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Effectiveness of cervicothoracic and thoracic manual physical therapy in managing upper quarter disorders – a systematic review

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ABSTRACT

Study Design: Systematic review.
Background: Physical therapists often use cervicothoracic and thoracic manual techniques to treat musculoskeletal disorders of the upper quarter ,however, the overall effectiveness of this approach remains to be elucidated.
Objective: This systematic review explored studies that examined the short- and long-term effectiveness of manual physical therapy directed at the cervicothoracic and thoracic region in the management of upper quarter musculoskeletal conditions.
Methods: The electronic databases MEDLINE, AMED, CINAHL, and Embase were searched from their inception through 30 October 2020. Eligible clinical trials included those where human subjects treated with cervicothoracic and/or thoracic manual procedures were compared with a control group or other interventions. The methodological quality of individual studies was assessed using the PEDro scale.
Results: The initial search returned 950 individual articles. After the screening of titles and abstracts, full texts were reviewed by two authors, with 14 articles determined to be eligible for inclusion. PEDro scores ranged from 66 to 10 (out of a maximum score of 10). In the immediate to 52-week follow-up period, studies provided limited evidence that cervicothoracic and thoracic manual physical therapy may reduce pain and improve function when compared to control/sham or other treatments.
Conclusions: Evidence provides some support for the short-termeffectiveness of cervicothoracic and thoracic manual physical therapy in reducing pain and improving function in people experiencing upper quarter musculoskeletal disorders. Evidence is lacking for long-term effectiveness as only two studies explored outcomes beyond 26 weeks and this was for patient-perceived improvement.
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KEYWORDS
Thoracic spine; Manipulation; Upper quarter

Introduction

Upper extremity musculoskeletal disorders (MSDs) are commonly reported in the general and working populations and usually present as pain and/or tingling in the neck, shoulder, or upper extremity. Upper extremity MSDs typically consists of conditions involving nerves, muscles, and/or joints. These conditions can often be multifactorial and work-related with a reported annual incidence range from 0.08 to 6.3 and prevalence from 0.14 to 14.9 [1,2]. Additionally, a 2006 systematic review suggested that women were significantly more likely to experience an upper extremity MSD than men, and this difference was not attributable to work-related variables. Musculoskeletal disorders have a substantial economic burden on society due to lost work productivity and health care costs [3]. Inpatient and outpatient surgery is the largest contributor to the total amount paid to treat many of these diagnoses and physical therapy services also contribute a portion to the overall care costs, which are estimated to be in the billions of dollars [4].

Physical therapy management of upper extremity (upper quarter) MSDs includes physical agents, therapeutic exercise, thrust or non-thrust manual physical therapy procedures, or a combination of these interventions [5]. Favorable outcomes related to intervention assume diagnosis and classification will determine if symptoms are emanating from the extremity itself or more proximal (such as the spine), thereby directing treatment to that region [6]. The most common upper extremity MSDs in the Truven Health MarketScan database are shoulder pain and rotator cuff tendinopathy, shoulder stiffness, shoulder arthritis, lateral epicondylitis, hand arthritis, trigger finger, wrist pain, and hand pain [6].

A systematic review conducted in 2006 was not able to identify any studies reporting incidence rates for upper quarter MSDs. The authors identified an absence of a universally accepted way of labeling or defining

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these conditions [3], a challenge which remains to this day. As extremity pain may emanate from the spine, this issue is further confounded. Rosedale and colleagues [7] found over 40% of 369 physical therapy patients with isolated extremity pain, who believed their pain was not originating from the spine, responded positively to spinal intervention, and were thus classified as having a spinal source of symptoms rather than an upper extremity MSD. Similarly, interventions directed only to a particular region, such as the shoulder, do not consider the role of neighboring structures such as the cervicothoracic spine and ribs [8]. Although evidence supports manual physical therapy intervention of the spine in the management of patients with shoulder pain [9–15], the effects of cervicothoracic and thoracic thrust and non-thrust manipulation on individuals with a primary complaint of upper quarter pain remain to be reported in a systematic review. Therefore, the purpose of this systematic review was to determine the effectiveness of manual physical therapy in the treatment of pain and disability in individuals with upper extremity MSDs as outlined above.

Methods

This systematic review was performed following the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines [16]. This study was registered a priori with PROSPERO (ID: CRD42020219456). The included studies were comprised of individuals with a musculoskeletal condition-related pain and/or disability related to the upper quarter. Individuals between the ages of 18 and 80 years of age were included in this systematic review. Studies were excluded if they pertained to post-surgical care.

Search strategy

Eligible studies in this systematic review included randomized clinical or controlled trials of patients with MSDs of the upper quarter treated by a physical therapist with cervicothoracic and/or thoracic thrust/non-thrust manipulation and compared with a control, sham, or other intervention. Randomized trials were included to avoid bias and provide rigor in examining cause-effect relationships between intervention and outcome. Studies were excluded if patients were less than 18 years of age or if the full text was not published in English. The electronic databases PubMed, AMED, SPORTDiscus, CINAHL, and the Cochrane Central register of controlled trials were searched independently by a biomedical librarian. The terms thoracic spine, manipulation, paired with 'random', 'group', trial" randomized controlled trial," or 'controlled clinical trial' were used to search the electronic databases. Results were limited to human studies. Bibliographic reference lists from identified articles were hand searched for any other potential study not identified during the database searches. Search results are displayed in Appendix A.

After duplicate articles were removed, two independent reviewers (R.S. and J.C.) screened titles and abstracts to determine which studies met the inclusion and exclusion criteria. Studies that appeared to meet the inclusion criteria or whose eligibility could not be determined from the title/abstract screening were retrieved for full-text review by the two independent reviewers (R.S. and J.C.). Disagreements between reviewers were resolved by consulting a third reviewer (M.D.) who was blind to the other reviewers' decisions on whether the study should be included. Reliability between independent reviewers was calculated for both title/abstract and full-text review using an unweighted kappa.

Data extraction and quality assessment

Data extraction was performed by the primary investigator (R.S.) and was reviewed for accuracy by the senior author (J.C.). Data were then compiled into a standardized data-extraction form and were determined following validation by the two reviewers. Data included sample size, diagnosis, inclusion/exclusion criteria, duration of symptoms, type of manual physical therapy intervention (thrust, non-thrust, massage), main outcomes, and time to an outcome. Data included from extracted studies are found in Table 1 and were determined following validation by the two reviewers.

The quality of randomized trials were identified through the PEDRO database and were confirmed by two independent reviewers (R.S. and J.C.) using the PEDro (Physiotherapy Evidence Database) quality scale. The PEDro scale is based on 11 criteria, of which 10 contribute to the score, representing internal validity, methodological quality, and risk of bias. The first criterion is not included in the score, as it relates to external validity of the study. Higher scores indicate higher methodological quality. The PEDro scale has been shown to have fair to good interrater reliability, with an intraclass correlation coefficient of 0.55 (95% confidence interval (CI): 0.41, 0.72) [17]. The reviewers' disagreement was resolved by consulting a third author (M.D.) who was blind to previous assessment scores.

Results

Study selection

Database searches returned a total of 1046 studies. After removing 96 duplicates, 950 titles and abstracts

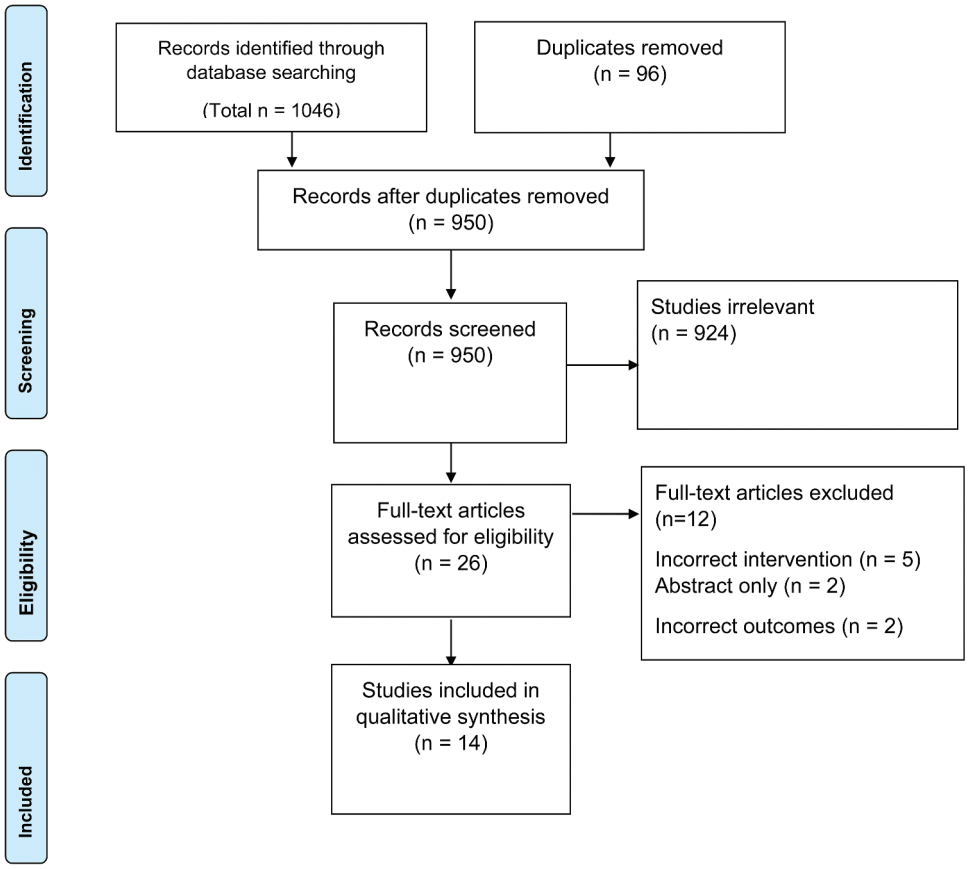

Figure 1. PRISMA flow diagram.

were screened for eligibility. Of these, 26 full-text articles were reviewed. Following full-text review, 14 eligible articles remained and were included in this review. Figure 1 represents the flow diagram of article selection. No articles were identified by hand-searching reference lists of included studies. Inter-rater reliability was good for inclusion/exclusion of articles by the title/abstract and full-text with substantial (k = .63) and almost perfect (k = .93) agreement respectively.

Study Quality

Of the 14 studies selected for this review, the range of PEDro scores was 6–10 and the mean score was 7.92.

Study Characteristics

Fourteen studies met the criteria for inclusion in this systematic review. Twelve of the 14 included studies had a primary intervention of thoracic thrust manipulation [18,19,20,21,22,23,24,25,26,27,28,29], and 2 had a primary intervention of cervicothoracic manipulation [30,31]. Thirteen of the studies included subjects with shoulder diagnoses, and one included a diagnosis related to the elbow [22]. Characteristics of the 14 included studies are included in Table 1.

The 14 included trials in this systematic review included a total of 865 participants. Scores for the quality and risk of bias of the included studies are found in Table 2. PEDro scores for study quality ranged from 6 to 10 (out of a maximum score of 10), with a median score of 7.5 and an interquartile range of 2. Two of the trials (14%) blinded the treating physical therapist [17,19,28,30], and 50% of the trials were blinded subjects using sham or alternative treatment [19–21,26,28–30]. Nine (62%) of the studies included concealed allocation [19–21,23,24,27–29,31]. All 14 of the studies specified eligibility criteria, randomized patients, reported results of between-group statistical comparisons for at least 1 key outcome, and provided point measures and measures of variability for at least 1 key outcome. All 14 of the studies had similar groups at baseline and collected measures of at least 1 key outcome from more than 85% of the subjects initially allocated to groups.

Six of the studies (43%) included exercise with the manual physical therapy intervention [18,19,25,29–31] and 7 (50%) included manual therapy procedures alone [20–24,26,28]. One study included thoracic manual therapy combined with usual medical care [27]. The comparison groups were varied. Three studies included sham manual interventions [20,26,28] and 1 included a placebo group [21] (Table 1). Physical therapists performed all manual physical therapy procedures and comparison treatments. Six studies included follow-up assessments. Time to follow up

Table 1. Data extracted from the included studies.

	Study Characteristics								
Study	Sample Size	Participants	Diagnosis (Duration)	Intervention group (n) (SD)	Outcome Measure	Comparison group (n)	Follow up	Results	PEDro score
Kaya et al (2014)	n = 54	21 males; 33 females age (30–60)	Subacromial impingement syndrome 6 wk. treatment	Thoracic manual therapy with exercise (n = 26) Mean age 47.15 (±9.44)	VAS DASH US of tendon thickness	Kinesiotape with exercise (n = 28) Mean age 50.85	No	Significant differences in pain and DASH within groups; no difference in US thickness	6
Land et al (2017)	n = 60	30 males; 30 females; age 40–60	Subacromial shoulder impingement 12 wk. treatment	Upper thoracic mobilization (n = 20) Mean age 51 (±4.4) Shoulder massage, mobilization, stretching (n = 20) Mean age 51 (±4.4)	AROM shoulder Passive glenohumeral IR Pain Shoulder pain and function disability index Pain (SPADI)	Ultrasound (control) (n = 20) Mean age 51 (±4.4)	E-Mail follow up of pain and function (SPADI) Time frame	Outcomes significantly improved in the groups receiving upper thoracic treatment compared with the active control group and in the posterior shoulder treatment compared with the active control group with no differences detected between the shoulder treatment compared with the thoracic treatment	10
Kardouni et al (2015)	n = 45	23 females; 22 males; age 18–59	Subacromial impingement syndrome; 6 techniques during one session	Thoracic SMT (n = 24) Mean age 31.1 (±2.3)	NPRS; Penn shoulder score; GROC	Sham thoracic SMT (n = 21); Mean age 31.2 (±12.1)	No	There were no differences in pain sensitivity between groups. Both groups improved patient rated pain and function within 24–48 hrs.	9
Silva et al (2019)	n = 60	19 males; 41 females; age 20–70	Rotator cuff tendinopathy Two treatments	Thoracic manipulation group (n = 30) Mean age 46.06 (16.11); placebo group (n = 30) Mean age 44.46 (±12.14)	VAS; shoulder flexion, abduction range of motion	Placebo – therapist maintained minimal pressure on thoracic segments with patient in prone	No	Both groups demonstrated a reduction in pain, but there was no clinically significant improvement between groups. Both showed increased shoulder ROM, but only abduction of the painful shoulder in the MG reached the MDC.	8
Fernandez-Camero (2011)	n = 18	9 females; 8 males; age 18–60	Lateral epicondylalgia; 1 session	Thoracic manipulation (T5-8)	Pain pressure threshold; pain-free grip strength	Cervical manipulation (C5-6)	No	Cervical spine manipulation produced a greater increase of PPT in both sides compared with thoracic. For pain-free grip strength, no interaction between group and time existed	7
Riley et al (2015)	n = 88	54 females; 34 males Age 18–69	Patients with shoulder pain; 1 session	Thoracic HVLATM (n = 22); age 52.3 (±8.5): 13 females; nine males Scapular HVLATM (n = 22); age 45.9 (±13.2); 15 females; 7 males	NPRS; NPRS with impingement testing; SPADI	Thoracic neutral massage (n = 22); age 48.5 (±12.0); 14 females; 8 males Scapular neutral massage (n = 22); age 48.1 (±10.4); 12 females; 10 males	Outcome measures at 6–9 days post	Patients improved following the interventions. Neither the type of HVLATM nor the message conveyed had a significant effect on patient improvements	8

(*Continued*)

Table 1. (Continued).

Study	Study Characteristics								
	Sample Size	Participants	Diagnosis (Duration)	Intervention group (n) (SD)	Outcome Measure	Comparison group (n)	Follow up	Results	PEDro score
Park et al (2020)	n = 30	9 males; 21 females; age	Subacromial impingement syndrome 4 wk treatment, 12 sessions	Thoracic joint mobilization (n = 10); age 49.20 (±9.48) Ex group (n = 10); age 50.90 (±9.10)	Thoracic kyphosis; pec major and upper trap pain muscle tone and stiffness; affected side PROM; SPADI	Combination group (n = 10); age 50.20 (±8.99)	No	All three groups had significant improvements in all variables. The combination group displayed a significant improvement in thoracic kyphosis and upper trapezius muscle tone as well as flexion, medial and lateral rotation ROM and SPADI compared to the mobilization and exercise groups.	8
Wright et al (2017)	n = 18	8 females; 10 males; >18 yo (mean 43.1)	Subacromial impingement syndrome; treatment 2x/ week for 4 weeks	Cervicothoracic thrust/non-thrust plus shoulder manual therapy and exercise (n = 10); 5 males, 5 females; age 46.3 (±15.9)	NPRS; SPADI	Shoulder only manual therapy and exercise (n = 8); 4 males, 4 females; age 39.1 (±15.8)	DC assessment	Both groups showed statistically significant improvements in both pain and function at 2, 4 wks. and DC. Between group differences for changes in pain and physical function were not significant	7
Haider et al (2018)	n = 40;	22 females; 18 males; mean age 49.55 (±9.706)	Subacromial pain; 4 thoracic manipulations over 6 treatment session	Thoracic manual procedures, hot or cold pack, shoulder ROM and strengthening exercises (n = 20)	NPRS; SPADI	Hot or cold pack, shoulder ROM and strengthening exercises (n = 20)	1 week follow up	Pain intensity and function score improved to a greater extent in the experimental group	6
Haik et al (2017)	n = 61	38 males; 23 females	Shoulder impingement syndrome; 2 interventions over 1 week	Mid-thoracic manipulation (n = 20); Mean age 32.5(±12.0)	NPRS; DASH; Western Ontario Rotator Cuff Index	Sham thoracic manipulation group (n = 31); Mean age 31.3 (±11.0)	Day 3 follow up	TSM increased scapular upward rotation during arm lowering. Did not influence activity of the scapular muscles and pain, function, scapular tilt and internal rotation were not conclusive	8
Bergman et al (2004)	n = 150	79 females; 71 males	Shoulder pain; 6 treatments over 12 weeks	Usual medical care plus cervical and thoracic manipulation (n = 79); 42 females, 37 males; mean age 48.4 (±12.4)	Patient-perceived recovery; severity of main complaint; shoulder disability; general health	Usual medical care (n = 71); 37 females, 43 males; mean age 47.8 (±11.8)	52 weeks follow up 87–94%	More patients from intervention group reported full recovery or very large improvement. The intervention and control groups differed significantly in perceived recovery and patients who reported feeling 'cured' at 52 weeks. The outcomes of shoulder pain and disability favored additional manipulative therapy; however, only shoulder disability received a sig difference at 26 wks.	8
Vinuesa-Montoya et al (2017)	n = 41	28 males; 13 females	Shoulder impingement syndrome; 10 sessions over 5 weeks (2 session/wk)	Cervicothoracic manipulation plus exercise; (n = 21); 15 males, 6 females; age 46.85 (±8.02); 25–57	VAS; DASH; Shoulder disability questionnaire; Hawkins-Kennedy and Neer test; Shoulder AROM	Home exercise program; (n = 20); 13 males, 7 females; age 51.21(±5.29); 38–58	no	Between group differences in the DASH. No statistically significant differences for shoulder disability questionnaire and pain intensity. Both groups improved regarding disability and clinical tests for subacromial impingement syndrome	9
Grimes et al (2019)	n = 60	37 males, 23 females	Shoulder pain syndrome; 2 thoracic manipulative techniques	Seated thoracic manipulation (n = 20); 12 males, 8 females, age 35.6(±14.7) Supine thoracic manipulation (n = 20); 10 males, 10 females; age 37.6(±15.3)	Self-reported pain; Pain shoulder score; impairment measures	Sham manipulation (n = 20); 15 males, 5 females; age 36.5(±15.5)	no	No differences in pain, satisfaction and function compared to a sham manipulation. Thoracic spine manipulation did not have an immediate effect on the scapular impairments measured.	8
Mintken (2016)	n = 140; age 18–65	76 females; 64 males	Shoulder pain; 8 sessions of manual therapy with exercise or exercise alone	Thoracic manual therapy plus exercise (n = 70); 40 females, 30 males; age 40.5(±11.7)	SPADI; NPRS; QuickDASH; GROC; PASS	Exercise alone; (n = 70); 36 females, 34 males; age 44.8(±12.9)	6 mos. follow up	Adding two sessions of high dose cervicothoracic manual therapy to an exercise program did not improve pain or disability in patients with shoulder pain, but did improve patient-perceived success at 4 wks. and 6 mos. and acceptability of symptoms at 4 wks.	9

Table 2. PEDro quality assessment.

	Kaya et al.[16]	Land et al[17].	Silva et al[19].	Kourdouni et al[18].	Fernandez-Comero et al[20]	Riley et al[21].	Park et al[22].	Wright et al[29].	Haider et al[23].	Haik et al[24].	Bergman et al[25]	Vinuesa-Montoya et al[28]	Grimes et al[26].	Mintken et al[27].
PEDro Item														
Eligibility criteria were specified	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Random allocation of subjects	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Allocation concealment	-	+	+	+	-	+	+	+	-	-	+	-	+	+
Similar groups at baseline	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Subjects blinded	-	+	+	+	-	-	-	-	-	+	-	+	+	+
Therapists administering treatment blinded	-	+	-	-	-	-	-	-	-	-	-	+	-	-
Assessors blinded	-	+	-	-	+	+	+	-	-	+	+	+	-	+
One key outcome obtained from 85% of subjects initially allocated to groups	+	+	+	+	+	+	+	+	+	+	+	+	+	+
'Intention to treat' used for analysis of one key outcome	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Between-group statistics for one key outcome reported	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Point measures and measures of variability for one key outcome	+	+	+	+	+	+	+	+	+	+	+	+	+	+
SCORE	6	10	8	9	7	8	8	7	6	8	8	9	8	9
Internal Validity	F	E	G	E	G	E	E	G	G	E	G	E	E	E

varied from 3–9 days in 4 studies [19,23,25,26], 6 months [29] in one study, and one year in one study [27]. Thirteen of the 14 studies assessed both pain and function. Function was assessed with the SPADI in 6 studies [19,23–25,29,31], the DASH in 4 studies [18,26,29,30], and other shoulder disability questionnaires in 4 studies [20,26,27,30]. Pain was assessed using the Numerical Pain Rating Scale (NPRS) in 5 studies [20,23,25,29,31], and the Verbal Analog Pain Scale (VAS) in 3 studies [18,21,30].

Thoracic manual procedures versus control/sham

Five studies [19–21,26,28] examined the short to immediate-term effect of thoracic manual procedures compared to a control or sham. Of the 5 studies, only one showed a significant improvement in pain and function in the treatment group when compared to an active control [19]. There were no significant differences between groups in pain measures or function in two of the studies [20,28]. A statistically significant but not clinically meaningful difference for shoulder pain was found in one study. In this study, only abduction of the painful shoulder reached minimal detectable change [21]. In a trial comparing mid-thoracic manipulation to a sham treatment, manipulation was found to increase scapular upward rotation during arm lowering. However, effects of manipulation on shoulder pain, function, scapular tilt, and internal rotation were inconclusive [26]. The methodological quality of these studies ranged from 7–9 on the PEDro scale.

Cervicothoracic and thoracic manual procedures versus other interventions

Eight studies compared the effects of cervicothoracic or thoracic manual procedures to other interventions [18,22,24,25,27,29–31]. Three of the 8 studies [18,24,30] found significant improvements in pain or function.

The methodological quality of these studies ranged from 7–9 on the PEDro scale.

Long-term effects of thoracic manipulation

Only two studies [27,29] examined the long-term effects of thoracic manipulation. With the addition of thoracic manipulation as a targeted intervention, significant improvement in perceived recovery was found at 52 weeks in one trial [27], and 6-months in the other [29]. The methodological quality of [27] was 8 and [29] was 9 on the PEDro scale, respectively.

Discussion

Results of this systematic review suggest that treatments including cervicothoracic or thoracic manual physical therapy procedures (non-thrust and thrust manipulation) have limited effectiveness in reducing pain and disability for people with upper-quarter MSDs. A PEDro quality assessment found the included studies' internal validity range from fair to excellent [19–31].

While previous studies [9–15] suggested the effectiveness of thoracic manipulation in the treatment of uppers quarter MSDs, the evidence from this review is less conclusive. Favorable outcomes related to cervicothoracic or thoracic manipulation were found when comparing the intervention to an active control [19], when comparing thoracic manipulation intervention to other interventions [18,24,30], and when assessing patient perception of long-term recovery [27,29]. These results are in line with previous studies that highlight the potential for extremity pain to originate from a spinal source. In a study of extremity pain of spinal source (EXPOSS), 71 people (19%) who had upper extremity complaints were found to have a spinal source of their symptoms [7]. Irrespective of the challenge of diagnosis, the EXPOSS study reported a high proportion of extremity presentations, such as described in this systematic review, that responded to spinal intervention [7]. However, it should be noted that in this review, only one study met the inclusion criteria of an upper quarter disorder other than the shoulder, so it is difficult to generalize the results to disorders of the elbow or wrist/hand [22].

The short-term effectiveness of thoracic manual procedures on painful conditions of the upper quarter is supported by several studies in this review [18–25,27,31]. Short-term effectiveness also appears consistent with a earlier systematic review and meta-analysis that found a significant effect of spinal manipulation on the pain pressure threshold at the remote sites of stimulus application [32]. These results further point to a potential neurophysiological effect rather than a mechanical effect of spinal manipulation [33–36]. Additionally, MSDs, such as those of the upper quarter, may not be limited to the painful area and, additionally, may be mediated by central mechanisms [8,32,37]. This concept has been supported in studies on shoulder [12–15,23–31] and elbow dysfunction [22].

This systematic review includes two studies of the long-term effectiveness of manual procedures directed at the cervicothoracic and thoracic spine by a single health profession (physical therapy) for people with upper-quarter MSDs. These two included studies [27,29] examined the effectiveness of the addition of thoracic manipulation on shoulder dysfunction at

6-months and 52-weeks following the intervention. Both studies did not find a significant improvement in pain or function, but did report an improvement in patient perceived recovery at follow-up.

Limitations

This systematic review has some limitations. The included studies were limited to those investigating manual procedures performed by physical therapists, which may have excluded articles reporting the effects of thrust and non-thrust manipulation on upper quarter MSDs performed by other practitioners. This limitation was intentional, as this review examined evidence specific to physical therapists performing manual procedures. The authors have addressed this concern by limiting the conclusions of the review to only those studies reporting on interventions provided by physical therapists. For this reason, the present findings cannot be generalized to different patient populations treated by different practitioners with varying levels of manipulation training.

Conclusion

Evidence from studies of upper quarter MSDs suggests that manipulation of the cervicothoracic and thoracic spine performed by physical therapists has questionable effectiveness when compared to no treatment, sham, or other interventions for improving pain and function. Further, the limited evidence found in this review for the effectiveness of manipulation directed to the cervicothoracic or thoracic spine for upper quarter MSDs is in relation to short-term outcomes. Further high-quality studies involving other upper quarter MSDs are needed to determine the short-and long-term effectiveness of cervicothoracic and thoracic manipulation in managing these conditions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix A

Search Strategy Used in the Medline Database

The search strategy included MeSH Terms, keywords, and text words, related to upper quarter musculoskeletal pain treated with manual physical therapy procedures directed at the cervicothoracic and thoracic spine. Search strategies were altered, using data base specific filters, as necessary to complete searches in all data bases.

Articles published in the English language were searched using the above strategies. No publication date limitations were be used. Filters were used when able to restrict article searches to randomized controlled trials, controlled trials, or other trials with an appropriate control group. Hand searches were completed using reference lists of related articles. PubMed, AMED, SPORTDiscus, CINAHL, and the Cochrane Central register of controlled trials were searched with keywords thoracic, manipulation, upper quarter.

PubMed, AMED, SPORTDiscus, CINAHL, Cochrane Central register 1. Randomized controlled trials with or without a true control, sham intervention, or true comparison intervention 2. MeSH descriptor 3. Thoracic 4. Manipulation 5. Upper quarter.