant decrease in pain and increase in range of motion²⁵.

Current research supports the use of wet needling as the injection of lidocaine or botulinum toxin decreases the pain associated with the injection when compared with dry needling. There are conflicting results with respect to the efficacy of wet versus dry needling. In the meta-analysis by Cummings et al, some studies showed that wet needling is effective regardless of the substance injected, some showed no difference between wet and dry needling, while others reported dry needling to be more effective than wet needling²⁶. Although most studies included within the meta-analysis were of poor quality, the general trend suggests that both wet and dry needling can be an effective treatment for trigger points²⁶. Wet needling requires that the needle be wide enough to allow the passage of an injectable fluid into the trigger point. This procedure is not without possible adverse effects. Any injection or needle puncture can lead to local tenderness, bruising, and vasovagal syncope. Injection of lidocaine and other local anesthetics can result in sleepiness, lightheadedness, restlessness, visual and auditory disturbances, seizures, and hypersensitivity and allergic reactions, as well as muscle necrosis^{7,27}. Local anesthetics are often injected as a hydrochloride salt, requiring the tissues to buffer the solution²⁷. After repeated injections, the buffering capacity of the tissue can be depleted and decrease the effectiveness of subsequent injections²⁷. Botulinum toxin injection has been associated with local weakness in 17 % of patients and dysphagia in 13 %¹⁴. Malaise, general weakness, upper respiratory tract infections, nausea, vomiting, headaches, drowsiness, stiffness, dizziness, falling and rhinitis were all reported in up to 10% of patients¹⁴.

The efficacy of MTrP needling depends on the correct identification of the MTrP, accurate placement of the needle, and elicitation of the local twitch response. This can be achieved by both wet and dry needling, although the literature suggests dry needling has the advantage of fewer side effects and adverse reactions.

Applicability of evidence

Most of the studies on trigger point needling are on patients with “myofascial pain” or “myofascial pain syndrome”, a poorly defined diagnosis that is not limited to a population of athletes. However, the clinical trials define within their inclusion criteria that there are active trigger points that can be isolated in the muscles of the participants. The results should therefore be applicable to any muscles with active trigger points, whether the cause of the trigger point is myofascial pain syndrome or repetitive stress from exercise and training. For athletes, every training session, event or competition should result in microtrauma to the muscles, and the recovery from this damage is the basis of adaptation to training. Over time, however, this repetitive microtrauma can also lead to muscle shortening and the development of MTrPs². The



pathophysiology of an active trigger point is the same, regardless of how it is formed, and therefore can be treated the same. Addressing the physiology by increasing local blood flow and encouraging sarcomere relaxation will benefit a MTrP whether it be in a population of athletes or in the general population.

Quality of the evidence and sources of bias

An issue arises with the quality and methodology of acupuncture research. Generally, published acupuncture trials have had a relatively small sample size. The comparison groups tend to be no treatment/wait list, sham acupuncture, or standard treatment. Sham acupuncture is supposed to act as a control group, and usually is performed by improper placement or superficial insertion of the needle. Both of these can still cause local physiological changes, and are not a true placebo control.

AUTHOR'S CONCLUSIONS

Implication for practice

Overall, the research supports the use of wet and dry needling of trigger points to decrease pain and increase range of motion. The effect seems to be somewhat transient, with benefits lasting anywhere from two days to five weeks. However, these studies often did not address the structural or postural imbalances related to the MTrPs. The combination of dry needling, stretching and exercise therapy, hydrotherapy, and other non-invasive treatments would likely extend the documented benefits of dry needling. Dry needling has an added benefit over wet needling as it bypasses the extra stress processing pharmaceutical compounds to the already overworked athlete's body, and has less possible side effects. For athletes, this treatment has the ability to have a positive impact on pain, performance and quality of life.

Implication for research

Although there is extensive research on myofascial pain syndrome, dry and wet needling of trigger points, and chronic pain, there is clearly a lack of quality research on dry needling of trigger points and its effects on athletic performance. Empirically, acupuncture and dry needling is a safe procedure; however the studies included in this review did not assess safety and adverse effects. There is a need for well-designed studies in this area, as it is a practice used by a wide range of health care practitioners.

TABLES

Characteristics of included studies

Cummings & White (2001) ²⁶	
Methods	Systematic review
Studies	Twenty-three randomized controlled clinical trials
Interventions	Direct dry needling or wet needling of trigger points
Outcomes	Eight of 10 wet needling studies found the effect of needling to be independent of the substance injected In five studies comparing wet and dry needling, there was no difference found Two trials found the efficacy of dry needling to be no greater than placebo Three trials found dry needling of trigger points to have no effect beyond



	therapies of known efficacy such as physiotherapy or splints Three trials investigating indirect wet needling found the intervention ineffective
Notes/biases	Most of the studies summarized in the review were of poor quality, not properly blinded or had high dropout rates. Most studies showed a decrease in pain associated with either dry or wet needling of trigger points; however this effect was not statistically greater than placebo.

Tough et al. (2008) ²²	
Methods	Meta-analysis
Studies	Seven studies of direct needling of myofascial trigger points
Interventions	Direct needling of trigger points, usual care, or placebo
Outcomes	Two studies had conflicting results Four placebo-controlled studies found no statistically significant improvements, but had marked statistical heterogeneity One study found dry needling to be an effective treatment compared to standardized care
Notes/biases	Most studies had small sample sizes and did not show statistical significance, however the general direction of the meta-analysis points to a beneficial effect of dry needling trigger points on decreasing pain.

Ingber (2000) ¹⁷	
Methods	Case summaries
Participants	Three racquet sport athletes previously referred for arthroscopic surgery
Interventions	Eleven myofascial treatment sessions in the form of dry needling once per week, along with muscle stretching
Outcomes	Follow-up 1-2 years post-treatment revealed no further pain or limitations in range of motion for all three patients
Notes/biases	Case studies have poor strength of evidence; small sample size; no control group; good length of follow-up.

Edwards & Knowles (2003) ¹⁹	
Methods	Randomized controlled clinical trial
Participants	Forty patients with identified trigger points (a maximum of six points identified)
Interventions	Group 1: dry needling of trigger point and appropriate stretches recommended by Simons et al for three weeks, after which participants continued regimes at home Group 2: stretches recommended by Simons et al three times daily Group 3: no treatment
Outcomes	Pain thresholds at the start of treatment and following three weeks of treatment showed no significant differences between groups 1 and 2. At a six week follow up, group 1 fared significantly better than groups 2 or 3.
Notes/biases	Small sample size; would benefit from a longer-term follow up; does not isolate the effects of dry needling alone.



Hsieh et al. (2007) ²⁵	
Methods	Single-blinded, subjects were their own control
Participants	Fourteen patients with bilateral shoulder pain and active infraspinatus trigger points
Interventions	One side was dry needled, the other side was the control
Outcomes	Significant increase in active and passive range of internal rotation and pain threshold with reduced pain on the treated side, but no significant changes on the untreated side.
Notes/biases	Small sample size; since the control is on the same patient, pain scales aren't subject to inter-participant variation

Kamanli et al. (2002) ²⁴	
Methods	Prospective single-blind study
Participants	Twenty-three female and six male patients with myofascial pain syndrome
Interventions	Group 1: lidocaine injection into trigger point Group 2: dry needling of trigger point Group 3: botox injection into trigger point
Outcomes	Pain thresholds significantly decreased in all three groups, although greater improvements were demonstrated in the lidocaine and botox groups when compared with the dry needling group
Notes/biases	No placebo group; small sample size.

Irnich et al. (2002) ²³	
Methods	RCT
Participants	36 patients with chronic neck pain
Interventions	Acupuncture at a distant site, local dry needling of trigger points, or sham laser acupuncture
Outcomes	Distant acupuncture reduced showed the most improvement in outcome measures immediately after treatment; dry needling slightly reduced pain and slightly increased ROM and was ineffective for motion-related pain.
Notes/biases	should have a longer follow-up period, only one treatment so this study does not assess the effectiveness of multiple treatments

Nabeta & Kawakita (2002) ²¹	
Methods	RCT
Participants	34 volunteers with chronic neck pain
Interventions	Acupuncture with sparrow technique or sham acupuncture (without insertion of the needle) to tender points once a week for three weeks
Outcomes	significant decrease in VAS immediately after and one day after real acupuncture, prolonged improvement after repeated treatments; PPT decreased after real acupuncture; no improvements in sham acupuncture; real acupuncture effects subsided after 9 days
Notes/biases	Sparrow technique is modification to the dry needling technique

Furlan et al. (2005) ¹⁸	
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Methods	Systematic review
Studies	35 RCTs on acute and chronic low back pain
Interventions	Acupuncture, dry needling, no treatment or sham acupuncture
Outcomes	Acute back pain – no clear conclusions due to small sample size and low methodological quality Chronic back pain – acupuncture provides immediate and short-term relief of pain, but it is not a greater effect than other treatment modalities
Notes/biases	Studies included were low in methodological quality

Itoh et al. (2007) ²⁰	
Methods	RCT
Participants	40 outpatients with chronic neck pain for at least six months, aged 47-80 years
Interventions	Trigger point acupuncture, standard acupuncture, non-trigger point acupuncture or sham treatment over 13 weeks
Outcomes	Decreased pain intensity and increased quality of life in trigger point acupuncture group when compared with standard acupuncture and non-trigger point groups
Notes/biases	Generally an older population, most athletes don't fit the age category

Characteristics of excluded studies

Lewit (1979) ²⁸	
Methods	Clinical trial
Participants	241 patients and 312 pain sites
Interventions	Dry needling
Outcomes	In 86.8 % cases, there was immediate analgesia without hypesthesia when the tender spot was touched by the needle Author concluded the effectiveness of the treatment was related to the intensity of the pain produced and the precision of location of the most tender point
Reason for exclusion	Published prior to 2000

Venâncio et al. (2008) ²⁹	
Methods	RCT
Participants	45 patients with myofascial pain with headaches reproducible by activating a trigger point
Interventions	Dry needling, lidocaine injection or lidocaine plus corticosteroid injection
Outcomes	All groups showed statically favourable results for intensity, frequency and duration of pain, and duration of relief; local post-injection soreness only decreased in the lidocaine plus corticosteroid group
Reason for exclusion	Excluded due to focus on headaches and not myofascial pain



Manheimer et al. (2005) ³⁰	
Methods	Meta-analysis
Studies	33 RCTs
Interventions	Comparison of needle acupuncture with other treatments for low back pain (sham acupuncture, other sham treatments, no treatment, or other active treatment)
Outcomes	Acupuncture is an effective treatment for chronic low back pain, but is not more superior than other active treatments; data is limited and inconclusive with respect to acute back pain
Reason for exclusion	Excluded due to lack of differentiation of types of acupuncture

Hong (1994) ³¹	
Methods	RCT
Participants	58 patients with a myofascial trigger point in upper trapezius
Interventions	26 patients 0.5 % lidocaine to elicit twitch response, 15 patients dry needling to elicit twitch response; 9 with lidocaine and no twitch response, 8 with dry needling and no twitch response
Outcomes	Significant improvement in both lidocaine and dry needling groups achieving local twitch response; immediate relief of pain
Reason for exclusion	Published prior to 2000

Itoh et al. (2006) ³²	
Methods	RCT
Participants	26 out-patients, aged 65-91 years
Interventions	Randomized to two groups, each receiving a phase of sham treatments, a wash-out period and a phase of trigger point acupuncture, or in reverse order
Outcomes	Both trigger point acupuncture groups had significant reductions on VAS and Roland Morris Questionnaire but results were not sustained over the long term
Reason for exclusion	Elderly population does not correlate well with the athletic population

Itoh et al. (2004) ³³	
Methods	Blinded RCT
Participants	35 outpatients aged 65-81 years with low back pain for more than six months with a normal neurological examinations
Interventions	Two phases of standard acupuncture, superficial trigger point acupuncture, or deep trigger point needling with a wash-out period between phases
Outcomes	Decreased pain intensity and increase quality of life in deep trigger point acupuncture group when compared to other groups, but not statistically significant; significant decrease in pain intensity for the deep trigger point group between treatment and wash-out period
Reason for exclusion	Excluded due to elderly population



Itoh et al. (2008) ³⁴	
Methods	Preliminary RCT
Studies	30 osteoarthritis patients with non-radiating pain and a normal neurological exam
Interventions	5 acupuncture treatments over 21 weeks, randomized to traditional acupuncture, trigger point acupuncture or sham acupuncture
³⁵ Outcomes	Trigger point and traditional acupuncture groups had improved function of the knee, and a statistically significant reduction in pain intensity for 5 weeks after treatment. Trigger point acupuncture group reported a lower pain score on the VAS than the other groups
Reason for exclusion	Excluded due to predisposing pathology

Lee et al. (2008) ³⁵	
Methods	Clinical trial
Participants	40 patients with active MTrPs in the levator scapulae or upper trapezius
Interventions	4 weekly sessions of needle electrical intramuscular stimulation
Outcomes	Significant improvement in VAS, PPT, shoulder ROM
Reason for exclusion	Assesses only electroacupuncture treatments to MTrPs

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