EDITOR'S CHOICE

Dry Needling Versus Trigger Point Injection for Neck Pain Symptoms Associated with Myofascial Trigger Points: A Systematic Review and Meta-Analysis FREE

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Abstract

Objective

To examine the effects of dry needling against trigger point (TrP) injections (wet needling) applied to TrPs associated with neck pain.

Methods

Electronic databases were searched for randomized clinical trials in which dry needling was compared with TrP injections (wet needling) applied to neck muscles and in which outcomes on pain or pain-related disability were collected. Secondary outcomes consisted of pressure pain thresholds, cervical mobility, and psychological factors. The Cochrane Risk of Bias tool, the Physiotherapy Evidence Database score, and the Grading of Recommendations Assessment, Development, and Evaluation approach were used.

Results

Six trials were included. TrP injection reduced pain intensity (mean difference [MD] −2.13, 95% confidence interval [CI] −3.22 to −1.03) with a large effect size (standardized mean difference [SMD] −1.46, 95% CI −2.27 to −0.65) as compared

with dry needling. No differences between TrP injection and dry needling were found for pain-related disability (MD 0.9, 95% CI −3.09 to 4.89), pressure pain thresholds (MD 25.78 kPa, 95% CI −6.43 to 57.99 kPa), cervical lateral-flexion (MD 2.02°, 95% CI −0.19° to 4.24°), or depression (SMD −0.22, 95% CI −0.85 to 0.41). The risk of bias was low, but the heterogenicity and imprecision of results downgraded the evidence level.

Conclusion

Low evidence suggests a superior effect of TrP injection (wet needling) for decreasing pain of cervical muscle TrPs in the short term as compared with dry needling. No significant effects on other outcomes (very low-quality evidence) were observed.

Level of Evidence

Therapy, level 1a.

Keywords: Dry Needling, Trigger Point Injection, Lidocaine: Meta-Analysis, Cervical Pain, Pain, Systematic Review

Issue Section: Review Articles

Introduction

Neck pain is a common musculoskeletal condition showing a point prevalence of 20% and a lifetime prevalence of 70% in the general population [1]. The Global Burden of Disease Study identified neck pain as the fourth highest condition for number of years lived with disability [2].

The etiology of mechanical neck pain is not completely understood, and it seems to be multifactorial. One hypothesis associated with the development of neck pain is the presence of myofascial trigger points (TrPs). A TrP is defined as a hypersensitive spot in a taut band of skeletal muscle that, when stimulated, induces referred pain symptoms and also motor phenomena [3]. It has been shown that, of

all of the neck-shoulder musculature, the upper trapezius is most affected by TrPs in patients with mechanical neck pain [4]. In fact, the referred pain elicited by active TrPs from the upper trapezius muscle often reproduces symptoms associated with insidious neck pain or traumatic neck pain [3].

Different therapeutic approaches are advocated for the management of TrPs, with needling interventions being the most commonly used [5]. There are two needling procedures used for the management of TrPs: wet and dry needling [3]. Wet needling (also called TrP injections) refers to procedures that include the injection of a substance (usually a local anesthetic) into a TrP through a hypodermic beveled-cutting-edge needle, whereas dry needling is defined as a "skilled intervention using a thin filiform needle to penetrate the skin that stimulates myofascial TrPs, muscles, and connective tissue for the treatment of musculoskeletal pain disorders" [6].

Current evidence supporting the effects of either needling intervention is conflicting. The review by Cagnie et al. recommended dry needling for the treatment of patients with upper trapezius TrPs; however, no meta-analysis was conducted [7]. The meta-analysis by Liu et al. recommended dry needling for the management of neck-shoulder myofascial pain at short- and mid-term follow-ups [8]. These authors included a comparison between TrP injections and dry needling and found that TrP injection (wet needling) was more effective than dry needling 1 month after the intervention [8].

A previous review found a trend toward a greater effect of lidocaine injection for reducing pain over dry needling in individuals with neck-shoulder pain [9]; however, the analysis of that study has been questioned [10]. The meta-analysis investigated only changes in pain intensity [9]. One review investigating the effects of TrP injection (wet needling) and dry needling in people with temporomandibular pain found inconclusive evidence in favor of either needling intervention [11]. Similarly, two recent meta-analyses reported low evidence supporting the use of local anesthetic injections for decreasing pain in individuals with head-neck myofascial pain [12,

13]. These meta-analyses included patients with multiple diagnoses, including headache, temporomandibular pain, and neck pain.

To the best of the authors' knowledge, no meta-analysis has specifically compared the effects of TrP injection (wet needling) with the effects of dry needling in the management of neck pain symptoms associated with TrPs. Additionally, more clinical trials have been published since the publication of the meta-analysis by Liu et al. [8]. Therefore, an updated analysis of the current literature comparing the effects of TrP injection (wet needling) vs dry needling is needed.

The purpose of the present systematic review and meta-analysis was to compare dry needling with TrP injection (wet needling), applied over neck-shoulder muscle TrPs that reproduce neck pain of musculoskeletal origin, with regard to effects on pain intensity, pain-related disability, pain sensitivity, and cervical range of motion.

Methods

This systematic review and meta-analysis adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [14]. The international OPS Registry registration link is https://doi.org/10.17605/OSF.IO/3H6GS. The methods used in the present review and meta-analysis have been used in previous meta-analyses and have been described in detail previously [15–17]. We will briefly summarize the most relevant aspects here.

Systematic Literature Search and Selection Criteria

Electronic literature searches were conducted in the MEDLINE, CINAHL, PubMed, PEDro, Cochrane Library, SCOPUS, and Web of Science databases from their inception to July 10, 2020. If possible, searches were restricted to randomized clinical trials. This systematic review and meta-analysis included randomized clinical trials in which any form of dry needling was compared with any form of TrP injections (wet needling) in adults with neck pain due to myofascial TrPs. Acupuncture was excluded. The primary outcome of the trial had to include pain intensity or pain-related disability. Pressure pain

sensitivity (e.g., pressure pain thresholds), cervical range of motion, or psychological factors (e.g., depression, anxiety) were considered as secondary outcomes. The search strategy for each database can be seen in Supplementary DataTable 1.

Table 1. Characteristics of the sample of the included studies

Study	Diagnosis	Group	Total (Men/Women)	Age, y, mean±SD	Pain Durat mo, mear
Hong et al. [27]	Myofascial pain syndrome	G1: LI with LTR + home program	35 (10/25)	41.6±11.4	10.6±
		G2: DN with LTR + home program	23 (6/17)	41.8±12.8	8.1±4
		G1a: LI with LTR + home program*	26 (7/19)	42.2±12.1	10.2±
		G2a: DN with LTR + home program*	15 (4/9)	41.7±14.4	7.6±4
		G1b: LI without LTR + home program	9 (3/6)	39.9±9.6	11.7±
		G2b: DN without LTR + home program	8 (2/6)	42.1±10.2	9.1±4
Kamanli et al. [28]	Myofascial pain syndrome	G1: DN	10 (NR)	37.2±8.1	32.5±
		G2: LI injection	10 (NR)	37.3±9.75	49.2±

		G3: bolutinum toxin-A injection (N/A)	9 (NR)	38.3±5.25	50.6±
Ay et al. [30]	Myofascial pain syndrome	G1: DN + home exercises	40 (14/26)	38.1±9.8	34.3±
		G2: LI + home exercises	40 (14/26)	37.2±10.1	30.6±
Ga et al. [29]	Diagnosis of neck pain and myofascial pain syndrome	G1: DN + self-stretching	18 (1/17)	79.2±6.8	>6 mo
		G2: LI + self-stretching	21 (2/19)	75.9±8.7	>6 mo
Eroglu et al. [31]	Diagnosis of neck pain and myofascial pain syndrome	G1: DN	20 (1/19)	33.75±8.1	48 (ra 2–120
		G2: LI injection	20 (6/14)	32.85±9.05	36 (ra 3–120
		G3: flurbiprofen injection (N/A)	20 (0/20)	34.55±8.3	24 (ra 1–72)
Raeissadat et al. [33]	Diagnosis of neck pain and myofascial pain syndrome	G1: DN	20 (4/16)	41.6±6.8	4.6±1
		G2: ozone injection	22 (6/16)	37.6±8.8	4.4±1
		G3: LI injection (N/A)	20 (4/16)	39.4±7.7	4.4±1
Ibrahim et al. [32]	Myofascial pain syndrome	G1: DN	20 (10/10)	70.05±4.9	>3 mo
		G2: LI injection	20 (9/11)	68.2±3.2	>3 mo

DN= dry needling; LI= lidocaine injection; LTR= local twitch response; NR= not reported; N/A= not applicable to the meta-analysis.

* Groups included in the meta-analysis due to the time period analysis.

Screening, Selection Process, and Data Extraction

Articles identified from the different databases were independently reviewed by two authors, as previously described [15–17]. A standardized form was used for extracted data from each trial. Data extraction was conducted by two authors, as previously described [15–17].

Assessment of Methodological Quality and Risk of Bias

The risk of bias (RoB) of the included trials was independently assessed by two authors using the Cochrane Risk of Bias assessment tool [18]. The RoB was applied and classified according to the Cochrane Collaboration's tool [18]. The methodological quality of the studies was evaluated with the Physiotherapy Evidence Database (PEDro) scale [19]. A trial was considered to be of high quality when the PEDro score was ≥6 out of 10 points [19].

Level of Evidence

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach was used to summarize the quality of the evidence [20]. The level of evidence was classified as high (when all items were negative), moderate (when one item showed serious risk), low (when two items showed serious risk or one item very serious risk), or very low (when three or more items had serious risk or two or more items had very serious risk) [21].

Data Synthesis and Analysis

Data synthesis considered the following follow-up periods: short-term follow-up (1 to 12 weeks), mid-term follow-up (12 to 24 weeks), and long-term follow-up (>24 weeks), 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 trial presented nonparametric values (medians and interquartile ranges), they were converted to means and standard deviations as appropriate [22, 23].

Cervical range of motion was pooled just for lateral-flexion, as it was the only motion assessed in more than two studies. When the trial calculated the total range of motion or either side separately, the mean was used in the quantitative analysis.

A random-effects model was used to determine the overall effect size (standardized mean difference [SMD]). Effect sizes on all outcomes were calculated at short-term follow-up (1 to 12 weeks), as no mid- or long-term data were available. Effect sizes (SMD) were classified as large (≥0.8), moderate (from 0.5 to 0.79), or small (from 0.2 to 0.49) [24]. *P* values <0.05 were considered statistically significant.

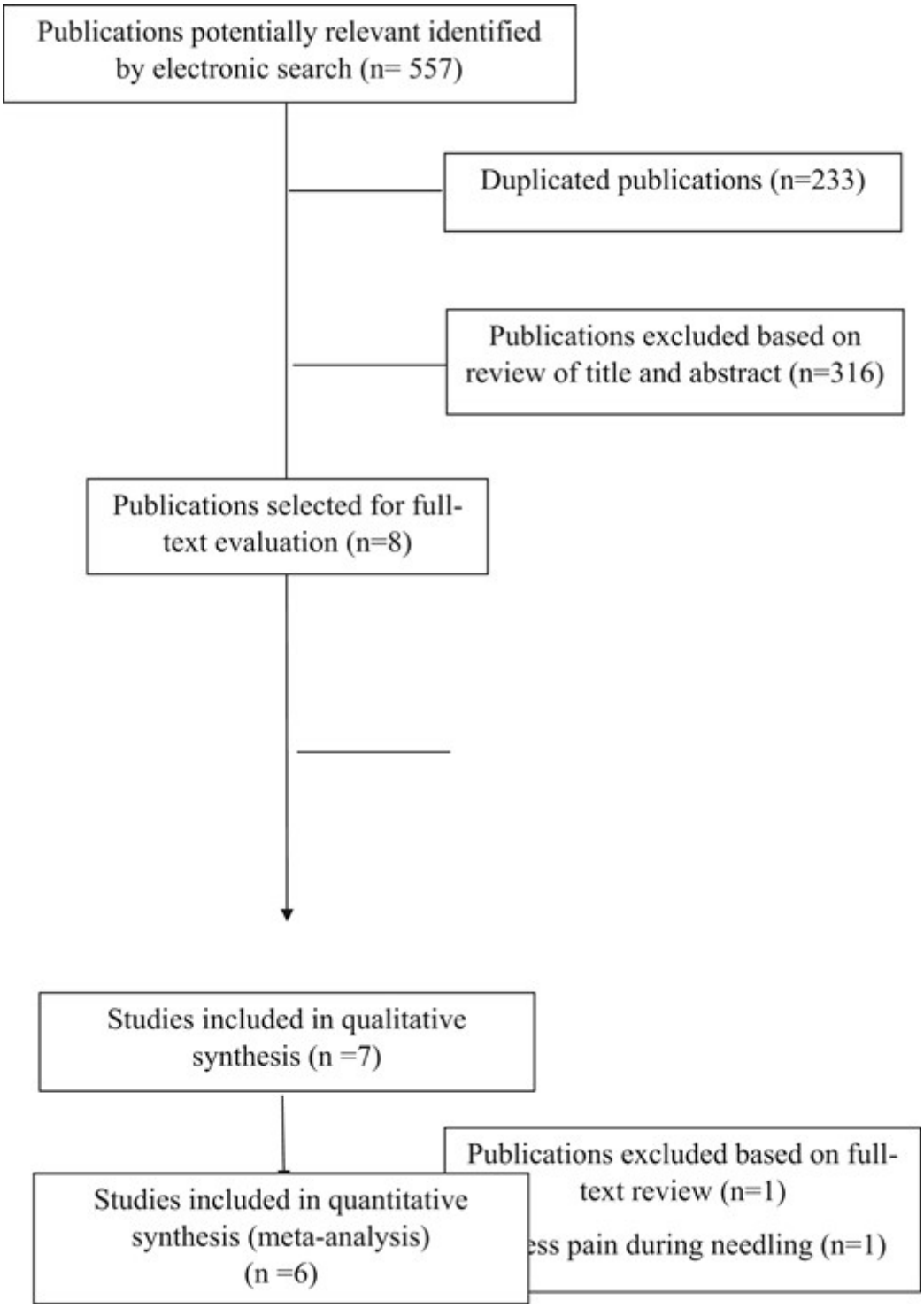
The heterogeneity of the studies was assessed with the I^2 statistic and classified as considerable heterogeneity (I^2 from 75% to 100%), substantial heterogeneity (I^2 from 50% to 90%), moderate heterogeneity (I^2 from 30% to 60%), or not relevant/important heterogeneity (I^2 from 0% to 40%) [25].

Results

Study Selection

A total of 557 potential studies were identified for review. After removal of duplicates, 324 studies remained. Of those, 316 were excluded after their titles or abstracts had been read, which left eight articles for full-text analysis [26–33]. One article was excluded because it measured the intensity of pain during each needling intervention [26]. Finally, a total of seven trials [27–33] were included in the systematic review, and six trials [27–30, 32, 33] were included in the quantitative analyses (Figure 1).

Figure 1.



PRISMA flow diagram.

Study Characteristics

The characteristics of the participants of the included studies are shown in Table 1. Supplementary DataTable 2 summarizes the characteristics of the needling interventions applied in each trial. All

studies targeted active TrPs (i.e., those that referred pain that reproduced the patient's symptoms) with the needle, five targeted only upper trapezius TrPs [24, 26, 29, 30], and the remaining two targeted active TrPs in all neck muscles identified [28, 31]. Five trials reported the presence of local twitch responses during the needling intervention [27, 29–32]. All clinical trials included a group receiving lidocaine injection as a TrP injection (wet needling) and a group receiving dry needling . Kamanli et al. [28] also included one group receiving botulinum toxin injection, and Raeissadat et al. [33] included one group receiving oxygen injection. Only the comparison between lidocaine injection and dry needling was pooled in the quantitative analysis. All trials except one [31] applied just one needling treatment session. All studies included neck pain as the primary outcome, whereas just one included pain-related disability [33]. Pressure pain thresholds and depressive levels were assessed in three studies, and cervical range of motion in lateral-flexion was assessed in four studies. All included studies investigated the effects at short-term follow-up, ranging from 2 to 4 weeks (mean: 3 ± 1 week) [27–30, 32, 33].

Table 2. Score of randomized clinical trials with PEDro scale

	1	2	3	4	5	6	7	8	9	10	TOTAL
Hong et al. [27]	Y	N	Y	N	N	Y	N	N	Y	Y	5/10
Kamanli et al. [27]	Y	N	Y	N	N	N	Y	N	Y	Y	5/10
Ga et al. [29]	Y	N	Y	N	N	N	Y	N	Y	Y	5/10
Ay et al. [30]	Y	Y	Y	N	N	N	Y	Y	Y	Y	7/10
Eroglu et al. [31]	Y	N	Y	Y	N	Y	Y	N	Y	Y	7/10
Raeissadat et al. [33]	Y	Y	Y	Y	N	N	Y	N	Y	Y	8/10
Ibrahim et al. [32]	Y	N	Y	Y	N	Y	Y	Y	Y	Y	8/10

1 = random allocation of participants; 2 = concealed allocation; 3 = similarity between groups at baseline; 4 = participant blinding; 5 = therapist blinding; 6 =

assessor blinding; 7 = fewer than 15% dropouts; 8 = intention-to-treat analysis; 9 = between-group statistical comparisons; 10 = point measures and variability data.

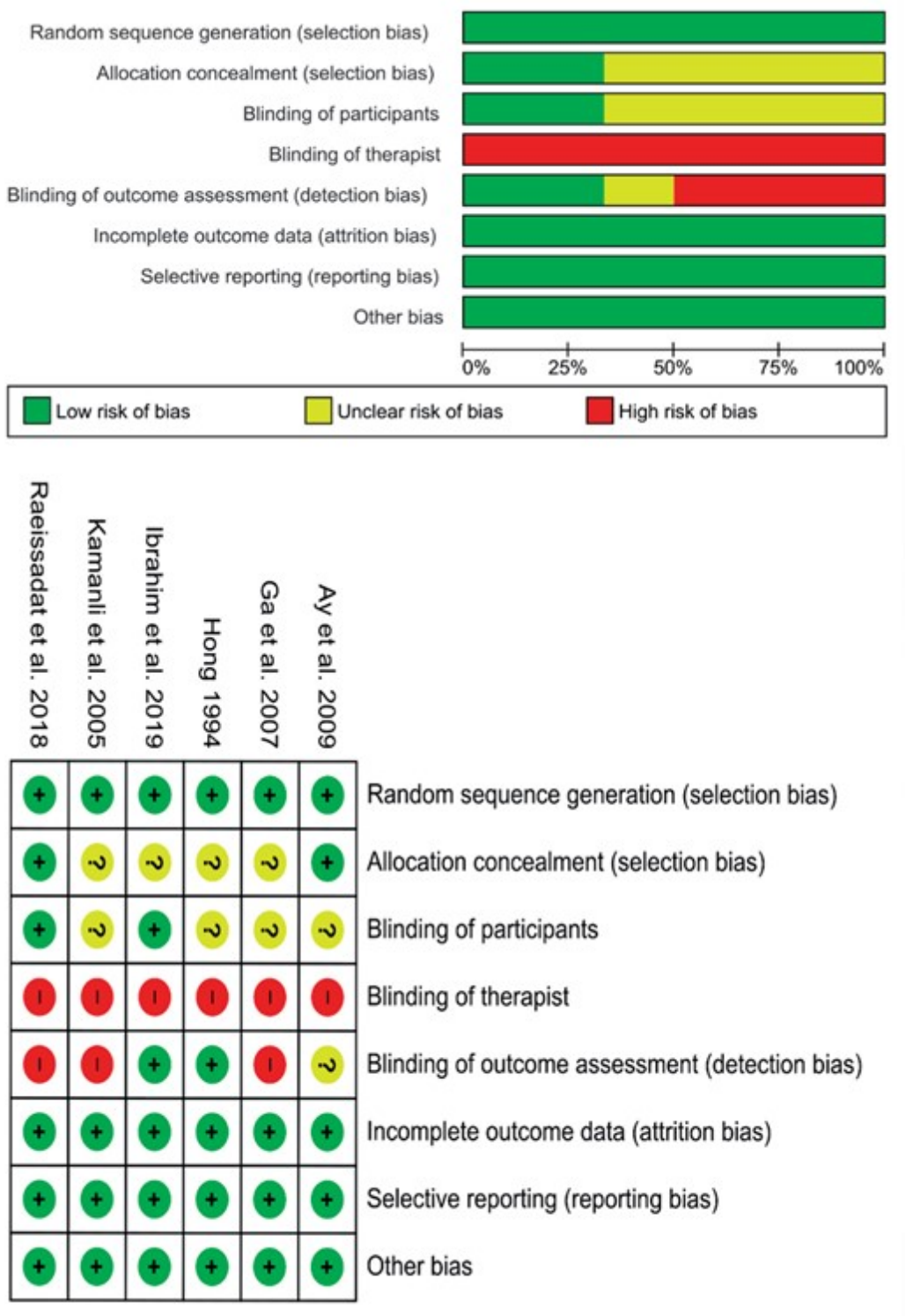
Methodological Quality

The methodological quality scores ranged from 5 to 8 (mean: 6.4, standard deviation: 1.4) out of a maximum of 10 points. Four studies (57%) were considered to be of high methodological quality (≥6 points), and the remaining three (43%) were considered to be of low methodological quality (<6 points). The most frequent methodological quality bias was lack of blinding of the participants, as only one study was able to report this item . Table 2 represents the details of the PEDro scale of each trial.

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 blind the therapists, and most trials had an unclear or high RoB in the item of blinding assessors and participants. In general, the RoB of the included trials in the present meta-analysis was low.

Figure 2.



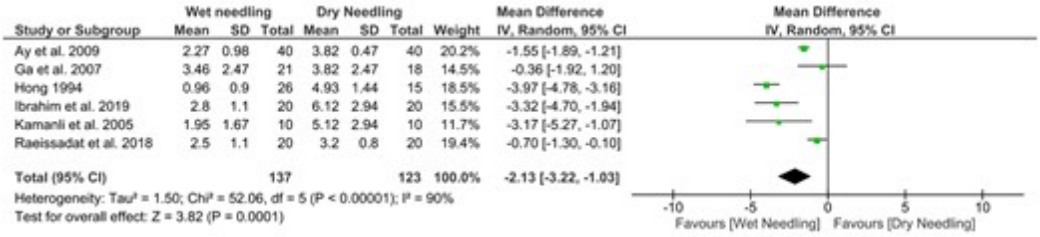
Plots of the RoB of the included studies.

Effects of TrP Injections vs Dry Needling on Pain and Pain-Related Disability

The meta-analysis found a statistically significant effect ($P < 0.001$) for reducing pain

(mean difference [MD] −2.13, 95% confidence interval [CI] −3.22 to −1.03, n = 6 trials, Figure 3) of TrP injection (wet needling) vs dry needling, with a large effect size (SMD −1.46, 95% CI −2.27 to −0.65, n = 291, $Z = 3.54$, $P = 0.0004$) but also with considerable heterogeneity ($I^2 = 91\%$) between studies at short-term follow-up. One study investigating the immediate differences reported no significant effect of TrP injection (wet needling) vs dry needling (MD −0.58, 95% CI −1.20 to 0.04) [27]. Similarly, no differences at mid-term follow-up (MD −0.28, 95% CI −0.64 to 0.08) were observed [30]. Table 3 summarizes the main results of the included studies.

Figure 3.



Comparison (MD) between the effects of TrP injection (wet needling) and the effects of dry needling on pain intensity at short-term follow-up.

Table 3. Results of the included studies

Study	Outcome/Group	Baseline Mean± SD	Short-Term Follow-Up (<12 Weeks after Treatment) Mean± SD
Hong et al. [27]	Pain (NPRS, 0–10)		
	G1a	7.88± 0.93	0.96± 0.90 (2 wk)
	G2a	7.80± 0.83	4.93± 1.44 (2 wk)
	PPT (kPa)		
	G1a	272.62± 55.89	361.86± 61.78 (2 wk)

	G2a	276.54± 68.64	363.82± 46.09 (2 wk)
	Lateral flexion (°)		
	G1a	34.8± 10.2	48.8± 9.2 (2 wk)
	G2a	35.7± 15.3	47.7± 18.2 (2 wk)
Kamanli et al. [28]	Pain (VAS, 0–10)		
	G1	7.03± 2.68	5.12± 2.94 (4 wk)
	G2	6.90± 1.43	1.95± 1.67 (4 wk)
	G3 (N/A)	6.09± 1.95	2.68± 1.04 (4 wk)
	PPT (kPa)		
	G1	302.04± 43.14	371.67± 76.49 (4 wk)
	G2	313.81± 41.18	427.56± 81.39 (4 wk)
	G3 (N/A)	314.79± 55.89	389.32± 76.49 (4 wk)
	Depression (0–53)		
	G1	10.80± 4.05	11.30± 3.65 (4 wk)
	G2	9.20± 5.65	7.00± 3.53 (4 wk)
	G3 (N/A)	12.62± 6.23	8.50± 4.81 (4 wk)
Ga et al. [29]	Pain (VAS, 0–10)		
	G1	6.98± 1.32	3.82± 2.47 (2 wk)
	G2	6.43± 2.08	3.46± 2.47 (2 wk)
	Lateral flexion (°)		

	G1	25.28± 6.08	35.00± 6.47 (2 wk)
	G2	29.65± 9.6	38.45± 10.62 (2 wk)
	Depression (GDS-SF)		
	G1	5.44± 3.15	4.17± 3.68 (2 wk)
	G2	6.10± 3.95	5.14± 4.35 (2 wk)
	Pain (VAS, 0–10)		
	G1	5.55± 1.33	3.82± 0.47 (4 wk)
	G2	5.82± 1.25	2.27± 0.98 (4 wk)
Ay et al. [30]	Right lateral flexion		
	G1	42.37± 2.52	42.25± 2.76 (4 wk)
	G2	41.25± 2.19	41.25± 2.46 (4 wk)
	Left lateral flexion		
	G1	42.62± 2.52	43.20± 2.39 (4 wk)
	G2	41.12± 2.50	42.12± 2.50 (4 wk)
	Lateral flexion (mean calculated)		
	G1	42.49± 2.52	42.72± 2.57 (4 wk)
	G2	41.18± 2.34	42.18± 2.50 (4 wk)
	Depression (BDI, 0–21)		

	G1	12.12± 3.57	10.87± 3.25 (4 wk)
	G2	14.52± 16.92	10.67± 2.58 (4 wk)
Eroglu et al. [31] (Excluded from meta-analysis)	• VAS pain • PPT • Right-lateral flexion • Left-lateral flexion • Right rotation • Left rotation	No differences were found between groups	No significant differences were obtained between groups in PPT, VAS, cervical range of motion
Raeissadat et al. [33]	VAS (0–10)		
	G1	6.3± 0.7	3.2± 0.8 (4 wk)
	G2 (N/A)	5.7± 0.9	2.4± 1.5 (4 wk)
	G3	6.2± 0.9	2.5± 1.1 (4 wk)
	PPT (kPa)		
	G1	272.62± 36.28	322.63± 37.26 (4 wk)
	G2 (N/A)	281.44± 67.66	363.82± 83.35 (4 wk)
	G3	284.39± 50.99	360.88± 45.11 (4 wk)
	Lateral flexion (°)		
	G1	32.8± 4.7	33.9± 3.9 (4 wk)
	G2 (N/A)	33.9± 4.2	35.9± 3.9 (4 wk)

	G3	33.8± 6.5	37.5± 3.0 (4 wk)
	Disability (NDI, %)		
	G1	46.3± 9.1	40.8± 7.3 (4 wk)
	G2 (N/A)	49.6± 11.4	36.8± 9.8 (4 wk)
	G3	51.0± 7.0	39.9± 7.9 (4 wk)
Ibrahim et al. [32]	Pain (VAS, 0–10)		
	G1	7.03± 2.68	6.12± 2.94 (2 wk)
	G2	7.42± 0.82	2.8± 1.1 (2 wk)

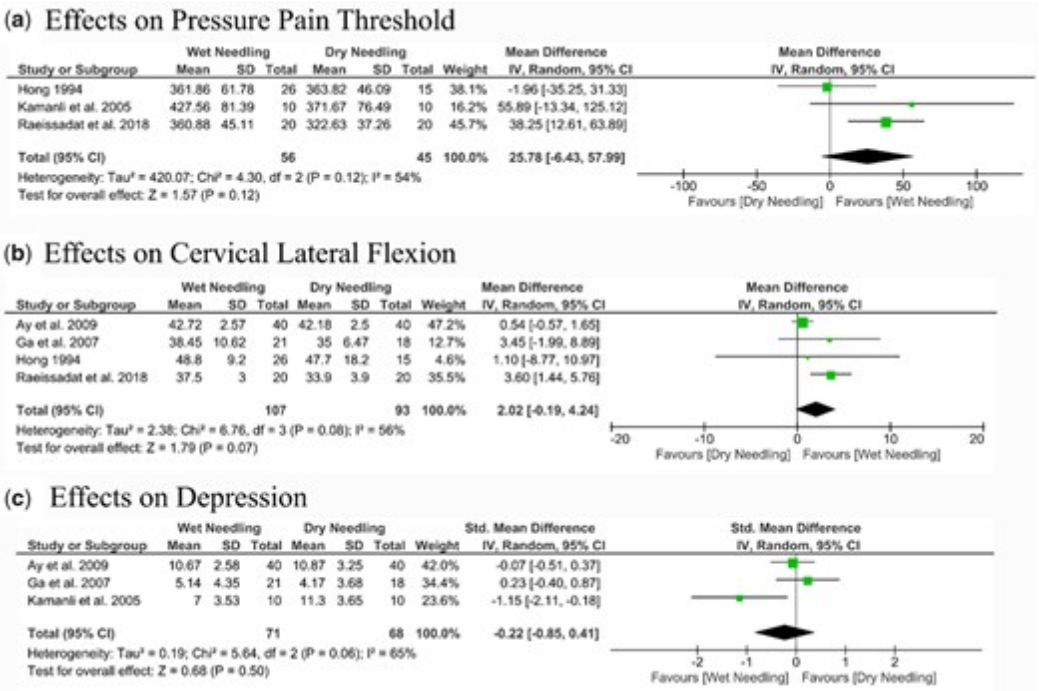
G = group; VAS = visual analog scale; NPRS = numeric pain rating scale; NDI = Neck Disability Index; PPT = pressure pain thresholds; BDI = Beck Depression Inventory; GDS-SF = Geriatric Depression Scale—Short; N/A = group not included in the meta-analysis.

Since only one trial investigated changes in pain-related disability between TrP injection (wet needling) and dry needling, a meta-analysis was not possible. No significant between-group differences were found (MD 0.90, 95% CI −3.09 to 4.89) for pain-related disability [33].

Effects of TrP Injection vs Dry Needling on Secondary Outcomes

The meta-analysis found that TrP injection (wet needling) exhibited a nonsignificant effect (MD 25.78 kPa, 95% CI −6.43 to 57.99 kPa, n = 101, $Z = 1.57$, $P = 0.12$, n = 3 trials) for increasing pressure pain thresholds as compared with dry needling, with moderate heterogeneity ($I^2 = 54\%$) between studies (Figure 4A). Similarly, no significant immediate differences (MD 22.55 kPa, 95% CI 22.37 to 67.47 kPa) in pressure pain threshold were found [27].

Figure 4.



Comparison between the effects of TrP injection (wet needling) and the effects of dry needling on **(A)** pressure pain thresholds (MD), **(B)** cervical range of motion in latera-flexion (MD), and **(C)** depressive levels (SMD) at short-term follow-up.

TrP injections (wet needling) did not show a significant effect (MD 2.02°, 95% CI −0.19° to 4.24°, n = 200, $Z = 1.79$, $P = 0.08$, n = 4 trials) as compared with dry needling for improving cervical lateral-flexion range of motion (Figure 4B). There was substantial heterogeneity between the trials ($I^2 = 56\%$). The only trial investigating immediate changes in cervical lateral-flexion motion reported no significant differences (MD 4.70°, 95% CI −0.30° to 9.70°) between TrP injection and dry needling [27]. Table 3 summarizes main results of the studies.

No significant differences (SMD −0.22, 95% CI −0.85 to 0.41, n = 139, $Z = 0.68$, $P = 0.50$, n = 3 trials, Figure 4C) in depressive symptoms between TrP injection (wet needling) and dry needling were either observed at short-term follow-up. This analysis showed moderate heterogeneity ($I^2 = 65\%$).

Quality of Evidence (GRADE)

Table 4 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/very serious inconsistency of the results (heterogeneity) and the serious/very serious imprecision downgraded the evidence level for TrP injection (wet needling) to low or very low.

Table 4. Level of Evidence (GRADE) for effects of TrP injection (wet needling) and dry needling on pain intensity, pressure pain sensitivity, cervical range of motion, and depressive levels in patients with neck pain

Number of Studies	RoB	Inconsistency	Indirectness of Evidence	Imprecision	Publication Bias
TrP injection (wet needling) vs dry needling on neck pain intensity					
Overall effect (n = 6)	No	Very serious (I^2 = 91%)	No	No	No
TrP injection (wet needling) vs dry needling on pressure pain sensitivity					
Overall effect (n = 3)	No	Serious (I^2 = 49%)	No	Serious	No
TrP injection (wet needling) vs dry needling on cervical lateral-flexion motion					
Overall effect (n = 4)	No	Serious (I^2 = 74%)	No	Very serious	No
TrP injection (wet needling) vs dry needling on depressive levels					

Overall effect (n =3)	No	Serious (I^2 = 57%)	No	Very serious	No

* Statistically significant ($P<0.05$).

RoB: No = most information is from results at low RoB; serious = crucial limitation for one criterion, or some limitations for multiple criteria, sufficient to lower confidence in the estimate of effect; very serious = crucial limitation for one or more criteria sufficient to substantially lower confidence in the estimate of effect.

Inconsistency: Serious= I^2>40%; very serious=I^2>80%.

Indirectness of evidence: No indirectness of evidence was found in any study.

Imprecision (based on sample size): Serious=n<250 subjects; very serious=n< 250, and the estimated effect is little or absent.

Publication bias (based on funnel plots): No publication bias was found. Funnel plots are not shown because of the small number of trials.

Adverse Events

Most studies did not report any serious adverse event [27–30, 32, 33]. Only one study did not provide information about adverse events [31] (Supplementary DataTable 3). The most common adverse events with the application of TrP injections (wet needling) were post-needling soreness, muscle pain, and discomfort after the intervention [27–29]. Other adverse events included paresthesia, fatigue, headache, hemorrhage, transient flare reaction, and dizziness [27–30, 32, 33]. All of these adverse events did not need further treatment and disappeared after a few days.

The most common adverse events with dry needling application were post-needling soreness, pain, and discomfort after the intervention [27, 29]. One patient experienced a transient flare reaction after dry needling [33]. All these adverse events did not need further treatment and disappeared spontaneously after a few days.

Discussion

TrP Injection (Wet Needling) or Dry Needling

This meta-analysis compared the effects of TrP injection (wet needling) vs dry needling for the management of neck pain symptoms of musculoskeletal origin associated with TrPs. We found low evidence suggesting that TrP injections (wet needling) with lidocaine had a superior effect for reducing pain when compared with dry needling. The RoB of the trials included in this meta-analysis was generally low, but the inconsistency (heterogeneity) and imprecision of the results downgraded the evidence level (GRADE).

The present meta-analysis is the first one specifically analyzing the impact of TrP injection (wet needling) vs dry needling on neck pain intensity, pain-related disability, pressure pain sensitivity, range of motion, and depressive levels in people with TrPs associated with neck pain. A previous meta-analysis did not find significant differences between these needling interventions [9], but the results should be considered with caution [10]. In contrast, Liu et al. [8] found a large effect for TrP injection (wet needling) when compared with dry needling (SMD 1.69; 95% CI 0.40 to 2.98) at 4 weeks. Our results are similar (SMD −1.46, 95% CI −2.27 to −0.65) to those previously reported by Liu et al. [8]; however, they considered 9–28 days after the intervention as mid-term follow-up, when it may be more appropriate to be considered as short-term follow-up. In addition, our results were similar to those previously reported in people with temporo-mandibular pain disorders associated with masticatory TrPs [12, 13]. Current evidence would support that TrP injection (wet needling) may be effective for the management of pain associated with neck and head TrPs (low evidence); however, it should be considered that the effects were mostly observed at short-term follow-up (2 to 12 weeks after treatment).

The pooled data reported an overall mean decrease of pain intensity of −2.13 points (95% CI −3.22 to −1.03) after TrP injections (wet needling). This between-groups MD reached the minimal clinically important difference (MCID) of 2.1 points described for subjects with

mechanical neck pain [34] and was superior to the MCID (1.4 cm) determined by Bijur et al. [35]. This between-groups MD suggests a potential clinical superiority of TrP injections (wet needling) vs dry needling; however, it should be considered that the lower bound of the confidence interval did not surpass the MCID. It is possible that some individuals with myofascial TrPs associated with neck pain symptoms exhibit more benefits from TrP injections or dry needling than do others.

We were unable to pool data for comparing the effects of TrP injections vs dry needling for pain-related disability because this outcome was included in only one study. No between-groups differences were observed. Similarly, we did not observe significant differences between TrP injection (wet needling) and dry needling in changes observed in pressure pain sensitivity, cervical range of motion in lateral-flexion, and depression. The results suggest that both needling interventions produced similar effects on these outcomes, although this conclusion should be considered with caution (very low evidence).

Adverse Events

Safety is an outcome highly relevant to the application of a needling intervention. Most studies reported the presence of post-needling soreness after either TrP injections or dry needling interventions. Boyce et al. reported that minor adverse events after dry needling can be seen in up to 37% of the patients, with bleeding (16%), bruising (7.7%), and pain during dry needling (5.9%) being the most frequent [36]. Post-needling soreness is attributed mainly to tissue damage during needle insertion. It is important to note that most trials included in the present meta-analysis compared lidocaine TrP injections and dry needling applied with a syringe needle instead of a solid-filament acupuncture needle. The level of tissue damage induced by beveled-cutting-edge needles is higher than that observed with the solid-filament needles commonly used in dry needling [5]. In fact, one major adverse event of needling thoracic and paraspinal muscles is the possibility of needling the lung and creating a pneumothorax. In such a scenario, the length of the needling, instead

of the gauge, could be more relevant for a safe application of the needling procedure. Although TrP injections (wet needling) and dry needling seem to be safe procedures, clinicians need to consider the potential risks associated with their application in each body area to which they are applied.

Strengths and Limitations

The results of this updated meta-analysis comparing the effects of TrP injections (wet needling) with the effects of dry needling should be analyzed according to its strengths and weaknesses. Strengths of this meta-analysis include a comprehensive literature search, methodological rigor, data extraction, and statistical analysis. Among the limitations, we recognized that the number of trials included in the quantitative analysis was small (n = 6), and only two were of high methodological quality. Nevertheless, this is the largest number of trials included in a meta-analysis on this topic . Additionally, the heterogeneity seen in the forest plots limits extrapolation of the results. This heterogeneity leads to the use of a random-effects model rather than the use of a fixed-effects model [37]. In fact, the results reported by Eroglu et al. [28] were not included in the present meta-analysis, although the inclusion and exclusion criteria were met, because no post-intervention data were provided in that study and no answer from authors was obtained. Second, the dosage (volume of lidocaine) and pH used during TrP injections (wet needling) was not clarified in most studies. Finally, no mid- or long-term data comparing TrP injection (wet needling) vs dry needling are available. Therefore, large-scale, high-quality clinical trials including longer follow-ups are necessary to determine the advantages or disadvantages of TrP injections (wet needling) and dry needling.

Clinical and Research Implications

This meta-analysis found low evidence supporting the application of TrP injection (wet needling) for the treatment of musculoskeletal neck pain associated with active TrPs; however, several questions remain to be elucidated. First, most studies investigated just short-term effects. Further high–methodological quality randomized

controlled trials including mid- and long-term follow-ups are needed. Second, four trials investigated the isolated application of lidocaine TrP injection or dry needling, which does not represent common clinical practice [28, 31–33]. Similarly, most studies targeted only the upper trapezius muscle, which, again, does not represent the clinical practice for patients with mechanical neck pain. In fact, most studies applied the needling intervention unilaterally, when the bilateral presence of TrPs in the upper trapezius muscle is commonly observed in patients with neck pain symptoms [4]. Future clinical trials should identify whether adding TrP injection or dry needling to multimodal and pragmatic approaches is more effective not including it in this pain population. Third, we observed an inadequate reporting of injection or needling location; however, it is important to understand that there is no exact anatomic location of TrPs, and most muscles can exhibit multiple TrPs. Finally, a topic for future research may be the cost-effectiveness analysis of both TrP injection (wet needling) and dry needling interventions. As lidocaine injections seem to be more expensive than dry needling, this context requires future well-conducted trials to evaluate their cost-effectiveness.

Conclusion

On the basis of the available evidence to date, this systematic review and meta-analysis found low-quality evidence suggesting that lidocaine TrP injection exhibits a superior effect for reducing pain when compared with dry needling in patients with TrPs associated with neck pain symptoms. Very low-quality evidence showed no significant differences in pain-related disability, pressure pain sensitivity, and depressive levels. The RoB of the included trials was generally low, but the inconsistency (heterogeneity) and the imprecision of the results downgraded the level of evidence. Future trials investigating mid-and long-term follow-up periods are needed to further determine the effects of both needling interventions.

Supplementary Data

Supplementary Data may be found online at http://painmedicine.oxfordjournals.org.

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Supplementary data

pnab188_Supplementary_Data - zip file