ROCIO LLAMAS-RAMOS, PT[1] • DANIEL PECOS-MARTÍN, PT, PhD[1] • TOMÁS GALLEGO-IZQUIERDO, PT, PhD[1]
INÉS LLAMAS-RAMOS, PT[2] • GUSTAVO PLAZA-MANZANO, PT[3] • RICARDO ORTEGA-SANTIAGO, PT, PhD[4-6]
JOSHUA CLELAND, PT, PhD[7-9] • CÉSAR FERNÁNDEZ-DE-LAS-PEÑAS, PT, PhD, DMSc[4-6]

Comparison of the Short-Term Outcomes Between Trigger Point Dry Needling and Trigger Point Manual Therapy for the Management of Chronic Mechanical Neck Pain: A Randomized Clinical Trial

STUDY DESIGN: Randomized clinical study.

OBJECTIVES: To compare the effects of trigger point (TrP) dry needling (DN) and TrP manual therapy (MT) on pain, function, pressure pain sensitivity, and cervical range of motion in subjects with chronic mechanical neck pain.

BACKGROUND: Recent evidence suggests that TrP DN could be effective in the treatment of neck pain. However, no studies have directly compared the outcomes of TrP DN and TrP MT in this population.

METHODS: Ninety-four patients (mean ± SD age, 31 ± 3 years; 66% female) were randomized into a TrP DN group (n = 47) or a TrP MT group (n = 47). Neck pain intensity (11-point numeric pain rating scale), cervical range of motion, and pressure pain thresholds (PPTs) over the spinous process of C7 were measured at baseline, postintervention, and at follow-ups of 1 week and 2 weeks after treatment. The Spanish version of the Northwick Park Neck Pain Questionnaire was used to measure disability/function at baseline and the 2-week follow-up. Mixed-model, repeated-measures analyses of variance (ANOVAs) were used to determine if a time-by-group interaction existed on the effects of the treatment on each outcome variable, with time as the within-subject variable and group as the between-subject variable.

RESULTS: The ANOVA revealed that participants who received TrP DN had outcomes similar to those who received TrP MT in terms of pain, function, and cervical range of motion. The 4-by-2 mixed-model ANOVA also revealed a significant time-by-group interaction ($P<.001$) for PPT: patients who received TrP DN experienced a greater increase in PPT (decreased pressure sensitivity) than those who received TrP MT at all follow-up periods (between-group differences: posttreatment, 59.0 kPa; 95% confidence interval [CI]: 40.0, 69.2; 1-week follow-up, 69.2 kPa; 95% CI: 49.5, 79.1; 2-week follow-up, 78.9 kPa; 95% CI: 49.5, 89.0).

CONCLUSION: The results of this clinical trial suggest that 2 sessions of TrP DN and TrP MT resulted in similar outcomes in terms of pain, disability, and cervical range of motion. Those in the TrP DN group experienced greater improvements in PPT over the cervical spine. Future trials are needed to examine the effects of TrP DN and TrP MT over long-term follow-up periods.

LEVEL OF EVIDENCE: Therapy, level 1b. *J Orthop Sports Phys Ther 2014;44(11):852-861. Epub 30 September 2014. doi:10.2519/jospt.2014.5229*

KEY WORDS: *dry needling, manual therapy, neck pain, trigger points*

Neck pain is a common musculoskeletal complaint, with a point prevalence of 15% of males and 23% of females experiencing symptoms.[23] It has been reported that as many as 50% to 80% of patients who develop neck pain experience chronic symptoms at a 5-year follow-up.[40] The economic burden associated with neck pain should not be underestimated, as many patients may continue to utilize health care resources for up to 10 years after the initial onset.[15,34] Interestingly, Martin et al[34] reported that these increased costs have not been shown to be correlated with improvements in the overall health of individuals suffering from musculoskeletal spinal conditions.

[1]Department of Physical Therapy, Universidad de Alcalá, Alcalá de Henares, Spain. [2]Private practice, physical therapy, Madrid, Spain. [3]Department of Physical Medicine and Rehabilitation, Universidad Complutense de Madrid, Madrid, Spain. [4]Department of Physical Therapy, Occupational Therapy, Physical Medicine and Rehabilitation, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain. [5]Esthesiology Laboratory, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain. [6]Cátedra de Investigación y Docencia en Fisioterapia: Terapia Manual y Punción Seca, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain. [7]Department of Physical Therapy, Franklin Pierce University, Concord, NH. [8]Rehabilitation Services, Concord Hospital, Concord, NH. [9]Manual Therapy Fellowship Program, Regis University, Denver, CO. This study was approved by the human research committee of the Universidad Alcalá de Henares (Spain) and Hospital Universitario Principe de Asturias (Spain). The authors certify that they have no affiliations with or financial involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in the article. Address correspondence to Dr César Fernández-de-las-Peñas, Facultad de Ciencias de la Salud, Universidad Rey Juan Carlos, Avenida de Atenas s/n 28922 Alcorcón, Madrid, Spain. E-mail: cesarfdlp@yahoo.es; cesar.fernandez@urjc.es

Individuals reporting neck pain often seek physical therapy for the management of their symptoms. In fact, physical therapy is usually the first management option for people with mechanical neck pain.[6] Physical therapists use a number of interventions in this population, including mobilization and manipulation,[9,22] therapeutic exercise,[28] traction,[20] and other modalities such as electrotherapy[31] and education.[21] Manual therapy (MT) targeting the cervical joints and deep neck flexor exercises have been suggested to be the most accepted therapeutic intervention for management of this population.[14,36] Additionally, clinical practice guidelines for physical therapy management of patients with neck pain suggest a treatment approach consisting of both MT, including cervical spine manipulation and/or mobilization, and training of the deep neck flexors.[6]

The use of cervical spinal joint manipulation remains controversial because of its reported adverse reactions and subsequent concerns about its safety.[4] As a result, some authors have proposed that soft tissue interventions might also be effective in the management of mechanical insidious neck pain without the potential risks associated with manipulation. Recent reviews have concluded that soft tissue interventions may provide immediate improvements in patients with neck pain; however, future studies are needed before strong recommendations relative to their effectiveness can be made.[30,41]

The theory as to why soft tissue interventions may be beneficial is related to the hypothesis that muscle trigger points (TrPs), such as those in the upper trapezius muscle,[16,37] can be present in patients with insidious mechanical neck pain. These TrPs consist of hypersensitive spots in taut bands of skeletal muscle that are painful on stimulation and elicit a referred pain.[45] If they are active, TrPs cause spontaneous pain symptoms and the elicited referred pain reproduces the patient's symptoms. If they are latent, TrPs do not cause spontaneous symptoms and the elicited referred pain does not reproduce any of the patient's familiar symptoms.[45]

Soft tissue therapies and TrP dry needling (DN) are therapeutic interventions advocated for inactivating TrPs.[12,45] There is some evidence suggesting that MT is effective in the short term for reducing TrP-related symptoms in individuals with mechanical neck pain.[39,49] Other studies have reported that TrP DN is more effective for reducing neck pain than sham needling in individuals with chronic neck pain.[26,48] A recent meta-analysis by Kietrys et al[29] reported that TrP DN is beneficial for decreasing pain immediately after treatment and at a 4-week follow-up in patients with neck pain. Although the effect size was strong in the identified studies, the 95% confidence intervals (CIs) were wide, suggesting imprecision of the results and the need for further investigation. In addition, the majority of the studies included a relatively small sample size (75% had 60 subjects or fewer), suggesting the need for large clinical trials.[29]

It is not known if the benefits of TrP DN exceed those of TrP MT, as none of the studies in the Kietrys et al[29] meta-analysis included such a comparison group. Therefore, the purpose of the current randomized clinical trial was to compare the short-term effects of TrP DN to TrP MT on pain, disability, and cervical range of motion in individuals with chronic mechanical neck pain and active TrPs in the upper trapezius muscle. It was hypothesized that patients who received TrP DN would have greater improvement in pain, disability, pressure pain sensitivity, and cervical range of motion than those who received TrP MT.

METHODS

Participants

A randomized clinical trial was conducted. Consecutive patients with chronic idiopathic mechanical neck pain referred by their physician to physical therapy were screened for eligibility criteria from January 2011 to January 2013. In the current trial, mechanical neck pain was defined as neck and shoulder pain with symptoms provoked by neck postures, neck movement, or palpation of the cervical muscles. Participants were screened for signs of vertebrobasilar insufficiency (eg, nystagmus, gait disturbances, or Horner's syndrome)[7] and underwent manual screening for upper cervical spine ligamentous instability (Sharp-Purser test, alar ligament stress test, and transverse ligament tests).

The diagnosis of a TrP was determined by the presence of all of the following[45]: (1) a hypersensitive spot in a palpable taut band, (2) palpable or visible local twitch on pincer palpation, and (3) reproduction of referred pain elicited by palpation of the sensitive spot. These criteria have been shown to exhibit moderate to good interexaminer reliability (κ = 0.36-0.84) when applied by an experienced clinician.[18] Lucas et al[33] found that reliability was related to the presence or absence of a TrP and not related to the distinction between active and latent TrPs; however, a later study reported that the identification of clinically relevant TrPs in the upper trapezius muscle is reproducible when performed by experienced clinicians.[38] The TrPs were considered active when the referred pain elicited by palpation reproduced the neck symptoms and the patients recognized the pain as their familiar symptoms.[45] Participants were examined for the presence of active TrPs in the upper trapezius muscle by a clinician with more than 6 years of experience in the management of TrPs.

Participants were excluded if they exhibited any of the following criteria: (1) whiplash injury, (2) previous cervical surgery, (3) cervical radiculopathy or myelopathy, (4) diagnosis of fibromyalgia,[52] (5) any physical therapy intervention in the previous year, (6) fear of needles, or (7) any contraindication for dry needling (eg, anticoagulants or psychiatric disorders). The study protocol was approved by the local human research committee of the Universidad Alcalá de Henares (Spain) and Hospital Universitario Prin-

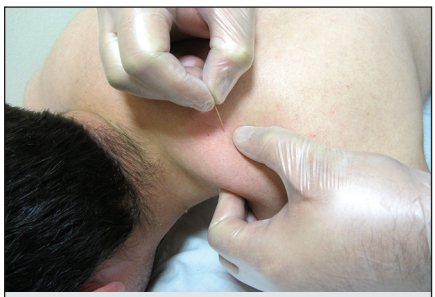

FIGURE 1. Trigger point dry needling applied over active trigger points in the upper trapezius muscle of a patient with mechanical neck pain. With the patient in prone, the needle was inserted into the skin over the trigger point until the first local twitch response was obtained, and moved up and down (2- to 3-mm vertical motions with no rotations) at approximately 1 Hz for 25 to 30 seconds.

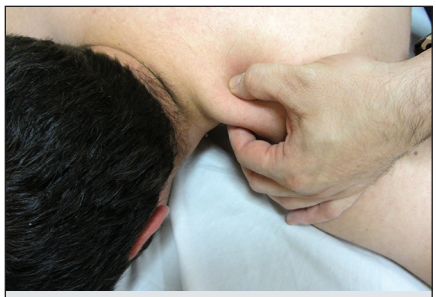

FIGURE 2. Trigger point pressure release applied over upper trapezius muscle trigger points.

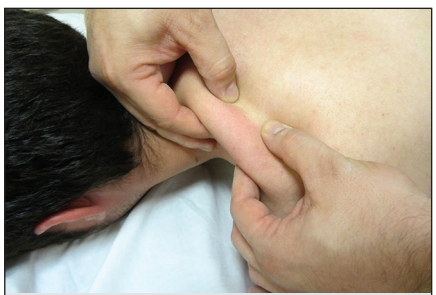

FIGURE 3. Stretching of upper trapezius muscle taut band. Both thumbs of the therapist are placed over the taut band above and below the trigger point. The therapist applies moderate, slow pressure over the trigger point and slides the fingers in opposite directions.

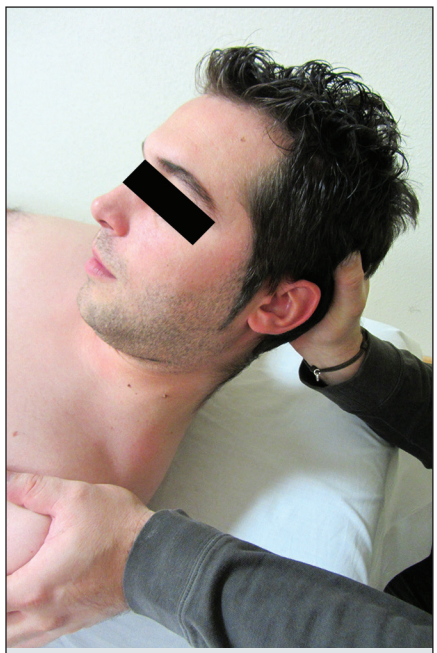

FIGURE 4. Passive stretching of the upper trapezius muscle in cervical flexion, contralateral flexion, and homolateral rotation.

cipe de Asturias (Spain). All participants signed an informed-consent form prior to inclusion in the study.

Outcome Measures

The primary outcomes in the current trial were neck pain intensity and disability. Participants rated the intensity of their neck pain at rest on an 11-point numeric pain rating scale (0, no pain; 10, maximum pain).[27] Cleland et al[8] reported that the minimal detectable change (MDC) and minimal clinically important difference (MCID) were 1.3 and 2.1 points, respectively, in patients with mechanical neck pain.

The Spanish version of the Northwick Park Neck Pain Questionnaire (NPQ) was used to assess self-perceived level of disability as a result of neck pain.[19] The NPQ is a self-administered questionnaire that includes 9 questions that assess how neck pain affects the patient's ability to manage typical daily activities (pain intensity, sleeping, numbness, duration, carrying, reading and watching television, working/housework, social activities, and driving). Each section is scored on a Likert scale ranging from 0 to 4, with 4 representing the greatest disability. The total score is obtained by summing the scores for the 9 sections (possible score, 0-36).[32] The MCID for the NPQ has been determined as a 25% reduction in score from baseline.[44]

The secondary outcome measures included pressure pain threshold (PPT) over the C7 spinous process and cervical range of motion. To determine the mechanical hypoalgesic effect of the interventions, PPT (defined as the amount of pressure applied for the pressure sensation to first change to pain) was assessed with a mechanical algometer (Pain Diagnosis and Treatment Inc, New York, NY). Participants were instructed to press a switch when the sensation first changed from pressure to pain. The mean of 3 trials was calculated, converted to kPa, and used for the analysis. A 30-second rest was allowed between each measure. Pressure algometry over the cervical spine has been found to have excellent intrarater reliability (intraclass correlation coefficient [ICC] = 0.94-0.97) and good to excellent interrater reliability (ICC = 0.79-0.90) in individuals with acute neck pain.[51] The same study reported that the MDC for PPT over the cervical spine in patients with neck pain was 47.2 kPa. Cervical mobility was assessed with a CROM device (Performance Attainment Associates, St Paul, MN), following previous guidelines.[10,11] For each movement, 2 trials were recorded and the mean was used in the analysis. Cervical range of motion was recorded in a standard sequence: flexion, extension, right/left lateral flexion, and right/left rotation. Fletcher and Bandy[17] found high intratester reliability (ICC = 0.87-0.96) and that a change of 5° to 10° would be needed to suggest a real change (MDC) in cervical range of motion in individuals with neck pain.

Neck pain, PPT, and active cervical range of motion were assessed at baseline, postintervention, and at 1 week and 2 weeks after the 2 TrP DN or TrP MT interventions by an assessor blinded to the treatment allocation group. The NPQ was assessed at baseline and 2 weeks after the last treatment session.

Randomization

Following the baseline examination, patients were randomly assigned to receive either TrP DN or TrP MT. Concealed allocation was performed using a computer-generated randomized table of numbers

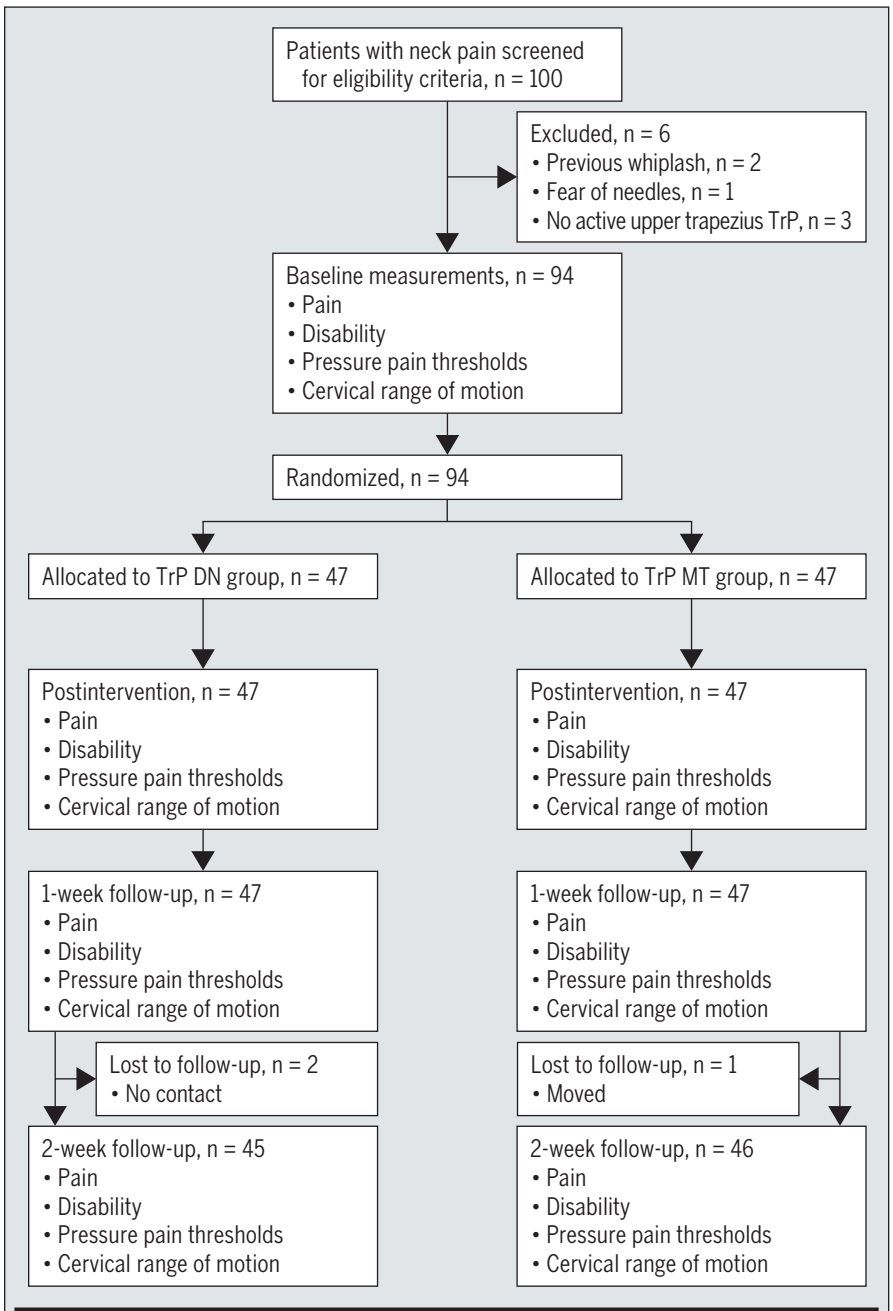

FIGURE 5. Flow diagram of patients throughout the course of the study. Abbreviations: DN, dry needling; MT, manual therapy; TrP, trigger point.

created prior to the start of data collection by a researcher not involved in the recruitment and/or treatment of patients. Individual and sequentially numbered index cards were used to randomly assign participants to the treatment groups. The index cards were folded and placed in sealed, opaque envelopes. A second therapist, blinded to baseline examination findings, opened the envelope and proceeded with treatment according to the group assignment.

Each group was treated by a clinician with more than 6 years of experience in the management of TrPs. There is no recommendation on clinical guidelines of the inclusion of TrP DN or TrP MT for the management of mechanical neck pain.[6] Additionally, there are no available data on the number of treatment sessions of TrP therapy for the management of individuals with mechanical neck pain. Based on clinical experience, we expected a positive outcome after the 2 treatment sessions. Therefore, all participants attended a physical therapy clinic once per week for 2 weeks (2 sessions). Patients received the first session (either TrP DN or TrP MT) at day 1 after baseline outcomes were collected. The patients returned 1 week later for the second session. Immediate postintervention outcomes were assessed 1 day after the second session to avoid posttreatment soreness. Finally, patients returned 1 week and 2 weeks after the last treatment session for the follow-up assessments.

Both treatments were applied to the symptomatic side of the neck, at the site of the active TrP. Patients were unaware of the objective of the study, such that they were aware of the clinical implications but did not know which intervention was being evaluated. All patients were informed of the true nature of the study at the end of the trial.

Trigger Point Dry Needling

Because the upper trapezius is the muscle in which trigger points are most often found in individuals with mechanical neck pain,[16,37] the clinician applied TrP DN to this muscle. The TrP DN was performed with disposable stainless-steel needles (0.3 × 30 mm; Novasan, S.A., Madrid, Spain) inserted into the skin over the TrP area, using the fast-in and fast-out technique described by Hong.[24] Once the TrP was located with pincer palpation in the upper trapezius, the overlying skin was cleaned with alcohol. The needle was inserted so as to penetrate the skin 10 to 15 mm into the TrP until a local twitch response was obtained (**FIGURE 1**). It has been suggested that TrP DN, when properly applied, should elicit local twitch responses.[24] Once the first local twitch response was obtained, the needle was moved up and down (2- to 3-mm

vertical motions with no rotations) at approximately 1 Hz for 25 to 30 seconds.

Trigger Point Manual Therapy

Different manual approaches (eg, compression, stretching, or transverse friction massage) are used in TrP MT.[13] Vernon and Schneider[49] have reported moderate to strong evidence supporting the use of TrP pressure release for immediate pain relief of TrPs. Therefore, pressure release over the upper trapezius TrP was applied. Briefly, pressure was progressively increased over the TrP until a definite increase in tissue resistance (barrier) was perceived by the therapist. This pressure was maintained until the clinician sensed a relief of the taut band. At that time, the pressure was increased again until the clinician felt the next increase in tissue resistance (**FIGURE 2**). This process was repeated 3 times at each session. Patients also received a stretching intervention of the taut-band muscle fibers. Both thumbs of the therapist were placed over the taut band, above and below the TrP. The therapist applied moderate, slow pressure over the TrP, sliding the fingers in opposite directions (**FIGURE 3**). Trigger point manual therapy was applied slowly, without inducing pain. Finally, most studies investigating the effectiveness of different treatment interventions for the management of TrP-related pain have used passive muscle stretching as combined techniques.[49] Therefore, passive stretching of the upper trapezius muscle was also performed for 45 seconds (**FIGURE 4**).

Adverse Events

Patients were asked to report any adverse event experienced either after the intervention or during the 2-week follow-up period. An adverse event was defined as a sequela of any symptom that was medium term in duration, perceived as distressing and unacceptable to the patient, and required further treatment.[5] Adverse events were self-reported by the patients and collected by a clinician not involved in the study. Because TrP DN sometimes induces posttreatment soreness, patients were advised to report any increase in their symptoms after the intervention.

TABLE 1 Baseline Demographics for Both Groups*

	TrP DN (n = 47)	TrP MT (n = 47)
Gender, n		
Male	17	15
Female	30	32
Age, y	31 ± 3	31 ± 2
Affected side, n		
Left	36	34
Right	11	13
Time duration, mo	7.4 ± 2.6	7.1 ± 2.9
Pain intensity (0-10)	6.2 ± 1.0	6.2 ± 1.3
NPQ (0-36)	19.1 ± 6.4	17.8 ± 7.3
Pressure pain threshold, kPa	188.1 ± 39.5	188.1 ± 49.4
Cervical range of motion, deg		
Flexion	54.1 ± 7.0	54.2 ± 6.9
Extension	60.5 ± 8.0	60.7 ± 7.5
Lateral flexion toward treated side	38.8 ± 3.6	39.9 ± 5.0
Lateral flexion away from treated side	38.6 ± 3.9	38.5 ± 4.9
Rotation toward treated side	63.5 ± 5.9	64.4 ± 5.5
Rotation away from treated side	65.8 ± 5.4	66.6 ± 5.8

Abbreviations: DN, dry needling; MT, manual therapy; NPQ, Northwick Park Neck Pain Questionnaire; TrP, trigger point.
**Values are mean ± SD unless otherwise indicated.*

Sample-Size Determination

The sample size was calculated using Ene 3.0 software (Autonomic University of Barcelona, Barcelona, Spain). Sample-size calculations were based on detecting a difference of 2.1 on an 11-point numeric pain rating scale (MCID) after data collection, assuming a standard deviation of 2.1,[8] a 2-tailed test, an alpha level of .05, and a desired power (β) of 90%. Based on these calculations, the minimum sample size was estimated to be 22 patients per group. To increase the statistical power, the estimated minimum sample size was doubled.

Statistical Analysis

Statistical analysis was performed using SPSS statistical software (Version 18.0; SPSS Inc, Chicago, IL) and conducted according to an intention-to-treat analysis. When postintervention data were missing, scores from the last available assessment were carried forward. Means, standard deviations, and/or 95% CIs were calculated for each variable. The Kolmogorov-Smirnov test showed a normal distribution of the data ($P>.05$). Because participants received a unilateral intervention, sides were classified as ipsilateral (toward) or contralateral (away) to the treated side. A 4-by-2 repeated-measures analysis of variance (ANOVA), with time (baseline, postintervention, 1 week follow-up, and 2-week follow-up) as the within-subject factor and group (TrP DN, TrP MT) as the between-subject factor, was used to determine the effects of the intervention on pain and PPT. A 2-by-2 repeated-measures ANOVA, with time (baseline, 2-week follow-up) as the within-subject factor and group (TrP DN, TrP MT) as the between-subject factor, was used to calculate changes in disability (NPQ). A 4-by-2-by-2 mixed-model ANOVA was used to evaluate the differences in cervical range of motion for cervical lateral flexion and rotation,

TABLE 2 Outcome Data for Neck Pain, Disability, and Pressure Pain Sensitivity

	Baseline	Postintervention	1-wk Follow-up	2-wk Follow-up
Pain intensity (0-10)				
TrP DN*	6.2 ± 1.0	1.9 ± 1.4	1.3 ± 1.1	0.9 ± 0.8
TrP MT*	6.2 ± 1.3	2.2 ± 1.8	1.6 ± 1.5	1.0 ± 1.1
Within-group change score from baseline†				
TrP DN‡		−4.3 (−4.7, −3.9)§	−4.9 (−5.3, −4.5)§	−5.3 (−5.7, −5.9)§
TrP MT‡		−4.0 (−4.5, −3.4)§	−4.6 (−5.1, −4.1)§	−5.2 (−5.6, −4.7)§
Between-group difference in change score‡		0.3 (−0.3, 1.0)	0.3 (−0.2, 0.9)	0.1 (−0.4, 0.7)
NPQ (0-36)				
TrP DN*	19.1 ± 6.4			5.4 ± 3.1
TrP MT*	17.8 ± 7.3			5.0 ± 3.7
Within-group change score from baseline†				
TrP DN‡				−13.7 (−15.2, −12.2)§
TrP MT‡				−12.8 (−14.3, −11.4)§
Between-group difference in change score‡				0.9 (−1.1, 2.9)
PPT, kPa				
TrP DN*	188.1 ± 39.5	326.0 ± 39.5	326.8 ± 49.4	326.2 ± 39.0
TrP MT*	188.1 ± 49.4	267.0 ± 39.0	257.6 ± 39.5	247.3 ± 49.0
Within-group change score from baseline†				
TrP DN‡		137.9 (128.6, 148.4)§	138.7 (128.6, 158.2)§	138.1 (118.7, 148.4)§
TrP MT‡		78.9 (69.2, 89.0)§	69.5 (69.2, 89.0)§	59.2 (49.4, 79.1)§
Between-group difference in change score‡		59.0 (40.0, 69.2)§	69.2 (49.5, 79.1)§	78.9 (49.5, 89.0)§

Abbreviations: DN, dry needling; MT, manual therapy; NPQ, Northwick Park Neck Pain Questionnaire; PPT, pressure pain threshold; TrP, trigger point.
**Values are mean ± SD.*
†*Compared to pretreatment.*
‡*Values are mean (95% confidence interval).*
§*Statistically significant differences (P<.01).*

with time (baseline, postintervention, 1-week follow-up, and 2-week follow-up) and side (toward or away from treated side) as the within-subject factors and group (TrP DN, TrP MT) as the between-subject factor. Separate 4-by-2 ANOVAs, with time (baseline, postintervention, 1-week follow-up, and 2-week follow-up) as the within-subject factor and group (TrP DN, TrP MT) as the between-subject factor, were used to evaluate differences in cervical flexion and extension motion. The main hypothesis of interest was the group-by-time interaction, with a Bonferroni-corrected alpha of .0125 (4 moments). To enable comparison of effect sizes, standardized mean score differences (SMDs) were calculated by dividing mean score differences between TrP DN and the comparison group (TrP MT) by the pooled standard deviation.

RESULTS

One hundred consecutive patients with neck pain were screened for eligibility criteria. Ninety-four patients (mean ± SD age, 31 ± 3 years; 66% female) satisfied the eligibility criteria, agreed to participate, and were randomized into the TrP DN group (n = 47) or the TrP MT group (n = 47). The reasons for ineligibility can be found in **FIGURE 5**, a flow diagram of patient recruitment and retention. Baseline features between both groups were similar for all variables (**TABLE 1**).

The mixed-model ANOVAs did not indicate a statistically significant time-by-group interaction for neck pain ($F = 0.425$, $P = .516$) or disability ($F = 0.681$, $P = .411$). But there was a main effect for time, with both groups experiencing similar decreases in the intensity of neck pain ($F = 129.73$, $P<.001$) and disability ($F = 67.175$, $P<.001$) at all follow-up periods. Within-group effect sizes were large for both groups (SMD>2.8) and between-group effect sizes were small (SMD<0.21) at all follow-up periods. **TABLE 2** provides the data for assessments of neck pain intensity and disability at baseline, postintervention, and at the 1-week and 2-week follow-ups, as well as within-group differences with their associated 95% CIs.

The 4-by-2 mixed-model ANOVA revealed a significant time-by-group interaction ($F = 76.486$, $P<.001$) for PPT: patients receiving TrP DN experienced a greater increase in PPT (decreased pressure pain sensitivity) than those receiving TrP MT at all follow-up periods (**TABLE 2**). There were large between-group effect sizes at all follow-up periods (0.91<SMD<1.22) favoring the TrP DN group.

TABLE 3 Outcome Data for Cervical Range of Motion

Analysis/Measure	Baseline	Postintervention	1-wk Follow-up	2-wk Follow-up
Outcomes				
Cervical flexion*				
TrP DN	54.1 ± 7.0	63.1 ± 6.4	61.7 ± 6.8	60.2 ± 6.6
TrP MT	54.2 ± 6.9	62.1 ± 6.2	60.6 ± 6.6	59.8 ± 6.0
Cervical extension*				
TrP DN	60.5 ± 8.0	71.4 ± 5.4	70.0 ± 4.1	68.0 ± 4.4
TrP MT	60.7 ± 7.5	71.0 ± 5.8	69.9 ± 5.4	68.2 ± 5.1
Cervical lateral flexion toward treated side*				
TrP DN	38.8 ± 3.6	47.0 ± 4.1	45.0 ± 4.3	43.2 ± 3.8
TrP MT	39.9 ± 5.0	46.4 ± 4.5	44.2 ± 4.5	42.9 ± 3.7
Cervical lateral flexion away from treated side*				
TrP DN	38.6 ± 3.9	49.8 ± 4.1	47.3 ± 3.9	45.4 ± 3.6
TrP MT	38.5 ± 4.9	49.1 ± 5.0	47.0 ± 5.1	44.9 ± 4.7
Cervical rotation toward treated side*				
TrP DN	63.5 ± 5.9	75.0 ± 3.8	71.5 ± 2.9	70.0 ± 2.4
TrP MT	64.4 ± 5.5	75.4 ± 3.7	71.2 ± 3.0	70.0 ± 3.0
Cervical rotation away from treated side*				
TrP DN	65.8 ± 5.4	74.9 ± 4.1	72.1 ± 3.1	70.5 ± 2.4
TrP MT	66.6 ± 5.8	74.4 ± 3.6	71.0 ± 2.7	69.6 ± 2.9
Within-group change score from baseline†				
Cervical flexion‡				
TrP DN		9.0 (7.1, 10.7)§	7.6 (5.1, 8.8)§	6.1 (4.4, 7.3)§
TrP MT		8.0 (6.2, 9.8)§	6.4 (4.6, 8.3)§	5.6 (3.9, 7.4)§
Cervical extension‡				
TrP DN		10.9 (8.6, 13.1)§	9.5 (7.3, 11.4)§	7.5 (5.5, 9.3)§
TrP MT		10.3 (8.5, 11.9)§	9.2 (7.4, 10.9)§	7.5 (5.9, 9.0)§
Cervical lateral flexion toward treated side‡				
TrP DN		8.2 (6.9, 9.5)§	6.2 (4.7, 7.4)§	4.4 (3.1, 5.6)§
TrP MT		6.5 (5.0, 8.0)§	4.3 (2.8, 5.9)§	3.0 (1.5, 4.5)§
Cervical lateral flexion away from treated side‡				
TrP DN		11.3 (9.6, 12.5)§	8.7 (7.2, 10.2)§	6.8 (5.4, 8.2)§
TrP MT		10.6 (9.2, 12.1)§	8.5 (7.0, 10.0)§	6.4 (4.9, 7.8)§
Cervical rotation toward treated side‡				
TrP DN		11.5 (9.6, 13.4)§	8.0 (6.2, 9.7)§	6.5 (4.7, 8.1)§
TrP MT		10.0 (8.4, 11.6)§	6.8 (5.3, 8.4)§	5.6 (3.8, 6.9)§
Cervical rotation away from treated side‡				
TrP DN		9.1 (7.3, 10.8)§	6.3 (4.6, 8.0)§	4.7 (3.1, 6.3)§
TrP MT		7.8 (6.0, 9.5)§	4.4 (2.6, 6.1)§	3.0 (1.4, 4.6)§

Table continues on page 859.

The 2-by-4-by-2 mixed-model ANOVA found no statistically significant interactions for cervical lateral flexion (group by time: F = 1.424, *P* = .234; side by time: F = 0.864, *P* = .354; group by side: F = 0.015, *P* = .904; group by time by side: F = 0.499, *P* = .481) and rotation (group by time: F = 2.311, *P* = .139; side by time: F = 0.327, *P* = .568; group by side: F = 0.499, *P* = .481; group by time by side: F = 0.246, *P* = .864). Similarly, the 4-by-2 ANOVA found no significant time-by-group interaction for cervical flexion (F = 0.051, *P* = .822) and extension (F = 0.170, *P* = .917) range of motion. There were main effects for time, with both groups experiencing similar increases in active cervical range of motion (all, *P*<.001). At all follow-up periods, within-group effect sizes were large for both groups (SMD>1.4) and between-group effect sizes were small

TABLE 3 Outcome Data for Cervical Range of Motion (continued)

Analysis/Measure	Baseline	Postintervention	1-wk Follow-up	2-wk Follow-up
Between-group difference in change score‡				
Cervical flexion		1.0 (−1.5, 3.5)	1.2 (−2.0, 3.1)	0.5 (−1.9, 2.4)
Cervical extension		0.6 (−2.1, 3.4)	0.3 (−2.3, 2.8)	0.0 (−2.4, 2.4)
Cervical lateral flexion toward treated side		1.7 (0.3, 3.3)	1.9 (0.3, 3.6)	1.4 (0.2, 2.7)
Cervical lateral flexion away from treated side		0.7 (−1.6, 2.4)	0.2 (−1.9, 2.2)	0.4 (−1.5, 2.3)
Cervical rotation toward treated side		1.5 (0.9, 2.4)	1.2 (0.1, 2.5)	0.9 (−1.1, 3.1)
Cervical rotation away from treated side		1.3 (0.2, 2.3)	1.9 (0.4, 3.5)	1.7 (0.5, 3.0)

Abbreviations: DN, dry needling; MT, manual therapy; TrP, trigger point.
**Values are mean ± SD.*
†*Compared to pretreatment.*
‡*Values are mean (95% confidence interval).*
§*Statistically significant differences (P<.001).*

(SMD<0.13). **TABLE 3** provides the data for cervical range of motion assessments at baseline, postintervention, and at 1-week and 2-week follow-ups, as well as within-group and between-group differences with 95% CIs.

In our study, 26 patients assigned to the TrP DN group (55%) experienced muscle soreness at the upper trapezius muscle after treatment but did not experience an increase in symptoms. Posttreatment soreness from TrP DN resolved spontaneously within 24 to 36 hours without any intervention. In addition, 11 patients assigned to the TrP MT group (23%) experienced muscle fatigue at the cervical spine after treatment, which resolved spontaneously within 24 to 48 hours without any other intervention.

DISCUSSION

The results of the current randomized clinical trial suggest that 2 sessions of TrP DN result in similar outcomes as 2 sessions of TrP MT in patients with mechanical neck pain after treatment and at the 2-week follow-up. Though both groups made significant and clinically important improvements from baseline to the follow-up periods, we cannot be certain if this was a result of the interventions or the passage of time, because we did not include a control group that received no intervention.

Clinical guidelines have suggested that manual physical therapy (including joint mobilization and manipulation) plus the addition of exercise may result in improved outcomes in patients with mechanical neck pain.[6] Those same recommendations did not identify TrP DN or TrP MT as an effective intervention, not because there was evidence against these interventions but because there was a lack of quality studies on the topic. It would be interesting to compare the effects of TrP DN and TrP MT to a pragmatic approach of MT and exercise as it was used in the Walker et al[50] trial. Because physical therapists generally use a multimodal treatment approach, it would be interesting to see if TrP DN or TrP MT would add any additional benefit to an approach including mobilization/manipulation and exercise for the management of mechanical neck pain. In fact, there is preliminary evidence suggesting that inclusion of TrP MT into a multimodal approach is effective for the management of heel pain.[42]

The current randomized clinical trial found that 2 sessions of either TrP MT or TrP DN were similarly effective for decreasing pain and improving function and cervical range of motion. It is possible that TrP management, independent of the intervention applied, may have similar clinical effects in individuals with mechanical neck pain. In fact, similar potential mechanical (ie, disruption of the contraction knot, increase of sarcomere length) and neurophysiological (ie, decrease of peripheral nociception and activation of central pain pathways) mechanisms of both interventions have been suggested.[1,3,12,13,45]

The data from the current trial identified that there was a statistically significant difference between groups for changes in PPT in favor of the group that received 2 sessions of TrP DN. The physiological mechanism for this remains unknown. However, there currently exists much speculation surrounding the mechanisms of TrP DN, which potentially include both segmental and central involvement.[3,25] It is plausible that TrP DN might also stimulate Aδ fibers and activate noradrenergic inhibitory pain systems.[1] Additionally, Shah et al[43] showed that TrP DN can reduce substance P and calcitonin gene-related peptide in TrPs. The mechanical stimulus of the needle into the TrP might result in an increase in microcirculation and a reduction in chemical mediators.[2,3,25,43] Regardless of the mechanism, we identified an increase in PPT over the cervical spine, as have other studies, suggesting a local[47] and widespread[35] antinociceptive effect of TrP DN. Another possible reason why PPT did not improve with TrP MT as much as it did with TrP DN is that PPT can increase or decrease relative to manual pressure and within the same group,

resulting in less net change in PPT than the TrP DN group.[46]

There are a number of limitations of the current study that should be considered. First, only 2 clinicians performed the TrP DN and TrP MT techniques, which might limit the generalizability of the results. Further, only TrPs in 1 muscle, the upper trapezius, were treated. Referred pain from TrPs in other muscles (eg, levator scapulae, splenius cervicis, cervical multifidus, semispinalis cervicis, or scalenes) can also be involved with mechanical neck pain symptoms. Additionally, we only collected data at a short-term follow-up of 2 weeks. We used TrP DN and TrP MT in isolation, which does not reflect actual clinical practice, where physical therapists usually take a multimodal approach. There was not a control group in the current study, so it cannot be determined if the improvements seen in both groups may be attributed to the interventions or simply the passage of time (although this is unlikely because our patients exhibited chronic pain symptoms). Further, we also did not assess changes in other potential variables related to neck pain, such as depression, anxiety, mood, or sleep disorders. Finally, our treatment interventions were only applied over 2 sessions for practical reasons and based on the authors' clinical experience, because no available data exist. We do not know if a greater number of sessions would have revealed greater changes in outcomes or differences between the interventions. Future studies should continue to examine the effectiveness of TrP DN and TrP MT alone and in conjunction with other used physical therapy interventions for the management of mechanical neck pain. We also suggest that it would be useful for future trials to include a control or placebo group and collect data at a long-term follow-up period.

CONCLUSION

The results of the current randomized clinical trial suggest that 2 sessions of TrP DN or TrP MT resulted in similar outcomes in terms of pain and disability, after the intervention and at a 2-week follow-up. Although significant and clinically relevant within-group changes were identified, it cannot be ascertained if this was a result of the intervention or simply the passage of time, as we did not include a control group. We identified greater improvements in PPT over the cervical spine in those patients receiving TrP DN. ◉

KEY POINTS

FINDINGS: Two sessions of TrP DN or TrP MT resulted in similar reductions in pain and improvements in function and cervical range of motion. Trigger point dry needling resulted in greater improvements of pressure pain sensitivity than TrP MT.

IMPLICATIONS: The effects on pain and function of TrP MT and TrP DN in the management of patients with mechanical neck pain may be similar, at least in the short term.

CAUTION: Only 2 therapists provided all the interventions, which may limit the generalizability of the results. We also did not include a control group, so we cannot be sure if the groups improved because of the intervention or as a result of other variables.

REFERENCES

1. Baldry PE. *Acupuncture, Trigger Points and Musculoskeletal Pain*. Edinburgh, UK: Elsevier/Churchill Livingstone; 2005.
2. Cagnie B, Barbe T, De Ridder E, Van Oosterwijck J, Cools A, Danneels L. The influence of dry needling of the trapezius muscle on muscle blood flow and oxygenation. *J Manipulative Physiol Ther*. 2012;35:685-691. http://dx.doi.org/10.1016/j.jmpt.2012.10.005
3. Cagnie B, Dewitte V, Barbe T, Timmermans F, Delrue N, Meeus M. Physiologic effects of dry needling. *Curr Pain Headache Rep*. 2013;17:348. http://dx.doi.org/10.1007/s11916-013-0348-5
4. Carlesso LC, Gross AR, Santaguida PL, Burnie S, Voth S, Sadi J. Adverse events associated with the use of cervical manipulation and mobilization for the treatment of neck pain in adults: a systematic review. *Man Ther*. 2010;15:434-444. http://dx.doi.org/10.1016/j.math.2010.02.006
5. Carlesso LC, MacDermid JC, Santaguida LP. Standardization of adverse event terminology and reporting in orthopaedic physical therapy: application to the cervical spine. *J Orthop Sports Phys Ther*. 2010;40:455-463. http://dx.doi.org/10.2519/jospt.2010.3229
6. Childs JD, Cleland JA, Elliott JM, et al. Neck pain: clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Orthop Sports Phys Ther*. 2008;38:A1-A34. http://dx.doi.org/10.2519/jospt.2008.0303
7. Childs JD, Flynn TW, Fritz JM, et al. Screening for vertebrobasilar insufficiency in patients with neck pain: manual therapy decision-making in the presence of uncertainty. *J Orthop Sports Phys Ther*. 2005;35:300-306. http://dx.doi.org/10.2519/jospt.2005.35.5.300
8. Cleland JA, Childs JD, Whitman JM. Psychometric properties of the Neck Disability Index and numeric pain rating scale in patients with mechanical neck pain. *Arch Phys Med Rehabil*. 2008;89:69-74. http://dx.doi.org/10.1016/j.apmr.2007.08.126
9. Cross KM, Kuenze C, Grindstaff TL, Hertel J. Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review. *J Orthop Sports Phys Ther*. 2011;41:633-642. http://dx.doi.org/10.2519/jospt.2011.3670
10. De-la-Llave-Rincón AI, Fernández-de-las-Peñas C, Laguarta-Val S, Ortega-Santiago R, Palacios-Ceña D, Martínez-Perez A. Women with carpal tunnel syndrome show restricted cervical range of motion. *J Orthop Sports Phys Ther*. 2011;41:305-310. http://dx.doi.org/10.2519/jospt.2011.3536
11. De-la-Llave-Rincón AI, Fernández-de-las-Peñas C, Palacios-Ceña D, Cleland JA. Increased forward head posture and restricted cervical range of motion in patients with carpal tunnel syndrome. *J Orthop Sports Phys Ther*. 2009;39:658-664. http://dx.doi.org/10.2519/jospt.2009.3058
12. Dommerholt J, Fernández-de-las-Peñas C. *Trigger Point Dry Needling: An Evidenced and Clinical-Based Approach*. Edinburgh, UK: Elsevier/Churchill Livingstone; 2013.
13. Dommerholt J, McEvoy J. Myofascial trigger point release approach. In: Wise C, ed. *Orthopaedic Manual Physical Therapy: From Art to Evidence*. Philadelphia, PA: F.A. Davis; 2010.
14. D'Sylva J, Miller J, Gross A, et al. Manual therapy with or without physical medicine modalities for neck pain: a systematic review. *Man Ther*. 2010;15:415-433. http://dx.doi.org/10.1016/j.math.2010.04.003
15. Enthoven P, Skargren E, Öberg B. Clinical course in patients seeking primary care for back or neck pain: a prospective 5-year follow-up of outcome and health care consumption with subgroup analysis. *Spine (Phila Pa 1976)*. 2004;29:2458-2465.
16. Fernández-de-las-Peñas C, Alonso-Blanco C, Miangolarra JC. Myofascial trigger points in subjects presenting with mechanical neck pain: a blinded, controlled study. *Man Ther*. 2007;12:29-33. http://dx.doi.org/10.1016/j.math.2006.02.002

17. Fletcher JP, Bandy WD. Intrarater reliability of CROM measurement of cervical spine active range of motion in persons with and without neck pain. *J Orthop Sports Phys Ther*. 2008;38:640-645. http://dx.doi.org/10.2519/jospt.2008.2680
18. Gerwin RD, Shannon S, Hong CZ, Hubbard D, Gevirtz R. Interrater reliability in myofascial trigger point examination. *Pain*. 1997;69:65-73.
19. González T, Balsa A, Sáinz de Murieta J, Zamorano E, González I, Martin-Mola E. Spanish version of the Northwick Park Neck Pain Questionnaire: reliability and validity. *Clin Exp Rheumatol*. 2001;19:41-46.
20. Graham N, Gross A, Goldsmith CH, et al. Mechanical traction for neck pain with or without radiculopathy. *Cochrane Database Syst Rev*. 2008:CD006408. http://dx.doi.org/10.1002/14651858.CD006408.pub2
21. Gross A, Forget M, St George K, et al. Patient education for neck pain. *Cochrane Database Syst Rev*. 2012;3:CD005106. http://dx.doi.org/10.1002/14651858.CD005106.pub4
22. Gross A, Miller J, D'Sylva J, et al. Manipulation or mobilisation for neck pain: a Cochrane Review. *Man Ther*. 2010;15:315-333. http://dx.doi.org/10.1016/j.math.2010.04.002
23. Gummesson C, Isacsson SO, Isacsson AH, et al. The transition of reported pain in different body regions – a one-year follow-up study. *BMC Musculoskelet Disord*. 2006;7:17. http://dx.doi.org/10.1186/1471-2474-7-17
24. Hong CZ. Lidocaine injection versus dry needling to myofascial trigger point. The importance of the local twitch response. *Am J Phys Med Rehabil*. 1994;73:256-263.
25. Hsieh YL, Yang SA, Yang CC, Chou LW. Dry needling at myofascial trigger spots of rabbit skeletal muscles modulates the biochemicals associated with pain, inflammation, and hypoxia. *Evid Based Complement Alternat Med*. 2012;2012:342165. http://dx.doi.org/10.1155/2012/342165
26. Itoh K, Katsumi Y, Hirota S, Kitakoji H. Randomised trial of trigger point acupuncture compared with other acupuncture for treatment of chronic neck pain. *Complement Ther Med*. 2007;15:172-179. http://dx.doi.org/10.1016/j.ctim.2006.05.003
27. Jensen MP, Turner JA, Romano JM, Fisher LD. Comparative reliability and validity of chronic pain intensity measures. *Pain*. 1999;83:157-162.
28. Kay TM, Gross A, Goldsmith CH, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev*. 2012;8:CD004250. http://dx.doi.org/10.1002/14651858.CD004250.pub4
29. Kietrys DM, Palombaro KM, Azzaretto E, et al. Effectiveness of dry needling for upper-quarter myofascial pain: a systematic review and meta-analysis. *J Orthop Sports Phys Ther*. 2013;43:620-634. http://dx.doi.org/10.2519/jospt.2013.4668
30. Kong LJ, Zhan HS, Cheng YW, Yuan WA, Chen B, Fang M. Massage therapy for neck and shoulder pain: a systematic review and meta-analysis. *Evid Based Complement Alternat Med*. 2013;2013:613279. http://dx.doi.org/10.1155/2013/613279
31. Kroeling P, Gross A, Graham N, et al. Electrotherapy for neck pain. *Cochrane Database Syst Rev*. 2013;8:CD004251. http://dx.doi.org/10.1002/14651858.CD004251.pub5
32. Leak AM, Cooper J, Dyer S, Williams KA, Turner-Stokes L, Frank AO. The Northwick Park Neck Pain Questionnaire, devised to measure neck pain and disability. *Br J Rheumatol*. 1994;33:469-474.
33. Lucas N, Macaskill P, Irwig L, Moran R, Bogduk N. Reliability of physical examination for diagnosis of myofascial trigger points: a systematic review of the literature. *Clin J Pain*. 2009;25:80-89. http://dx.doi.org/10.1097/AJP.0b013e31817e13b6
34. Martin BI, Turner JA, Mirza SK, Lee MJ, Comstock BA, Deyo RA. Trends in health care expenditures, utilization, and health status among US adults with spine problems, 1997-2006. *Spine (Phila Pa 1976)*. 2009;34:2077-2084. http://dx.doi.org/10.1097/BRS.0b013e3181b1fad1
35. Mejuto-Vázquez MJ, Salom-Moreno J, Ortega-Santiago R, Truyols-Domínguez S, Fernández-de-las-Peñas C. Short-term changes in neck pain, widespread pressure pain sensitivity, and cervical range of motion after the application of trigger point dry needling in patients with acute mechanical neck pain: a randomized clinical trial. *J Orthop Sports Phys Ther*. 2014;44:252-260. http://dx.doi.org/10.2519/jospt.2014.5108
36. Miller J, Gross A, D'Sylva J, et al. Manual therapy and exercise for neck pain: a systematic review. *Man Ther*. 2010;15:334-354.
37. Muñoz-Muñoz S, Muñoz-García MT, Alburquerque-Sendín F, Arroyo-Morales M, Fernández-de-las-Peñas C. Myofascial trigger points, pain, disability, and sleep quality in individuals with mechanical neck pain. *J Manipulative Physiol Ther*. 2012;35:608-613. http://dx.doi.org/10.1016/j.jmpt.2012.09.003
38. Myburgh C, Lauridsen HH, Larsen AH, Hartvigsen J. Standardized manual palpation of myofascial trigger points in relation to neck/shoulder pain; the influence of clinical experience on inter-examiner reproducibility. *Man Ther*. 2011;16:136-140. http://dx.doi.org/10.1016/j.math.2010.08.002
39. Nagrale AV, Glynn P, Joshi A, Ramteke G. The efficacy of an integrated neuromuscular inhibition technique on upper trapezius trigger points in subjects with non-specific neck pain: a randomized controlled trial. *J Man Manip Ther*. 2010;18:37-43. http://dx.doi.org/10.1179/106698110X12595770849605
40. Palmer KT, Walsh K, Bendall H, Cooper C, Coggon D. Back pain in Britain: comparison of two prevalence surveys at an interval of 10 years. *BMJ*. 2000;320:1577-1578.
41. Patel KC, Gross A, Graham N, et al. Massage for mechanical neck disorders. *Cochrane Database Syst Rev*. 2012;9:CD004871. http://dx.doi.org/10.1002/14651858.CD004871.pub4
42. Renan-Ordine R, Alburquerque-Sendín F, de Souza DP, Cleland JA, Fernández-de-las-Peñas C. Effectiveness of myofascial trigger point manual therapy combined with a self-stretching protocol for the management of plantar heel pain: a randomized controlled trial. *J Orthop Sports Phys Ther*. 2011;41:43-50. http://dx.doi.org/10.2519/jospt.2011.3504
43. Shah JP, Danoff JV, Desai MJ, et al. Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. *Arch Phys Med Rehabil*. 2008;89:16-23. http://dx.doi.org/10.1016/j.apmr.2007.10.018
44. Sim J, Jordan K, Lewis M, Hill J, Hay EM, Dziedzic K. Sensitivity to change and internal consistency of the Northwick Park Neck Pain Questionnaire and derivation of a minimal clinically important difference. *Clin J Pain*. 2006;22:820-826. http://dx.doi.org/10.1097/01.ajp.0000210937.58439.39
45. Simons DG, Travell JG, Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual Volume 1: Upper Half of Body*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 1998.
46. Sjölund BH, Persson AL. Pressure pain threshold changes after repeated mechano-nociceptive stimulation of the trapezius muscle: possible influence of previous pain experience. *J Pain*. 2007;8:355-362. http://dx.doi.org/10.1016/j.jpain.2006.11.003
47. Srbely JZ, Dickey JP, Lee D, Lowerison M. Dry needle stimulation of myofascial trigger points evokes segmental anti-nociceptive effects. *J Rehabil Med*. 2010;42:463-468. http://dx.doi.org/10.2340/16501977-0535
48. Tekin L, Akarsu S, Durmus O, Çakar E, Dinçer U, Kiralp MZ. The effect of dry needling in the treatment of myofascial pain syndrome: a randomized double-blinded placebo-controlled trial. *Clin Rheumatol*. 2013;32:309-315. http://dx.doi.org/10.1007/s10067-012-2112-3
49. Vernon H, Schneider M. Chiropractic management of myofascial trigger points and myofascial pain syndrome: a systematic review of the literature. *J Manipulative Physiol Ther*. 2009;32:14-24. http://dx.doi.org/10.1016/j.jmpt.2008.06.012
50. Walker MJ, Boyles RE, Young BA, et al. The effectiveness of manual physical therapy and exercise for mechanical neck pain: a randomized clinical trial. *Spine (Phila Pa 1976)*. 2008;33:2371-2378. http://dx.doi.org/10.1097/BRS.0b013e318183391e
51. Walton DM, MacDermid JC, Nielson W, Teasell RW, Chiasson M, Brown L. Reliability, standard error, and minimum detectable change of clinical pressure pain threshold testing in people with and without acute neck pain. *J Orthop Sports Phys Ther*. 2011;41:644-650. http://dx.doi.org/10.2519/jospt.2011.3666
52. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia: report of the Multicenter Criteria Committee. *Arthritis Rheum*. 1990;33:160-172. http://dx.doi.org/10.1002/art.1780330203

ERRATUM

In the November 2014 issue of *JOSPT*, the authors of the article titled "Comparison of the Short-Term Outcomes Between Trigger Point Dry Needling and Trigger Point Manual Therapy for the Management of Chronic Mechanical Neck Pain: A Randomized Clinical Trial" (*J Orthop Sports Phys Ther 2014;44(11):852-861. doi:10.2519/jospt.2014.5229*) incorrectly reported a range of kappa values from another study. The corrected values are listed in the following passage, from page 853: "The diagnosis of a [trigger point] was determined by the presence of all of the following[45]: (1) a hypersensitive spot in a palpable taut band, (2) palpable or visible local twitch on pincer palpation, and (3) reproduction of referred pain elicited by palpation of the sensitive spot. These criteria have been shown to exhibit moderate to good interexaminer reliability (κ = 0.36-0.84) when applied by an experienced clinician.[18]" We regret the error.