The Long-Term Effectiveness of Trigger Point Dry Needling and Exercise for Individuals With Shoulder Pain: A Critically Appraised Topic

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Clinical Scenario: Shoulder pain is a very common symptom encountered in outpatient physical therapy practice. In addition to therapeutic exercise and manual therapy interventions, trigger point dry needling (TDN) has emerged as a possible treatment option for reducing shoulder pain and improving function. Dry needling consists of inserting a thin stainless-steel filament into a myofascial trigger point with the intention of eliciting a local twitch response of the muscle. It is theorized that this twitch response results in reduced muscle tension and can aid in reduced pain and disability. To this point, multiple studies have found TDN to be effective at reducing pain and improving function in the short-term, but the long-term outcomes remain unknown.

Clinical Question: Does the addition of TDN to an exercise program result in better long-term pain intensity and disability reduction in patients with shoulder pain? **Summary of Findings:** Improvement in long-term pain and function can be expected regardless of the addition of TDN to an evidence-based exercise program for patients with shoulder pain. **Clinical Bottom Line:** Either TDN or an evidence-based therapeutic exercise program elicits improved long-term pain and disability reduction in patients with shoulder pain, which suggests that clinicians can confidently use either approach with their patients. **Strength of Recommendation:** Strong evidence (level 2 evidence with PEDro scores >8/10) suggesting that TDN does not outperform therapeutic exercise regarding long-term pain reduction.

Keywords: shoulder complex, manual therapy

Clinical Scenario

Shoulder pain is the third most commonly encountered musculoskeletal condition in orthopedic physical therapy practice, behind only neck and low-back pain.¹ Shoulder pain accounts for approximately 14% to 21% of all musculoskeletal visits, and the estimated costs approach 7 billion dollars annually in the United States.^{2,3} Shoulder pain involves a range of pathologies, such as subacromial impingement, rotator cuff tendonitis, instability, and subacromial bursitis. These conditions have traditionally been managed with corticosteroid injections and physical therapy intervention consisting of improving strength and flexibility.^{4,5}

In addition to therapeutic exercise and manual therapy interventions, trigger point dry needling (TDN) has emerged as a possible treatment option for reducing shoulder pain and functional status.⁶ TDN is an intervention performed by physical therapists that is defined as an intramuscular procedure involving the isolated treatment of myofascial trigger points for the management of pain and neuromusculoskeletal dysfunction. TDN is effective at immediately increasing the pressure pain threshold, improving range of motion, and decreasing musculoskeletal pain in orthopedic patients.⁷ Likewise, improved range of motion and decreased pain are thought to be related to reduced disability and improved function.⁸ However, long-term improvements in pain and function in patients treated with TDN for shoulder pain are unknown.

Focused Clinical Question

Does the addition of TDN to an evidence-based therapeutic exercise program result in better long-term pain intensity and disability reduction in patients with shoulder pain?

Summary of Search

The search terms retrieved 21 citations; 5 duplicate studies and 8 studies focusing on the wrong intervention/body region were excluded. Eight relevant citations were retrieved; 2 studies were excluded because they were not a high enough level of evidence (case reports), and 3 studies were excluded for not containing any long-term following (>3 mo). Three studies met the inclusion/exclusion criteria.

Clinical Bottom Line

There is strong evidence to suggest that both TDN and an evidence-based therapeutic exercise program yield similar outcomes regarding long-term pain and disability reduction in patients with shoulder pain. The studies appraised in this critically appraised topic (CAT) observed no significant difference in long-term pain reduction with or without the application of dry needling for shoulder pain. Clinicians should continue using evidence-based therapeutic exercise programs as the foundation for their treatment planning in patients with shoulder pain but may consider including TDN for added benefits, specifically with long-term functional improvements.

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Strength of Recommendation

Grade A evidence exists that TDN with exercise is no more effective than exercise alone at reducing pain long term.

Search Strategy

The databases of MEDLINE, CINAHL, and SPORTDiscus were systematically searched using the following key terms: shoulder pain AND dry needling AND function AND pain NOT neck.

- Patient/client group: adults with subacute or chronic shoulder pain, impingement, or tendinitis
- Intervention (or assessment): TDN
- Comparison: therapeutic exercise
- Outcome(s): pain, functional status

Inclusion and Exclusion Criteria

Inclusion Criteria

- Adults (>18 y old) with shoulder pain of nontraumatic origin
- TDN as the intervention
- Long-term follow-up (>3 mo)
- Published in English
- Included if written after the year 2010

Exclusion Criteria

- Studies that were case reports or expert opinion
- Subjects who had undergone surgical intervention for shoulder pain
- Studies written before 2010

Results of Search

An extensive search of the literature resulted in 21 total articles; however, only 3 met the eligibility requirements and were considered for review. These studies are summarized in Tables 1 and 2. Two studies were randomized controlled trials that examined the effect of TDN with and without exercise.^{10,12} One study was a retrospective case series.¹¹

Best Evidence

In total, 3 relevant studies^{10–12} that met the inclusion criteria were included in this appraisal. These studies utilized TDN and

therapeutic exercise as treatment, evaluated long-term pain reduction and/or functional outcomes related to TDN, and were the most recent studies evaluating this population.

Summary of Best Evidence

Implications for Practice, Education, and Future Research

The main findings from this critical appraisal suggest that the addition of TDN to an evidence-based therapeutic exercise program is more effective at achieving long-term functional disability reduction than exercises alone. However, it appears that TDN to the shoulder muscles is not superior to therapeutic exercise specific to long-term shoulder pain reduction. Although TDN has grown in popularity in the clinical setting, long-term outcomes in pain and disability reduction of this tool have never been synthesized. To this point, most research has focused on the short-term or immediate effectiveness of the TDN as a treatment for shoulder pain. A recent systematic review by Hall et al¹³ concluded that there is very low-level evidence supporting TDN to improve pain and function in patients with shoulder pain. However, it may be possible that dry needling is more applicable in specific populations. Kamali et al¹⁴ found that TDN to the infraspinatus muscle was effective at reducing pain and improving disability immediately following treatment in overhead athletes. However, no long-term follow-up was conducted. Similarly, Arias-Buria et al⁹ found that a single session of TDN to the shoulder led to a faster recovery of function in patients recovering from postoperative shoulder surgery. Again, these studies focused on the immediate pain and disability changes of the shoulder, with no sustainable long-term follow-up making it difficult to suggest that these effects are maintained indefinitely.

There is high-level evidence suggesting that pain relief and disability reductions can be achieved by utilizing TDN along with an exercise program for shoulder pain.^{10–12} However, the degree to which TDN contributes to long-term pain reduction and disability reduction is still somewhat ambiguous. Arias-Buria et al¹² reported that the addition of TDN to an exercise program had a significantly greater disability reduction, which surpassed the minimal clinically important difference at 12 months compared with exercise alone. However, there were not between-group differences regarding long-term pain reduction. In a retrospective case series, Saylor-Pavkovich et al¹¹ reported that functional status and pain reduction were significantly improved in a case series of 8 patients who received the combination of TDN and exercise 8 months following intervention. Conversely, Perez-Palomares et al¹⁰ found no difference in pain reduction or functional status at a 3-month follow-up in individuals who received TDN and exercise compared with only exercise. However, it should be noted that, in the randomized controlled trials by Arias-Buria et al¹² and Perez-Palomares et al,¹⁰ numerical pain rating and functional status increased similarly between those experimental and control groups (2). Besides post-needling soreness, the procedure appears to have limited adverse effects and may serve an effective addition to a high-quality therapeutic exercise program to patients expecting long-term pain relief and functional improvement.

This CAT is not without limitations. First, although this CAT included 2 randomized controlled trials,^{10,12} which directly compared an evidence-based therapeutic exercise to TDN, the third study was a retrospective case series¹¹ that did not have a control group for comparison. It is possible that both therapeutic exercise and TDN are effective means of reducing pain and improving

Table 1 Summary of Study Designs of Articles Retrieved

Level of evidence	Study design/ methodology of articles retrieved	Number located	Author
1b	Randomized controlled trial	2	Arias-Buria et al ⁹ and Perez-Palomares et al ¹⁰
4	Retrospective case series	1	Saylor-Pavkovich et al ¹¹

Table 2 Characteristics of Included Studies

	Study 1 Arias-Buria et al ⁹	Study 2 Perez-Palmares et al ¹⁰	Study 3 Saylor-Pavlovich et al ¹¹
Study design	RCT	RCT	Retrospective case series
Participants	A total of 50 patients (M = 37 and F = 13) with a diagnosis of subacromial pain syndrome were included in the study and randomized via computer-generated randomized table of numbers to either an intervention group (n = 25; M = 19 and F = 6; mean age = 49 [5] y) who received an exercise program with TDN or to the control group (n = 25; M = 18 and F = 7; mean age = 48 [6] y) who received exercise without TDN. There were no significant differences between groups at baseline (sex, age, years with pain, side of symptoms, intensity of shoulder pain [NPRS], and DASH score.)	A total of 120 subjects (M = 45 and F = 75) with shoulder pain were included in the study and were randomized via computer-generated random number sequence to either an intervention group (n = 57; M = 17 and F = 40; mean age = 52.74 [11.81] y or a control group (n = 63; M = 28 and F = 35; mean age = 54.32 [11.45] y) who received personalized exercise without TDN. There were no significant differences between groups at baseline (sex, age, pain [VAS], glenohumeral active range of motion [degrees], function [Constant-Murley score], nocturnal pain, and number of active trigger points.)	A total of 8 patients (M = 6 and F = 2) with chronic rotator cuff tendinopathy for >90 d were retrospectively reviewed. The mean age of the patients was 55.62 y.
Intervention(s) investigated	TDN and exercise vs exercise alone	TDN and personalized exercise and manual therapy vs personalized exercise and manual therapy alone	TDN and specific shoulder-strengthening exercise protocol
Control	Consisted of 3 exercises targeting the supraspinatus, infraspinatus, and scapular stabilizers. Recommended exercise dosage was 3 sets of 12 repetitions for each exercise. The exercises were taught and monitored by an experienced physical therapist for a total of 5 sessions. Each session lasted 20–25 min. The subjects were to perform the exercises at home 2 times per day for 5 wk.	Personalized physical therapy treatment was consistent with the most appropriate manual therapy techniques to improve glenohumeral or scapulothoracic joint movement, isometrics, proprioceptive exercises, and reeducation of scapular control for each individual subject. The exercises were taught and monitored by an experienced physical therapist for a total of 10 sessions administered twice per week. Each session lasted 30 min.	None
Experimental	Received the same exercise program as those in the control with the addition of 2 sessions of TDN. The dry needling was performed by a physical therapist with over 10 y of experience in dry needling during the second and fourth session and targeted the middle deltoid, supraspinatus, infraspinatus, teres minor/major, and subscapularis. Once the trigger points were identified, a 0.32 × 0.40-mm needle was inserted into the trigger point until a local twitch response occurred. The needle was then moved up and down until no further twitch responses were produced.	Received the same physical therapy program as those in the control, with the addition of TDN to active trigger points in the supraspinatus, infraspinatus, subscapularis, teres minor, and deltoid. A total of 3 needling sessions were performed on the first, fourth, and seventh treatment sessions.	Patients received the intervention 1–2 times per week for up to 8 wk. The number of treatment sessions and duration of treatment depended on each patient's response to the intervention. The number of treatment sessions ranged from 4 to 8.

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Study 1		Study 2		Study 3	
Arias-Buria et al ⁹		Perez-Palomares et al ¹⁰		Saylor-Pavlovich et al ¹¹	
Outcome measure(s)	<p>Primary outcome measure</p> <p>Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire—evaluates function of the upper extremity by assessing degree of difficulty with physical activities, severity/activity-related pain, stiffness, numbness and tingling, difficulties with social activities, work, sleep, psychological effects. Each item is scored on a 1 to 5 scale and summed to generate a raw score between 0 and 100 in which the greater the number equals more disability. MCID = 10.8, test-retest reliability = 0.96.</p> <p>Secondary outcome measure</p> <p>Numeric Pain Rating Scale (NPRS)—rates the intensity of pain on a 0–10 scale where 0 = no pain and 10 is the worst pain experienced. MCID = 1.1.</p> <p>All outcome measures were collected at baseline, 1-wk postfinal session, and at 3, 6, and 12 mo after intervention. Examiners administering all outcome measures were blinded to the group assignments.</p>	<p>Primary outcome measure</p> <p>Pain visual analogue scale (VAS)—patient self-report scored on a 10-cm line with the extremes marked 0 (no pain) and 10 (maximum pain experienced). MCID for the VAS = 1.5 points.</p> <p>Secondary outcome measure</p> <p>(1) Joint range of motion measurements (2) Constant–Murley score has shown to have good reliability and consists of subscales for subject pain and function. It is scored on a 0–100 point scale with the higher scores indicating better function and the MCID = 17 points.</p> <p>(3) Number of active trigger points were palpated and recorded in the infraspinatus, supraspinatus, subscapularis, teres minor, and deltoid. A trigger point was defined according to Travell and Simons diagnostic criteria: hypersensitive area in a taut band, a palpable or visible local twitch response, and reproduction of referred pain by palpation.</p> <p>All outcome measures were collected at baseline, posttreatment, and 3 mo. Examiners administering all outcome measures were blinded to the group assignments.</p>	<p>Primary outcome measure</p> <p>Pain visual analogue scale (VAS)—patient self-report scored on a 100-mm scale where a mark at 0 equals no pain and a mark at 100 equals maximum pain. MCID for the VAS = 11 mm.</p> <p>Secondary outcome measure</p> <p>Quick DASH—to assess functional disability where the higher the score indicates greater disability. MCID = 8 points, test-retest reliability = 0.90.</p> <p>All outcome measures were collected at baseline, at final treatment session, and at long-term follow-up (approx 8.75 mo).</p>		
Main findings	<p>The results of the study favored the addition of TDN and exercise as opposed to exercise alone at reducing shoulder-related disability, both short and long-term. No significant improvements were observed between groups regarding pain reduction.</p> <p>Shoulder-related disability</p> <p>Between-group analysis showed statistically significant ($P < .001$) and clinically meaningful improvement in upper-extremity function in upper-extremity function favoring the dry needling group at 12-mo follow-up. Functional disability measured by the DASH showed a large effect size (1.7) and changed scores exceeded the 10.8 MCID with narrow and significant confidence intervals indicating clinical meaningfulness.</p> <p>Pain rating</p> <p>No significant between-group differences ($P > .43$) were observed for the outcome of pain as measured by the NPRS at any time point. Within-group analysis showed improvements in pain scores, which exceeded the MCID of 1.1 on the NPRS, with narrow and significant confidence intervals indicating a clinically meaningful reduction in pain for both groups. Small effect sizes (0.07) were experienced between the groups.</p>	<p>The results of the study did not favor the addition of TDN to an exercise program in improving shoulder function or reducing pain either immediately or at 3 mo following intervention.</p> <p>Shoulder-related disability</p> <p>Between-group analysis showed no statistically significant (-0.07; 95% CI, -5.19 to 5.04) or clinically meaningful improvement in upper-extremity function when adding dry needling to evidence-based physical therapy program at 3-mo follow-up. Functional disability measured by the Constant–Murley score showed an insignificant effect size (0.08). Within-group analysis was statistically significant ($P < .001$), indicating that both groups improved; however, these change scores did not exceed the 17-point MCID, indicating questionable clinical meaningfulness.</p> <p>Pain rating</p> <p>There were no statistically significant or clinically meaningful between-group differences (0.52; 95% CI, -0.37 to 1.42) observed for the outcome of pain as measured by the VAS at 3-mo follow-up. Although statistically significant, only a small effect size (0.2) was experienced between the groups. Within-group analysis showed improvements in pain scores, which exceeded the MCID of 1.5 on the VAS, with narrow and significant confidence intervals indicating a clinically meaningful reduction in pain for both groups.</p>	<p>The results of the study favored the combination of TDN and a specific shoulder-strengthening program at reducing pain and improving function both following the conclusion of treatment and at long-term follow-up.</p> <p>Pain VAS rating</p> <p>From baseline to the completion of treatment, all 8 patients reported pain reduction that exceeded the MCID.</p> <p>The mean best VAS score improved from 22.5 to 2.36 mm. The mean current VAS improved from 28.36 to 5.0 mm. The mean worst VAS improved from 68.88 to 13.255 mm.</p> <p>At long-term follow-up, the mean best VAS was 0.36 mm, the mean current VAS was 4.888 mm, and the mean worst VAS was 17.88.</p> <p>Shoulder-related disability</p> <p>Quick DASH: The mean Quick Dash score decreased from 43.09 (baseline) to 16.04 at the completion of treatment. At long-term follow-up, obtained by calling the patients during preparation of the case series (average of 8.75 mo after completion of the treatment sessions), the Quick DASH average score was 6.59. Each patient met the MCID for the Quick DASH at completion of treatment and at long-term follow-up.</p>		

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Table 2 (continued)

	Study 1 Arias-Buría et al ⁹	Study 2 Perez-Palomares et al ¹⁰	Study 3 Saylor-Pavkovich et al ¹¹
Level of evidence	1b	1b	4
Validity	<p> PEDro scale = 8/10; Eligibility criteria: Yes; Random allocation: Yes; Concealed allocation: Yes; Baseline comparability: Yes; Blind subjects: No; Blind therapists: No; Blind assessors: Yes; Adequate follow-up: Yes; Intention-to-treat analysis: Yes; Between-group comparisons: Yes; Point estimates and variability: Yes. </p> <p>Shoulder function can be maximized and maintained up to 1 y by including TDN into a therapeutic exercise program for patients with subacromial impingement syndrome.</p>	<p> PEDro scale = 8/10; Eligibility criteria: Yes; Random allocation: Yes; Concealed allocation: Yes; Baseline comparability: Yes; Blind subjects: No; Blind therapists: No; Blind assessors: Yes; Adequate follow-up: Yes; Intention-to-treat analysis: Yes; Between-group comparisons: Yes; Point estimates and variability: Yes. </p> <p>No added benefit can be expected by adding TDN to an individualized exercise program for subjects with shoulder pain.</p>	<p> PEDro scale = 4/10; Eligibility criteria: Yes; Random allocation: No; Concealed allocation: No; Baseline comparability: No; Blind subjects: No; Blind therapists: No; Blind assessors: No; Adequate follow-up: Yes; Intention-to-treat analysis: Yes; Between-group comparisons: No; Point estimates and variability: Yes. </p> <p>Patients who received TDN and specific shoulder strengthening exercises experienced clinically meaningful improvements in pain and disability.</p>
Conclusion			

Abbreviations: CI, confidence interval; DASH, Disabilities of the Arm, Shoulder, and Hand; F, female; M, male; MCID, minimal clinically important difference; NPRS, Numeric Pain Rating Scale; RCT, randomized control trial; TDN, trigger point dry needling; VAS, visual analog scale.

function in the shoulder, which could explain why large differences could not be detected. Second, consistency among the dosage and frequency of TDN varies. Arias-Buria et al¹² only performed 2 sessions of TDN, 2 weeks apart, compared with Perez-Palmares et al,¹⁰ who recommended 3 sessions of TDN, 3 weeks apart. It is possible that the more frequent sessions of TDN over longer time would have resulted in a larger effect on the outcomes. Finally, the effects of manual therapy versus TDN need to be established. Perez-Palmares et al¹⁰ utilized manual therapy and therapeutic exercise compared with manual therapy, exercise, and TDN. It is possible that the effects of manual therapy may have masked the improvements of TDN, resulting in no difference between groups.

Future research should include high-quality randomized trials that include a true control group to better ascertain the effectiveness of TDN. Specifically studying the effects of manual therapy and exercise compared with TDN and exercise may provide insight into which treatment modality is more effective. Furthermore, future research should explore the development of a clinical predictive rule to identify characteristics consistent with positive TDN outcomes for patients with shoulder pain. This would provide rehabilitation professionals with guidance as to when TDN is most appropriate for individuals with shoulder pain.

Conclusion

The results of this CAT suggest that the combination of TDN and exercises is just as effective as an exercise program alone at reducing long-term pain and disability. Clinicians should feel confident that TDN will not result in major adverse effects and may better improve functional outcomes compared with the implementation of exercise exclusively. At this time, more research is needed to determine which situations are best for adding TDN to a therapeutic exercise program to maximize the long-term reduction of shoulder pain and dysfunction.

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