SYSTEMATIC REVIEW

Effects of dry needling in lower extremity myofascial trigger points

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Abstract

Objective: To explore the current evidences on effects of trigger point dry needling as a treatment strategy on pain and range of motion among subjects with lower extremity myofascial trigger areas.

Methods: The systematic review was conducted at the University Institute of Physical Therapy, Lahore, Pakistan, from February to August 2019, and comprised search of studies on Cochrane Library, PubMed, SPORTDiscus and PEDro databases published in the English language from 2000 to July 2019. The search terms used were 'Dry needling', 'Trigger points', 'Myofascial trigger points', 'Trigger area', 'Acupuncture therapy', 'Lower extremity' and 'Acupuncture'. Cochrane Risk of Bias tool was used to assess the randomised and non-randomised controlled trials. Methodological assessment was performed using Physiotherapy Evidence Database 10-point scale. Data synthesis was performed through vote counting method.

Results: Of the 564 articles initially found, 30(5.3%) were shortlisted for full-text assessment. Of them, 10(33.3%) were selected for final assessment; with 7(70%) scoring high and 3(30%) fair on the PEDro scale. All the 10(100%) studies documented improvement in the pain over time with dry needling strategy. None of the studies targeted any other outcome, like anxiety and sleep disturbances, related with myofascial trigger points.

Conclusion: On basis of the best evidences available, dry needling seemed to be effective in pain reduction related to lower extremity myofascial trigger points. Evidence also suggested that there was not much positive effect of myofascial trigger point dry needling on depression, anxiety, muscular strength and quality of life.

Keywords: Acupuncture therapy, Dry needling, Lower extremity, Myofascial trigger points. (JPMA 71: 2596; 2021)

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Introduction

Myofascial trigger points (MTrPs) are commonly encountered in basic care settings and pain centres as a chief cause of pain.[1] These are the localised, hyperalgesic sites in a tight and rigid band of muscular fibres.[2] These taut points usually emerge as a result of some impulsive injury, overloading or repetition of muscular activity causing microtrauma, and poor postures placing abnormal tension on muscles.[3] These trigger points result in a variety of functional and psychic complications, like anxiety, depressing moods and lost functional capacity.[4] They have been found to be linked with almost every musculoskeletal condition, like joint pathologies, disc dysfunctions, tendinopathies, spinal pathologies, pelvic dysfunctions, neuralgias and myalgias.[5] MTrPs prevalence was found to be 21-85% in subjects complaining of pain in different body parts.[6]

There is no universal criterion to explain the trigger points, but typically they have been classified as active and latent MTrPs. An active trigger point is an overly irritable and localised area in a tight muscular fibre. This active point is sensitive to touch and is hyperirritable to pressure. Pain may or may not radiate in typical patterns to the distant sites.[7] Likewise, latent trigger points have the same characteristics and pain is elicited on manual palpation only.[8] Such trigger points reside in a pain-free region in tight muscular fibre and may convert into active trigger points upon continuous stimulation.

Earlier, numerous interventional protocols were assumed for the trigger areas. Evidence supports the treatment of these trigger areas through stretching techniques, ischaemia-developing technique, proprioceptive neuromuscular techniques, muscular release, laser therapies, sonography, and other heat-emitting modalities. The specific treatment for such tight muscular bands is not yet established in literature.[9,10] Now-a-days, an emerging technique for trigger points is dry needling, which is also denoted as western acupuncture or traditional Chinese acupuncture technique.[1]

Trigger point dry needling (TDN) is an emerging intervention strategy to target and loosen the tight trigger points.[11] It is basically insertion of a hard and firm needle in the skin surface, penetrating the tight muscular band called the trigger point to target the pain of neuromuscular origin and also to improve range of motion (ROM) of the affected area. When the trigger point becomes inactive, the inserted needles are pulled out. Usually TDN is done in the

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target area followed by stretching exercises afterwards. The exact TDN mechanism is not known, but it is hypothesised that the local twitch response interrupts with the motor end-plate noise and produce pain-relieving effect.[12] When a localised twitch response is elicited followed by stretching exercise, the taut bands of skeletal muscle fibres become relaxed. Several studies concluded in the favour of dry needling to reduce pain of neuromuscular origin and to improve ROM, as it produces localised twitch response. The dry needling process involves the activation of alpha delta nerve fibres that are responsible for the interneuron activation.[13,14] The interneurons that are present in the inhibitory dorsal horn cause the production of enkephalins, resulting in pain suppression regulated by opioids. This intervention targets the level of various chemicals associated with the taut muscle band, like bradykinin and substance P.[15]

A systematic review, performed to investigate dry needling effects on various regions of body, showed minimal positive effectiveness of dry needling in contrast to the traditional physical therapy interventions.[16]

A review and meta-analysis of Level 1a was presented for the effects of dry needling on population with upper region myofascial pain. A literature search was executed and articles were screened using the specific inclusion criteria comprising randomised trials of myofascial pain syndrome targeting the upper region. There were 12 randomised trials finally selected and the results recommended the use of dry needling in contrast to placebo for pain reduction in subjects with upper-region myofascial pain syndrome. However, due to less number of quality trials, future studies with strong methodological rigour were recommended.[17]

A randomised, single-blind, multicentre and parallel grouped trial assessed the effects of dry needling plus the manual therapy programme, exercise interventions and therapeutic ultrasound. The outcomes were pain, disability and functionality in the subjects of plantar fasciitis. A total of 111 patients qualified to receive the study intervention. The inclusion of dry needling into a manual and other physiotherapeutic exercise programme provided pain relief, and improved functions compared to the manual therapy programme, therapeutic ultrasound and exercise interventions alone in the target population of plantar fasciitis.[18]

Dry needling is attracting the attention of physical therapists and other medical professionals for the treatment of trigger points. There is evidence that dry needling relieves neuromuscular pain, increases joint ranges and improves overall quality of life (QOL). But its utilisation in the physiotherapy field is yet not fully established. There is increased necessity to review and analyse literature to conclude whether this is an effective form of intervention for the release of trigger areas.[4] Past studies have mostly focussed on the shoulder complex area, foot joint complex, neck region, upper quarter and the lower region for either review or controlled trials.[19]

Latent trigger areas are strongly related with many other disorders and dysfunctions of lower limbs, such as patellofemoral pain, medial or lateral meniscal injuries leading to surgical procedures, and lower limb joints osteoarthritis affecting normal ranges. TDN is an emerging intervention strategy to target and loosen tight trigger points. Presently, no review has focussed on the lower extremity trigger points taking dry needling under consideration as a part of treatment protocol. The current systematic review was planned to explore the evidences evaluating effects of dry needling as a treatment strategy in subjects having lower extremity trigger areas associated with a wide variety of orthopaedic conditions.

Materials and Methods

The systematic review was conducted at the University Institute of Physical Therapy, Lahore, Pakistan, from February to August 2019, and comprised search of studies on Cochrane Library, PubMed, SPORTDiscus and PEDro databases published in the English language from 2000 to July 2019. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed (Figure) after approval from institutional ethics review

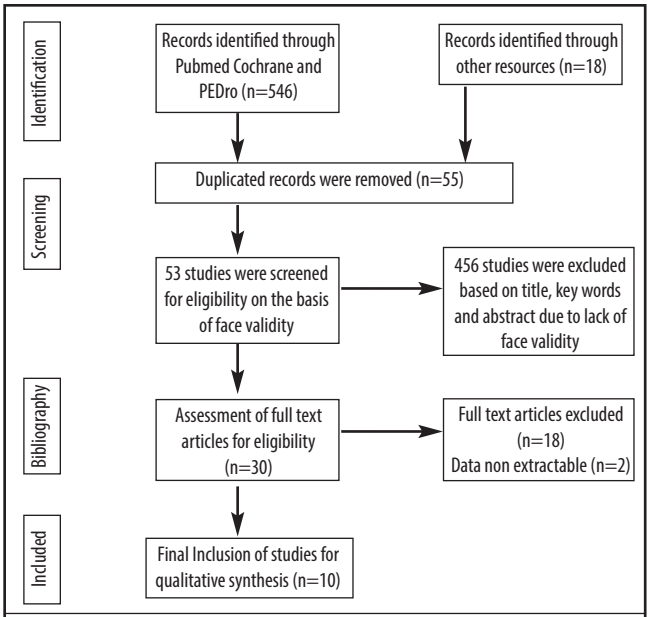

Figure: Study flow-chart according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).

board. The comprehensive search included grey literature as well so that there was no missing data. Registered protocols and trials, open thesis and dissertations, conference papers along with study reports were also searched. The 'Journal of Orthopedic & Sports Physical Therapy' was also manually searched for TDN-related material. Literature search on the databases was performed for relevant articles, and access to some articles was arranged by contacting the authors concerned. Also, views from national and international experts was taken on the matter. The search terms used for databases were 'Dry needling', 'Trigger points', 'Myofascial trigger points', 'Trigger area', 'Acupuncture therapy', 'Lower extremity' and 'Acupuncture'. References were also manually searched. Dry needling practitioners were also contacted to have their expert opinions. The search was conducted by two reviewers independently through the utilisation of standardised forms, and conflict of opinion, if any, was resolved through discussion.

Inclusion and exclusion of studies were made according to patient/population, intervention, comparison and outcomes (PICO) format. Randomised clinical trials, clinical trials, controlled clinical trials and pilot studies were included in the review. Primary quantitative or mixed-method research in participants with lower extremity trigger points and peer-reviewed articles were also included. Studies using conventional acupuncture were excluded, and so were those treating the upper extremity or upper quarter region.

Cochrane Risk of Bias tool was used in the study to assess the methodological quality of the retrieved data, and randomised and non-randomised trials were assessed through the Cochrane Collaboration tool.[20,21] Five domains of the tool were assessed; selection, performance, attrition, reporting and others. The internal validity and critical appraisal of the selected studies was performed using the Physiotherapy Evidence Database (PEDro) tool which has 11 scores but the first one is not a part of total scoring, as it has been nominated as a part of external validity. A score of seven or higher was marked as high-quality study, 5-6 as fair, and <4 poor.[22]

Data synthesis was performed by vote-counting method. The data was evaluated and presented in tabular form. Primary outcomes included pain and ROM measured through visual analogue scale (VAS) and foot health status questionnaire (FHSQ) pain subscale. The secondary outcome was QOL measured through EuroQol five-dimension-5-level (EQ-5D-5L) scale.

Results

Of the 564 articles initially found, 30(5.3%) were shortlisted for full-text assessment. Characteristics of the 10(33.3%) studies included were tabulated separately (Table 2). Of the, 10(33.3%) studies included for final assessment, 7(70%) scored high and 3(30%) fair on the PEDro scale (Table 3). Besides, 1(10%)[23] study followed randomised controlled protocol, while 9(90%)[3,4,24-29,32] were randomised controlled trials (RCTs). The reason for exclusion of studies[17,18,30,31,33-35] were noted (Table 1). TDN applied in the trials for the intervention group was either multiple-time insertion of needle or the superficial method. The placebo or control group received sham dry needling technique. The technique of multiple insertion involved partially picking of needle back and forth multiple times after the first insertion. The placebo or sham dry needling used the blunted tip needle on the superficial skin surface.

Table-1: Reasons for exclusion of studies.

Study	Exclusion Reason
Brennan et.al.[31]	Outcome measure used for pain did not meet inclusion criteria
Dunning et.al.[32]	electrical dry needling
Dunning et al.[34]	Disability being primary outcome, electrical dry needling
Espi-lopez et al.[35]	Outcome measure used for pain did not meet inclusion criteria
Uygur et.al.[36]	Data could not be extracted
Haser et.al.[37]	Muscular strength, endurance and range of motion were main outcomes
Kietrys et.al.[17]	A systematic review and meta-analysis

Two (20%) studies also addressed the function and disability of the lower extremity. Various outcome measures were used to quantify those outcomes. The studies suggested no significant or marked difference in these markers. Three (30%) studies suggested dry needling was not necessarily improving ROM or other pain-related impairments compared to the placebo or sham dry needling.

Six (60%)[3,4,27-29,32] studies documented improvement in the pain over time with dry needling as the intervention. Three (30%)[24-26] studies showed no or little effect of dry needling on pain, and 4(40%) studies[24-27] depicted no improvement in ROM (Table 4). None of the studies targeted other outcomes, like anxiety and sleep disturbances associated with myofascial trigger points.

Discussion

Trigger points have been found linked with almost every musculoskeletal condition, like joint pathologies, disc dysfunctions, tendinopathies, spinal pathologies, pelvic dysfunctions, neuralgias and myalgias. The current systematic review evaluated whether there was adequate evidence to support the utilisation of dry needling as an intervention in patients having lower extremity myofascial trigger points with a variety of orthopaedic conditions.

Table 2: Characteristics of the included studies.

Study	Study Design	Population	Intervention	Outcome Measures and Tests
Sánchez et al.[25]	Multicentre, Double-blind, Controlled RCT	62 participants with age of 62years or older having knee pain and uni or bilateral dysfunction, primary knee OA	I: therapeutic exercise program along with myofascial trigger point dry needling C: same therapeutic exercise program with sham Dry needling	NRS was used to measure Pain Intensity and WOMAC to measure knee disability Secondary outcome measures were Barthel Index, Timed Up and Go test, EuroQol 5D and GROC
Al-Boloushi et al.[24]	Prospective, two parallel groups Randomize Controlled Trial	94 participants between 21 and 60 years of age with history of heel pain over 1 month	I: invasive interventional group undergoing dry needling C: Percutaneous needle electrolysis	FHSQ as primary outcome measure VAS and EuroQol-5 dimension as secondary outcome
Velázquez-Saornil et al.[26]	Single Blinded RCT	40 subjects with 18-55 of age range in the subacute phase after unilateral surgical reconstruction of complete ACL rupture	I: Rehabilitation protocol plus dry needling (n=22) C: rehabilitation protocol only (n=22)	VAS to measure pain Universal goniometer to measure ROM Star Excursion Balance Test to measure stability WOMAC to measure physical activity of knee
Mason et al.[27]	Double blinded randomized controlled trial	Subjects presented with chief complain of atraumatic knee pain	I: Dry needling group C: Sham dry needling group	Active Knee extension Test and Active Straight Leg raise test to measure hamstring flexibility LEFS and VAS as secondary outcome measures
Eftekharsadat et al.[28]	Single-blinded randomized clinical trial	20 patients presenting with plantar heel pain	Participants were trained to massage their calf muscles and plantar muscles and their stretching. I: Dry needling one session per week for 4 consecutive weeks C: Control group	VAS to detect pain Foot function Index Range of motion of ankle joint in Dorsiflexion and planterflexion
Rayegani et al.[5]	Clinical trial	28 subjects with myofascial pain syndrome	Participants in the control group received 10 sequential sessions of physiotherapy 3 times per week I: Dry needling (case group) C: Physiotherapy(control group)	Visual Analogue Scale, Commander standard pressure algometer Short form-36 questionnaire for Quality of Life
Cotchett et al.[29]	Parallel-group, participant blinded, randomized controlled trial	84 subjects with plantar heel pain lasting from atleast one month	Subjects undergoing intervention received 1 treatment session per week for six weeks. Follow up continued for 12 weeks I: real trigger point dry needling C: sham trigger point dry needling	Primary outcome measures being VAS and Foot Health Status Questionnaire (FHSQ) Secondary outcome measures being SF-36, DASS-21, Foot Posture Index, Credibility/Expectancy Questionnaire (CEQ)and Physical Activity Recall Questionnaire (PAR)

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Table 2: (*Continued from previous page*).

Study	Study Design	Population	Intervention	Outcome Measures and Tests
Tekin et al.[32]	Double-evaluator, subject-blinded, Rrandomized controlled trial	39 subjects with myofascial pain syndrome with age between 24 and 65 years, and symptom duration greater than 6 months	I: Dry needling C: Sham needling (placebo group)	Pain measured through VAS Quality of life measured through SF-36 form
Mayoral et al.[30]	Randomized, double-blinded, placebo-controlled, clinical trial	Forty subjects diagnosed with knee osteoarthritis, and scheduled for total knee replacement surgery	I: True dry needling group C: Sham Dr needling group	Primary outcome measure: VAS Secondary outcome measure: WOMAC, Digital Inclinometer
Huguenin et al.[3]	Randomized, double blind, placebo-controlled trial	59 male runners	I: therapeutic needling C: Placebo needling at gluteal trigger points	Visual Analogue Scale

Table-3: PEDro scoring of the included studies.

Study	2	3	4	5	6	7	8	9	10	11	Total Score	Quality
Sánchez et al.[25]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9/10	High
Al-Boloushi et al.[24]	Y	Y	Y	Y	N	N	N	Y	N	N	5/10	Fair
Velázquez-Saornil et al.[26]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8/10	High
Mason et al.[27]	Y	Y	Y	Y	N	Y	N	N	Y	Y	7/10	High
Eftekharsadat et al.[5]	Y	Y	Y	Y	N	N	N	Y	Y	Y	7/10	High
Rayegani et al.[29]	Y	N	Y	N	N	N	N	Y	Y	Y	5/10	Fair
Cotchett et al.[29]	Y	Y	Y	Y	N	N	N	N	Y	Y	6/10	Fair
Tekin et al.[32]	Y	N	Y	Y	N	Y	Y	Y	Y	Y	8/10	High
Mayoral et al.[30]	Y	N	Y	Y	N	Y	N	Y	Y	Y	7/10	High
Huguenin et al.[3]	Y	Y	Y	Y	N	Y	N	Y	Y	Y	8/10	High
% of Yes per criterion	100	70	100	80	0	60	30	80	90	90	Score Avg: 7/10	

Y= criterion specified, N= criterion not specified; 2= Random allocation to group; 3= Allocation was concealed; 4= Similar Groups at baseline regarding prognostic factors; 5= Blinding of all subjects; 6= Blinding of therapist who administered therapy; 7= Blinding of all assessors who measured atleast one key outcome; 8= Measure of atleast one outcome for more than 85% of subjects; 9= All subjects received Intervention or "intention to treat" was stated; 10= Between-group statistical comparisons for atleast one key outcome; 11= Point measures and measures of variability for atleast one key outcome.

Table 4: Vote-counting.

Studies Objective	Conclusion	Effect
Sánchez et al.[25] evaluated the effect of dry needling and exercise on pain and disability in knee osteoarthritis subjects	The study concluded that inclusion of dry needling therapy into an exercise program does not improve pain and disability in knee osteoarthritis patients	Negative Effect
Al-Boloushi et al.[17] compared the effect of dry needling and percutaneous needle electrolysis to improve plantar heel pain due to myofascial trigger points	The study hypothesized that needle electrolysis in combination with dry needling may improve the outcomes	Protocol Study
Velázquez-Saornil et al.[26] evaluated the effects of vastus medialis dry needling on pain, range of motion, stability and functional improvements in patients with subacute Anterior Cruciate Ligament reconstruction.	The study concluded that Vastus medialis dry needling with rehabilitation protocol in subacute ACL reconstruction patients, the range of motion and functionality improves. Although pain did not decrease with dry needling and stability did not have much effect.	Negative Effect

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Table 4: (*Continued from previous page*)

Studies Objective	Conclusion	Effect
Mason et al.[27] determined the effect of adding dry needling to standard stretching program as compared to the sham dry needling in atraumatic knee pain patients. Secondary objectives were to compare the squatting ROM, Knee pain and Lower Extremity Functional Scale scoring between two groups	The study concluded that two sessions of dry needling did not improve range of motion and knee pain as compared to sham dry needling in active patients with atraumatic knee pain.	Negative Effect
Eftekharsadat et al.[28] examined the effects of myofascial dry needling on heel pain	The study concluded that there is insignificant effect on range of motion dorsiflexion and plantarflexion. It can be a good option as an alternative to other invasive therapies for plantar fasciitis	Negative Effect on ROM
Rayegani et al.[5] compared the effects of dry needling versus physiotherapy treatment in myofascial pain syndrome patients.	The study concluded that physiotherapy modalities and dry needling have equal effect in myofascial pain syndrome subjects	Positive Effect
Cotchett et al.[29] conducted a study to evaluate the effectiveness of dry needling plantar heel pain	The study concluded that there is statistically significant improvement in plantar heel pain	Positive Effect
Tekin et al.[32] evaluated the effect of dry needling as compared to sham dry needling in myofascial pain syndrome subjects	The study concluded that dry needling is effective in improving pain and quality of life of myofascial pain syndrome patients	Positive Effect
Mayoral et al.[30] determined the effect of dry needling as compared to sham needling on pain in patients with total knee arthroplasty	The study showed a superiority of dry needling over placebo	Positive Effect
Huguenin et al.[3] evaluated the effect of dry needling on gluteal muscles in patients with posterior thigh pain referring from gluteal trigger points	The study concluded that both of the interventions showed subjective improvement in activity related muscle pain and tightness	Positive Effect

The extensive literature review revealed 10 studies related to myofascial trigger points of lower extremity. There was variation in the methodology of dry needling intervention strategies. The studies reviewed had applied either multiple insertion method of dry needling or superficial needling technique. The multiple insertion technique correlates positively to the effectiveness of dry needling. The placebo or sham dry needling group in some studies used the blunted tip needle on the superficial skin surface.

The current systematic review suggested that dry needling had a positive effect on pain outcome compared to sham or placebo. Six of the selected studies showed that there was marked difference in the mean values of pain in pre- and post-intervention groups, and these findings were in line with previous reviews.[12,19] One of the recruited studies was a protocol study which hypothesised that there would be marked difference in pain outcome after dry needling intervention. One[26] of the studies which showed no effect on pain outcome rated 7 out of 10 on the PEDro scale and was unable to blind the therapist and attrition rate was very high in that study. Pain was taken as a secondary outcome.

One[24] study compared dry needling with therapeutic exercise programme and suggested that dry needling had at least similar effect to therapeutic exercise programme in improving pain. The six studies which proved a positive effect of TDN therapy on pain outcome stated mean value of VAS to be greater than the minimum required for clinically important difference in VAS. This suggested significant difference in pain intensity post-TDN, and the finding was in line with a previous review.[19]

Five[3,4,23,24,28] studies measured QOL. All the studies depicted marked increase in QOL, which was in line with a previous systematic review and meta-analysis evaluating the effects of dry needling in the upper quarter myofascial trigger points.[17] There had been insufficient evidence to evaluate the effects of dry needling in managing

depression, sleep quality, anxiety and muscle strength. An important point to be discussed was that the studies[3,9,28,29] which comparing the results of dry needling with sham or placebo needling showed marked improvement in pain. And most of the studies[24,26] comparing dry needling with some other therapeutic modality or manual therapy had similar results as far as pain outcome was concerned. Furthermore, 3 studies had no improvement in pain and 4 had no improvement in ROM of lower extremity. The findings were contradictory to a previous systematic review evaluating the effects of dry needling for musculoskeletal conditions by physiotherapists.[14]

Overall, the results of the reviewed studies suggested positive outcomes for pain reduction with the use of true dry needling along with physiotherapeutic techniques related with the lower extremity myofasical trigger points.

Conclusion

Myofascial trigger points, either active or latent, are associated with various lower extremity musculoskeletal conditions. On the basis of the best evidence available, dry needling is effective in pain reduction related to lower extremity myofascial trigger points. Evidence also suggests that there is not much positive effect of myofascial TDN on depression, anxiety and muscular strength. There is additional advantage of using dry needling in combination with other physiotherapeutic intervention strategies for trigger points.

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