Effects of trigger point dry needling for nontraumatic shoulder pain of musculoskeletal origin: A systematic review and meta-analysis.

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Abstract

Objective. The purpose of this study was to evaluate the effects of trigger point (TrP) dry needling alone or as an adjunct to other interventions on pain intensity and related disability in nontraumatic shoulder pain.

Methods. Ten databases were searched from inception to January 2020 for randomized clinical trials in which at least 1 group received TrP dry needling for shoulder pain of musculoskeletal origin with outcomes collected on pain intensity and related disability. Data extraction including participant and therapist details, interventions, blinding strategy, blinding assessment outcomes, and results were extracted by 2 reviewers. The risk of bias (RoB, Cochrane Guidelines), methodological quality (PEDro score), and evidence level (GRADE approach) were assessed. The search identified 551 publications with 6 trials eligible for inclusion.

Results. There was moderate quality evidence that TrP dry needling reduces shoulder pain intensity with a small effect (MD = -0.49 points, 95% CI = -0.84 to -0.13; SMD = -0.25, 95% CI = -0.42 to -0.09) and low quality evidence that TrP dry needling improves related disability with a large effect (MD = -9.99 points, 95% CI -15.97 to -4.01; SMD = -1.14, 95% CI -1.81 to -0.47) as compared to a comparison group. The effects on pain were only found at short-term. The RoB was generally low, but the heterogenicity of the results downgraded the evidence level.

Conclusions. Moderate- to low-quality evidence suggests positive effects of TrP dry needling for pain intensity (small effect) and pain-related disability (large effect) in nontraumatic shoulder pain of musculoskeletal origin, mostly at short term. Future clinical trials investigating long-term effects are needed.

Impact. Dry needling is commonly used for the management of musculoskeletal pain. This is the first meta-analysis to examine the effects of dry needling on nontraumatic shoulder pain.

KEYWORDS: Dry Needling, Shoulder Pain, Meta-Analysis

Shoulder pain represents a significant health problem showing a point prevalence from 7% to 26 % and a lifetime prevalence around 67%; however, these data depend on the criteria used for the diagnosis.[1] In the Netherlands, the annual incidence of people with should pain symptoms attending general practice consulting was estimated to be 29 per 1000 persons/year.[2] The annual cost per patient with shoulder pain in primary health care is estimated at €4139,[3] whereas direct costs for management of shoulder pain reached $7 billion in the United States of America annually.[4] In the Netherlands, the annual costs of shoulder pain is estimated to be €345 million.[5]

Conservative treatment is the first therapeutic option for the management of people with shoulder pain; however, the most appropriate treatment strategy remains unclear. In fact, different interventions including injections, medication, exercise, manual therapy, electrotherapy or cognitive therapy are all recommended, with different levels of evidence as reported in clinical guidelines.[6] Several systematic reviews investigating the effects of conservative interventions for shoulder pain reported strong recommendation for exercise and manual therapy (as additional therapy) for the management of subacromial shoulder pain.[7]

There is increasing evidence supporting a potential role of muscular trigger points (TrPs) in the etiology of shoulder pain.[8] Simons et al defined a TrP as a "hypersensitive spot within a taut band of a skeletal muscle that is painful with mechanical stimulation, elicits a referred pain, and generates motor dysfunction".[9] Previous studies have observed that the referred pain elicited by TrPs in the shoulder muscles reproduced shoulder pain symptoms in individuals with a diagnosis of shoulder impingement[10] or subacromial pain syndrome.[11] Several therapeutic approaches are advocated for the management of TrPs, with manual therapies and dry needling being one of the commonly used.[12] Dry needling is defined as a "skilled intervention using a thin filiform needle to penetrate the skin that stimulates TrPs, muscles, and connective tissue for the management of musculoskeletal disorders".[13] Two previous meta-analyses investigated the effects of TrP dry needling in neck and shoulder pain and reported contradictory results. Liu et al concluded that TrP dry needling can be recommended for the treatment of neck/shoulder pain at the short-term and midterm follow-up assessments,[14] whereas Hall et al found very low quality evidence supporting the use of TrP dry needling in the shoulder area for treating upper extremity pain or dysfunction.[15] It should be noted that the first meta-analysis included patients with concomitant neck pain,[14] whereas the second one included shoulder pain from differing etiologies including traumatic, nontraumatic, and neurological origin.[15] Combining cervical and shoulder or shoulder pain from different origin may bias findings regarding the potential effect of dry needling on shoulder pain of musculoskeletal origin. Therefore, the current systematic review and meta-analysis evaluates the effects of TrP dry needling alone or as an adjunct with other interventions on pain intensity and related disability in individuals with nontraumatic shoulder pain of musculoskeletal origin.

[H1] Methods

This systematic review and meta-analysis adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[16] We used similar methods than in a recent systematic review and meta-analysis on dry needling and knee pain.[17] The systematic review and meta-analysis was registered a priori with the international OPS Registry registration link is https://doi.org/10.17605/OSF.IO/SVT28

[H2] Data Sources and Searches

Electronic literature searches were conducted on MEDLINE, EMBASE, AMED, CINAHL, PubMed, PEDro, Cochrane Library, SCOPUS and Web of Science from their inception to 15 January 2020. When searched databases allowed limits, searches were restricted to randomized clinical trials. We also screened the reference lists of the papers that were identified in the database searches. Bibliographical database search strategies were conducted with the assistance of an experienced health science librarian.

[H3] Population: Adults with nontraumatic shoulder pain of musculoskeletal origin older than 18 years of age. For this aim, the search strategy had to include 1 of the following key words: *shoulder pain* OR *subacromial pain syndrome* OR *subacromial impingement* OR *rotator cuff*.

[H3] Intervention: Application of trigger point dry needling. For this aim, the search strategy had to include 1 of the following key words: *dry needling OR needle therapy AND trigger point OR myofascial pain syndrome.*

[H3] Comparator: Acceptable comparators were any type of placebo, sham, or no intervention. For this aim, the search strategy included 1 of these key words: *sham OR placebo OR control OR no intervention*. We also included a comparison of dry needling with another active intervention.

[H3] Outcomes: The primary outcome measure was pain, related disability, or function.

The search strategy for each database is available in Supplementary Appendix 1.

[H2] Study Selection

The systematic review included randomized clinical trials where at least 1 group received any form of TrP dry needling in individuals with nontraumatic shoulder pain of musculoskeletal origin. We considered nontraumatic shoulder pain of musculoskeletal origin diagnosis such as subacromial pain syndrome, rotator cuff disorder, subacromial impingement syndrome, or nonspecific shoulder pain.

The specific inclusion criteria were an adult population (>18 years old) with nontraumatic shoulder pain of musculoskeletal origin; 1 group receiving any type of TrP dry needling intervention; an acceptable comparator (eg, sham, placebo, control, or another active intervention); and the primary outcome of the study being pain intensity (eg, as measured with a visual analog scale or a numerical pain rating scale) or related disability (eg, as assessed with a specific-disease questionnaire). We excluded clinical trials that included pain related to neurological disorders (eg, poststroke pain) or shoulder pain of traumatic origin (eg, postoperative pain); studies not published as journal articles; and retrospectives clinical studies.

[H2] Data Extraction and Quality Assessment

Articles identified from the different databases were independently reviewed by 2 authors. First, the duplicates were removed. Second, title and abstract of the articles were screened for potential eligibility. Third, a full-text read of potentially eligible studies was conducted. Authors were required to achieve a consensus on the included trials. In a case of discrepancy between both reviewers, a third author participated in the process to reach the consensus and to decide whether the trial should be included or not in a meeting.

Data from each trial were extracted independently by 2 authors using a standardized form including study design, sample size, population, diagnosis, interventions, outcomes and follow-up periods. Both authors had to achieve a consensus on each item on the data-extraction form. If disagreement occurred, a third author participated in the determination, again, in a personal meeting with the 3 authors. An agreement of 100% between both authors was obtained in data extraction.

Risk of bias and methodological quality of the included trials were independently assessed by 2 researchers using the Cochrane Risk of Bias (RoB) assessment tool[18] and the Physiotherapy Evidence Database (PEDro) scale,[19] respectively.

The RoB tool includes the following item: selection bias (randomization sequence generation, allocation concealment), performance bias (masking participants, masking therapists), detection bias (masking outcome assessor), attrition bias (incomplete outcome data), reporting bias (source of funding bias/selecting outcome reporting), and other bias (sample size).[17] Each item was classified as low risk, high risk or unclear

according to the Cochrane Collaboration's tool.[18] "In all cases, an answer 'Yes' indicates a low risk of bias, and an answer 'No' indicates high risk of bias. If insufficient details are reported of what occurred during the trial, or the entry was not relevant to the study at hand (particularly for assessing masking and incomplete outcome data, when the outcome being assessed by the entry has not been measured in the study) the answer was 'unclear' risk of bias.[18]

The PEDro score assessed the following items: random allocation; concealed allocation; between-groups similarity at baseline; participant masking; therapist masking; assessor masking; dropout; intention-to-treat statistical analysis; between-group statistical comparison; point measures and variability data.[19] A PEDro score equal to or greater than 5 out of 10 points determines a high-quality trial.

To evaluate the quality of the evidence for trigger point dry needling, we used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.[20] According to the GRADE approach, the level of evidence can be classsified as high quality (the authors are very confident that the effect of the intervention is close to the estimated effect), moderate quality (the authors are somewhat confident that the intervention effect is probably close to the estimated effect, but there is a possibility that it is different), and low quality (the true intervention effect can be markedly different from the estimated effect).[20]

The evidence level is classified as high quality, moderate quality, low quality, or very low quality based on the presence of study limitations (RoB), indirectness of evidence, inconsistency of results or unexplained heterogeneity, imprecision of results, and high probability of publication bias.[21] The level of evidence starts from high quality and it is downgraded depending on the items. The presence of serious risk downgrades 1

level and the presence of very serious risk downgrades 2 levels. Therefore, the evidence level is high quality when all items are negative; it is downgraded to moderate quality when 1 item includes serious risk, to low quality when 2 items show serious risk or 1 item shows very serious risk, or downgraded to very low quality when 3 or more items have serious risk, or more than 2 items exhibit very serious risk. This method process of the evidence level was independently performed by 2 authors, with participation of a third when discrepancy occurred. An agreement of 85% on quality assessment/evidence level between the 2 authors was observed. The personal meeting revolved the disagreement by a consensus among the 3 authors on the particular trial where disagreement existed.

[H2] Data Synthesis and Analysis

The meta-analysis was conducted using the Review Manager statistical software (RevMan version 5.3). Data synthesis was categorized by groups according to the follow-up period as short term, midterm, and long term, if data were available.

We extracted the sample size, means and standard deviations for each variable. When the trial reported only standard errors, they were converted to standard deviations. When necessary, the mean scores and standard deviations were estimated from graphs. Also, if the study reported nonparametric values (median and interquartile range), using the method described by Wan et al[22] and Luo et al[23] the results were converted to means[23] and SDs.[22] We should note that related disability was assessed with 3 different questionnaires using different scoring measures. For instance, upward scoring, in which higher values indicated higher related disability, was used for the Disabilities of the Arm, Shoulder and Hand (DASH) and the Shoulder Pain and Disability Index (SPADI), whereas downward scoring, in which higher scores indicated

lower related disability, was used for the Constant-Murley score. In such a scenario, pooling of data was conducted in the upward direction, that is, considering Constant-Murley scores as negative.

The between-groups mean differences (MDs) of the trials were converted to the standardized mean difference (SMD), with their 95% CIs. A random-effects model was used to determine the overall effect size (SMD). An effect size (SMD) of 0.8 or greater was considered large, an effect size of 0.5 to 0.8 was considered moderate, and an effect size of 0.2 to 0.5 was considered small. *P* values of <.05 were considered statistically significant. The overall effect sizes and calculation of the effect size on pain intensity and related disability was obtained at short term (0–1 month), midterm (1–3 months), and long term (3–6 months) from baseline.

The heterogeneity of the studies was assessed using the I^2 statistic. The Cochrane group has established the following interpretation of the I^2 statistic: 0% to 40% may not be relevant/important heterogeneity; 30% to 60% suggests moderate heterogeneity, 50% to 90% represents substantial heterogeneity, and 75% to 100% represents considerable heterogeneity.[24] As described by the Cochrane group some data of heterogeneity overlap. The importance of the observed value of I^2 is based on the magnitude and the direction of effects and the strength of evidence for heterogeneity (*P* value). The GRADE approach[20] simplifies the interpretation of the I^2 statistic as follows: 0% to 40% = no heterogeneity/inconsistency, 40% to 79% = serious heterogeneity/inconsistency, and >80% = very serious heterogeneity/inconsistency We decide to use the simplified GRADE approach for determining heterogeneity of the included trials.

[H1] Results

[H2] Study Selection

The electronic searches identified 551 potential studies for review. After removal of duplicates, 319 studies remained. Three hundred eight were excluded based on examination of their titles/abstracts, leaving 11 articles for full-text analysis. Another 5 were excluded for the following reasons: pilot study from a major randomized clinical trial[25], inadequate comparator group or not a randomized clinical trial,[26,27] dry needling intervention adjunct with lidocaine injection[28] and no diagnosis of nontraumatic shoulder pain.[29] Finally, a total of 6 trials were included in the main analyses[30–35] (Fig. 1).

[H2] Study Characteristics

Supplementary Appendix 2 summarizes characteristics of the dry needling intervention applied in each trial. All trials included the presence of active TrPs, that is, those which referred pain reproduced the symptoms of the patients and targeted the supraspinatus and infraspinatus muscles with the needle. The needling technique was the same in all studies. Five trials (83%) used the fast-in fast-out intervention as described by Hong trying to elicit the local twitch response.[30,31,33-35] The remaining study[32] used the sparrow pecking intervention, which, in essential, is the same since the objective is to elicit a local twitch responses. On the contrary, there was diversity on the number and/or frequency of needling sessions and the type of comparator. In fact, only 1 trial compared TrP dry needling versus sham,[32] 3 trials compared dry needling with exercise or multimodal physical therapy treatment versus the respective isolated intervention,3 and the remaining 2 compared the

application of TrP dry needling in different muscles[34,35] (Suppl. Appendix 2). The principal findings of the included studies are summarized in **Table 1.**

[H2] Methodological Quality

The methodological quality scores ranged from 6 to 8 (mean = 7.3; SD = 0.8) out of a maximum of 10 points, all studies were considered of high methodological quality (≥5 points). The most frequent biases were masking of the therapists, followed by participant masking. Table 2 shows the details of the PEDro scale of each trial.

[H2] Risk of Bias

The details of the risk of bias assessment of the included trials are displayed in **Figure 2.** No trial was able to mask therapists, and all studies had an unclear bias in the item of masking participants. In general, the risk of bias of the trials included in the current meta-analysis was low (5 or more items with low risk of bias).

[H2] Effects of Dry Needling on Pain Intensity

The meta-analysis found that dry needling has a small effect (MD = −0.49 point [95% CI = −0.84 to −0.13]; *P* = .007; SMD = −0.25 [95% CI = −0.42 to −0.09]; n = 582; *z* = 3.04; *P* = .002) for decreasing the intensity of shoulder pain versus a comparison group but with serious heterogeneity (I^2 = 46%) between studies (Fig. 3A). The effects on pain were found only in the short term (MD = −0.65 points [95% CI = −1.05 to −0.26]; SMD = −0.34 [95% CI = −0.55 to −0.13]; *z* = 3.14; *P* = .002). The effects of dry needling on pain intensity at the midterm (MD =

−0.38 [95% CI = −1.31 to 0.54]; SMD = −0.15 [95% CI = −0.61 to 0.31]; z = 0.82; P =.41) and at the long term (MD = −0.10 [95% CI = −0.9 to 0.7]; SMD = −0.07 [95% CI = −0.62 to 0.49]; z = 0.24; P = .81) were not statistically significant. In fact, the long-term effect was based on just 1 trial.

[H2] Effects of Dry Needling on Related Disability

Trigger point dry needling showed an overall effect (MD = −9.99 points [95% CI = −15.97 to −4.01]; n = 520; z = 3.27; P = .001) with a significant large effect size (SMD = −1.14 [95% CI = −1.81 to −0.47]; P < .001) for decreasing related disability versus a comparison group but very serious heterogeneity (I^2 = 91%) between the trials (**Fig. 3B**). Significant large effect sizes on related disability were observed in the short (MD = −9.46 [95% CI = −18.06 to −0.87]; z = 2.16; P = .03; SMD = −1.12 [95% CI = −2.07 to −0.18]) and long (MD = −13.90 [95% CI = −18.31 to −9.49]; z = 6.18; P < .001; SMD = −1.72 [95% CI = −2.38 to −1.06]) terms, but with a very serious heterogeneity between trials (I^2 > 90%). Again, the long-term effect was based on just 1 trial. No significant effect on pain-related disability was found at the midterm (MD = −9.23 [95% CI = −24.62 to 6.16]; z = 1.18; P = .24; SMD = −0.99 [95% CI = −2.64 to 0.64]).

[H2] Quality of Evidence (GRADE)

Table 3 displays the details of GRADE assessment showing RoB, inconsistency of the results, indirectness of evidence, imprecision of results, and high probability of publication bias. The serious or very serious inconsistency of the results (heterogeneity) downgraded 1 level of evidence of the overall effect of dry needling for shoulder pain and related disability, as well as in the short- and midterm subgroup analyses.

[H1] Discussion

[H2] Effectiveness of Trigger Point Dry Needling

The objective of the current meta-analysis was to determine the effects of TrP dry needling for the management of nontraumatic shoulder pain of musculoskeletal origin. The results found moderate quality evidence of TrP dry needling for a small effect for reducing shoulder pain intensity and low-quality evidence for a large effect for reducing pain-related disability in individuals with nontraumatic shoulder pain of musculoskeletal origin. The RoB of the trials included in the current meta-analysis was low; but the inconsistency of the results (heterogeneity) downgraded 1 level of evidence (GRADE).

Two previous meta-analysis have analyzed the effects of dry needling in patients with neck/shoulder pain[14] or patients with upper extremity pain.[15] Liu et al[14] found that TrP dry needling showed large effect sizes at the short-term (SMD = −1.91 [95% CI = −3.10 to −0.73]) and midterm (SMD = −1.07 [95% CI = −1.87 to −0.27]) follow-up assessments in patients with neck-shoulder pain, whereas Hall et al[15] found no evidence supporting the use of TrP dry needling for treating upper extremity pain/dysfunction. Our results would agree partially with those

previously seen by Liu et al[14] but disagree with those by Hall et al.[15] The main reason for this discrepancy is that Hall et al[15] included individuals with upper extremity pain from highly diverse origins, such as traumatic, nontraumatic, and neurological origins.[15] It would be expected that the effects of TrP dry needling on patients with hemiplegic shoulder pain could be different than in individuals with musculoskeletal shoulder pain. Similarly, our results were smaller than those reported by Liu et al[14] because these authors analyzed trials including patients with neck pain. To our knowledge, our meta-analysis is the first to analyze the impact of dry needling on pain intensity and related disability for nontraumatic shoulder pain of musculoskeletal origin. Further, since dry needling should be applied over TrPs, it should be expected that the effects would be higher in people with a musculoskeletal origin of the symptoms where myofascial TrPs could have a relevant role.[10,11] Finally, it is also important to consider that, although all trials used the same needling intervention, the treatment duration ranged from 1 min to 10 min, which could lead to different clinical outcomes. We do not know if different treatment duration of the needling session would lead to different results.

It is also important to determine if the observed changes are clinically relevant. We reported an overall mean decrease of shoulder pain intensity of −0.49 point (95% CI = −0.84 to −0.13) which did not reach the minimal clinically important difference (MCID) of 1.1 points for the numerical pain rating scale (0–10) in individuals with shoulder pain.[35] This was different in the case of pain-related disability where an overall change of −9.99 points (95% CI = −15.97 to −4.01) was found. We should note that related disability was assessed with 3 different questionnaires, the DASH, SPADI, and Constant-Murley score. Roy et al[37] determined that the MCID for the DASH was 10.2 points, whereas

the MCID for the SPADI ranged between 8 and 13 points. Therefore, the effects of TrP dry needling on pain-related disability fall within the MCID for the SPADI and were closer to the score reported for the DASH, supporting a potential clinically relevant effect of TrP dry needling on pain-related disability. Nevertheless, these assumptions should be considered in the context that confidence intervals of the main effects of dry needling on pain intensity and related disability were wide.

To determine the isolated effect of dry needling was not possible from the current meta-analysis since only 1 trial compared TrP dry needling versus sham.[32] In fact, 3 trials (50%) compared the combination of dry needling with exercise or multimodal treatment versus the respective isolated intervention.[29,30,32] It is important to consider that clinicians do not apply just 1 intervention for managing patients with musculoskeletal pain; therefore, this is a pragmatic way to determine the clinical relevance of including TrP dry needling into a multimodal treatment approach. We found that dry needling was applied by physical therapists in most studies (n = 5; 83.5%). This is a relevant topic since clinical reasoning of the clinician applying this intervention can potentially modify the dry needling procedure (eg, traditional Chinese versus Western [occidental] reasoning). This is supported by the fact that all studies used the TrP hypothesis for the application of dry needling, where those muscles eliciting referred pain were the targeted tissue. Similarly, the meta-analysis by Gattie et al[38] focusing on dry needling interventions, just applied by physical therapists supported this potential difference.

The topic of a proper sham needling intervention should also be considered, since it is not possible to confirm that real dry needling is superior to sham dry needling for the treatment of nontraumatic shoulder pain of musculoskeletal origin. In fact, Braithwaite et al[39] concluded

that sham needling interventions used in clinical trials are highly diverse limiting the comparability of masking effectiveness across available studies. Therefore, current results should be considered with caution at this stage.

[H2] Safety of Trigger Point Dry Needling

An important topic to consider when applying dry needling is its potential safety. Most studies did not report the presence of any adverse event other than postneedling soreness (25% of patients). This minor adverse event was mainly attributed to the tissue damage during the needle insertion which usually disappears without any treatment after 48 to 72 h. A recent study investigating adverse events of dry needling reported that most adverse events can be categorized as minor, the top 3 being bleeding (16%), bruising (7.7%), and pain during dry needling (5.9%).[40] Nevertheless, some major adverse events, such as pneumothorax, were also reported at a rate of <0.1% (1/1024 needling treatments). Therefore, although dry needling seems to be a safe intervention when properly applied, therapists need to be aware of the potential risks associated with its application on some body areas such as the trunk.

[H2] Strengths and Limitations

Although this is the first meta-analysis analyzing the effects of TrP dry needling on pain or related disability in shoulder pain of musculoskeletal origin, the results should be analyzed according to its potential strengths and limitations. Strengths of this meta-analysis include a comprehensive literature search, methodological rigor, data extraction, rigorous statistical analysis, and the inclusion of randomized controlled trials of high methodological quality. Among the limitations, we recognized that the number of trials was small (n = 6). Additionally, the studies

also evaluated dry needling application with different dosages, that is, sessions, frequency of application and number of muscles. Another potential limitation is the heterogeneity and imprecision of the results of some of the trials; therefore, the results should be taken with caution.

[H2] Clinical and Research Implications

The current meta-analysis found some evidence supporting the application of TrP dry needling for the treatment of nontraumatic shoulder pain of musculoskeletal origin; however, several questions remain to be elucidated. First, most studies investigated just short-term effects, where only 1 study investigated long-term effects. In fact, changes observed for pain intensity were not clinically relevant since they did not reach the MCID determined for patients with shoulder pain. Therefore, there is clear needed for further randomized clinical trials examining long-term effects of TrP dry needling for shoulder pain conditions. Second, 3 trials investigated the isolated application of dry needling which does not represent common clinical practice. Future clinical trials should identify if adding TrP dry needling to multimodal approach is more effective than not including it. Third, we observed an inadequate reporting of detailed locations of the points receiving the intervention; however, it is important to understand that there is no exact anatomical location of TrPs and most muscles can exhibit multiple TrPs. Finally, a potential topic for research maybe the cost-effectiveness analysis of dry needling. There is 1 study suggesting a potential cost-effectiveness benefit of including TrP dry needling into an exercise program for people with subacromial pain syndrome,[41] but this hypothesis requires further investigation.

[H1] Conclusion

This meta-analysis found moderate quality evidence for a small effect (MD = −0.49 point [95% CI = −0.84 to −0.13]; SMD = −0.25 [95% CI = −0.42 to −0.09]) of TrP dry needling for decreasing shoulder pain intensity and low-quality evidence for a large effect (MD = −9.99 points [95% CI = −15.97 to −4.01]; SMD = −1.14 [95% CI = −1.81 to −0.47]) for reducing related disability in patients with nontraumatic shoulder pain of musculoskeletal origin. The effects on pain intensity were found only in the short term.

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Concept/idea/research design: J.L. Arias-Buria, C. Fernandez de las Penas, G. Plaza-Manzano
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All authors contributed to the study concept and design. M.N.S, G.G.C. and J.L.A.B. conducted literature review and did main statistical analysis. All authors contributed to interpretation of data. C.F.dlP. and J.C contributed to drafting the paper. All authors revised the text for intellectual content and have read and approved the final version of the manuscript.

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Systematic Review Registration

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Disclosure

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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Table 1.
Effects of Dry Needling on Pain and Related Disability for Nontraumatic Shoulder Pain[a]

Study	Intervention(s)	Sample Size	Intervention Duration	Comparison and Outcome Measure	Between-Groups Difference	95% CI	SMD
Itoh et al[31]	G1: TrP-DN	8		Pain (VAS, mm)			
	G2: sham TrP-DN	7	1 session for 5 wk	G1 vs G2	1 wk: −18.00	−36.41 to −0.41	−0.89
					2 wk: −20.00	−39.58 to −0.42	−0.94
					3 wk: −20.00	39.58 to −0.42	−0.94
					4 wk: −22.00	−41.58 to −2.42	−1.04

					5 wk: −23.00	−43.01 to −2.99	−1.06
					10 wk: −20.00	−36.21 to −3.79	−1.13
					20 wk: −13.00	−27.11 to −1.11	−0.83
				Disability (Constant-Murley score)			
				G1 vs G2	5 wk: 10.00	3.0 to 17.00	1.39
					10 wk: 3.00	−5.07 to 11.07	0.35

					20 wk: 3.00	−5.07 to 11.07	0.35
Arias-Buría et al[30]	G1: TrP-DN + exercises	25		Pain (NPRS, 0–10)			
	G2: exercises	25	1 session for 4 wk	G1 vs G2	Post: −0.10	−1.46 to 1.26	−0.04
					3 mo: 0.40	−0.46 to 1.26	0.25
					6 mo: −0.20	−1.28 to 0.88	−0.10
					12 mo: −0.10	−0.90 to 0.70	−0.07
				Disability (DASH)			

				G1 vs G2	Post: −20.60	−23.74 to −17.46	−3.58
					3 mo: −23.2	−28.13 to −18.27	−2.57
					6 mo: −23.5	−28.61 to −18.39	−2.51
					12 mo: −13.9	−18.31 to −9.49	−1.72
Salom-Moreno et al[29]	G1: TrP-DN + eccentric exercises	30		Pain (NPRS, 0–10)			
				G1 vs G2	72 h: −0.50	−1.77 to 0.77	−0.20
				G1 vs G3	72 h: −0.80	−1.97 to 0.37	−0.34

				G2 vs G3	72 h: −0.30	−1.52 to 0.92	−0.12
	G2: TrP-DN plus detuned ultrasound	30	1 session	Disability (SPADI)			
				G1 vs G2	72 h: −0.20	−4.48 to 4.08	−0.02
				G1 vs G3	72 h: −4.50	−9.75 to 0.75	−0.43
				G2 vs G3	72 h: −4.30	−9.61 to 1.01	−0.40
	G3: TrP-DN alone	30	1 session	Disability (DASH)			
				G1 vs G2	72 h: 0.20	−3.77 to 4.17	0.02

				G1 vs G3	72 h: −2.70	−7.87 to 2.47	−0.26
				G2 vs G3	72 h: −2.90	−7.75 to 1.95	−0.30
Pérez-Palomares et al[32]	G1: personalized treatment + TrP-DN	57	3 needling sessions at first, fourth, and seventh sessions	Pain (VAS)			
				G1 vs G2	Post: −0.90	−1.70 to −0.10	−0.40
					3 mo: −0.59	−1.49 to 0.31	−0.23
	G2: personalized treatment	63	10 personalized treatment sessions of 30 min (2 sessions for 5 wk)	Disability (Constant-Murley score)			
				G1 vs G2	Post: −4.15	−8.76 to 0.46	−0.32

					3 mo: −1.12	−6.33 to 4.09	−0.08
Calvo-Lobo et al[33]	G1: TrP-DN in ATrP and LTrP	33		Pain (NPRS, 0–10)			
	G2: TrP-DN in ATrP	33	1 session	G1 vs G2	1 wk: −1.64	−2.32 to −0.96	−1.18
Kamali et al[34]	G1: TrP-DN in infraspinatus	19		Pain (VAS, mm)			
				G1 vs G2	3 d: −2.1	−10.2 to 6.0	−0.16
	G2: TrP-DN in upper trapezius	21	3 sessions with 2-d intervals	Disability (DASH)			
				G1 vs G2	3 d: −6.28	−22.47 to 9.91	−0.24

[a]ATrP = active trigger point; DASH = Disabilities of the Arm, Shoulder and Hand; G1, G2, G3 = number of groups on each study; LTrP = latent trigger point; NPRS = numerical pain rating scale; Post = immediately posttreatment; SMD = standardized mean difference; SPADI = Shoulder Pain and Disability Index; TrP-DN = trigger point dry needling; VAS = visual analog scale.

Table 2.

Scores of Randomized Clinical Trials With the PEDro Scale[a]

Study	1	2	3	4	5	6	7	8	9	10	Total
Itoh et al[31]	Y	N	Y	Y	N	Y	Y	N	Y	Y	7
Arias-Buría et al[30]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8
Salom-Moreno et al[29]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8
Pérez-Palomares et al[32]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8
Calvo-Lobo et al[33]	Y	N	Y	N	N	Y	Y	Y	Y	Y	7
Kamali et al[34]	Y	N	Y	N	N	Y	Y	N	Y	Y	6

[a]PEDro = Physiotherapy Evidence Database.

Table 3.

GRADE Evidence Profile for the Effects of Dry Needling on Pain and Related Disability for Shoulder Pain[a]

Comparison	Parameter or Group (No. of Studies)	Risk of Bias[b]	Inconsistency[c]	Indirectness of Evidence[d]	Imprecision[e]	Publication Bias[f]	Quality of Evidence	SMD (95% CI)
Dry needling vs other comparative groups for shoulder pain intensity	Overall effect (6)	No	Serious (I^2 = 46%)	No	No	No	Moderate	−0.25 (−0.42 to −0.09)[g]
	Short-term subgroup (6)	No	Serious (I^2 = 56%)	No	No	No	Moderate	−0.34 (−0.55 to −0.13)[g]
	Midterm subgroup (3)	No	Serious (I^2 = 47%)	No	Serious	No	Low	−0.15 (−0.61 to 0.31)
	Long-term subgroup (1)	No	No	No	Very serious	No	Low	−0.07 (−0.62 to 0.49)
Dry needling vs other comparative groups for related	Overall effect (5)	No	Very serious (I^2 = 91%)	No	No	No	Low	−1.14 (−1.81 to −0.47)[g]

disability								
	Short-term subgroup (5)	No	Very serious (I^2 = 91%)	No	No	No	Low	−1.12 (−2.07 to −0.18)[g]
	Midterm subgroup (3)	No	Very serious (I^2 = 94%)	No	Serious	No	Low	−0.99 (−2.62 to 0.64)
	Long-term subgroup (1)	No	No	No	Very serious	No	Low	−1.72 (−2.38 to −1.06)

[a]GRADE = Grading of Recommendations Assessment, Development and Evaluation; SMD = standardized mean difference.
[b]No: most information was from results at low risk of bias; serious: crucial limitation for 1 criterion or some limitations for multiple criteria, sufficient to lower confidence in the estimate of the effect; very serious: crucial limitation for 1 or more criteria, sufficient to substantially lower confidence in the estimate of the effect.
[c]Serious: I^2 = 40%–79%; very serious: I^2 > 80%.
[d]No indirectness of evidence was found in any study.
[e]Based on sample size. Serious: n < 250 participants; very serious: n < 250 and the estimated effect was small or absent.
[f]Based on funnel plots (not shown because of the small number of trials). No publication bias was found.
[g]Statistically significant (P < .05).

Legend of Figures

Figure 1.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

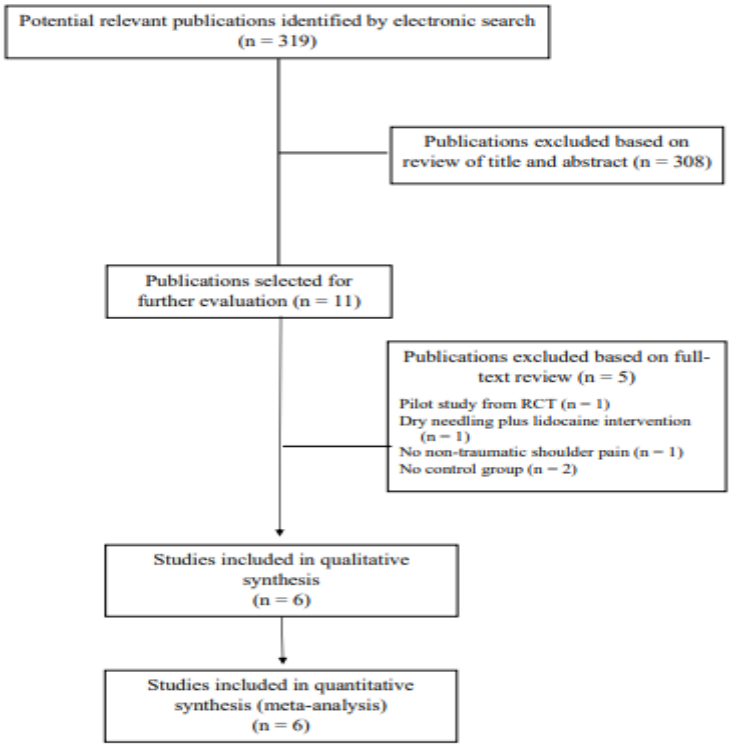


Figure 2.

Plots of risk of bias of the included studies.

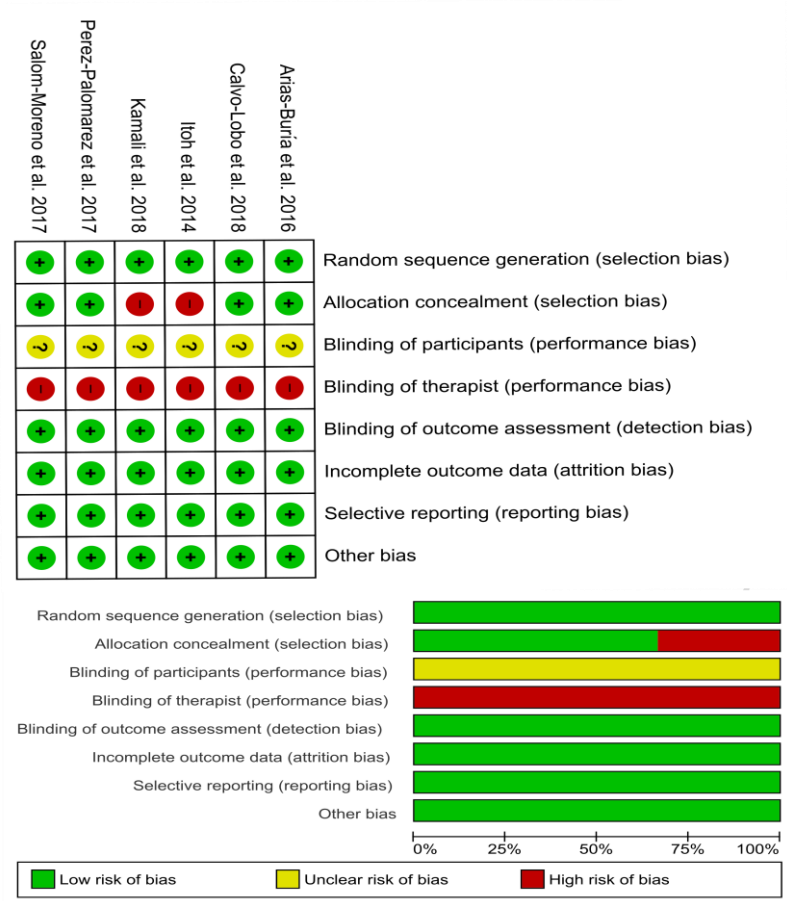
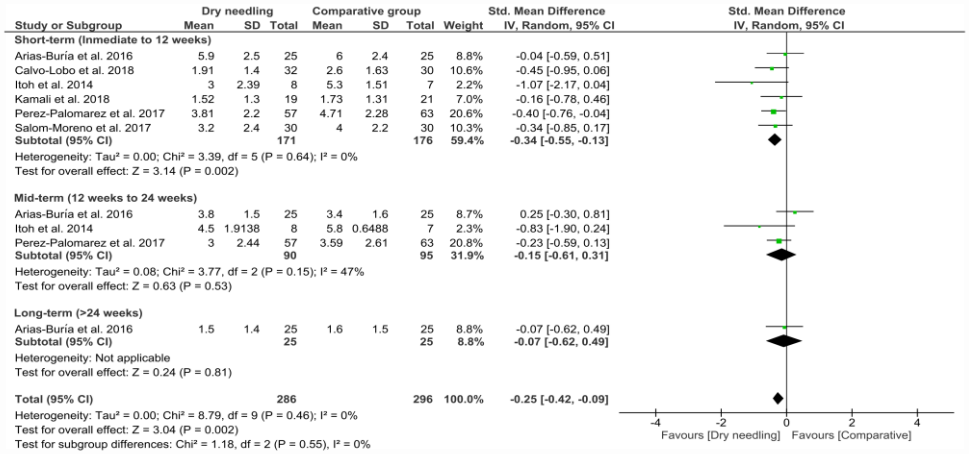


Figure 3.

(A) Comparison (standardized mean difference) of the effects of dry needling vs comparative groups pain intensity. (B) Comparison (standardized mean difference) of the effects of dry needling vs comparative groups for pain-related disability.

A. Shoulder Pain Intensity



B. Pain-Related Disability