**ABSTRACT**

**Objective:** The purpose of this study was to conduct a systematic review on manual and manipulative therapy (MMT) for common shoulder pain and disorders.

**Methods:** A search of the literature was conducted using the Cumulative Index of Nursing Allied Health Literature; PubMed; Manual, Alternative, and Natural Therapy Index System; Physiotherapy Evidence Database; and Index to Chiropractic Literature dating from January 1983 to July 7, 2010. Search limits included the English language and human studies along with MeSH terms such as *manipulation*, *chiropractic*, *osteopathic*, *orthopedic*, *musculoskeletal*, *physical therapies*, *shoulder*, etc. Inclusion criteria required a shoulder peripheral diagnosis and MMT with/without multimodal therapy. Exclusion criteria included pain referred from spinal sites without a peripheral shoulder diagnosis. Articles were assessed primarily using the Physiotherapy Evidence Database scale in conjunction with modified guidelines and systems. After synthesis and considered judgment scoring were complete, with subsequent participant review and agreement, evidence grades of A, B, C, and I were applied.

**Results:** A total of 211 citations were retrieved, and 35 articles were deemed useful. There is fair evidence (B) for the treatment of a variety of common rotator cuff disorders, shoulder disorders, adhesive capsulitis, and soft tissue disorders using MMT to the shoulder, shoulder girdle, and/or the full kinetic chain (FKC) combined with or without exercise and/or multimodal therapy. There is limited (C) and insufficient (I) evidence for MMT treatment of minor neurogenic shoulder pain and shoulder osteoarthritis, respectively.

**Conclusions:** This study found a level of B or fair evidence for MMT of the shoulder, shoulder girdle, and/or the FKC combined with a multimodal treatment approach for shoulder complaints, dysfunction, disorders, and/or pain. (J Manipulative Physiol Ther 2011;34:314-346)

**Key Indexing Terms:** Chiropractic; Manipulation; Shoulder; Shoulder Pain; Randomized Controlled Trials

In 2008, McHardy et al. published the first extensive systematic review of chiropractic treatment of upper extremity conditions and disorders. McHardy et al. required that research articles include “a peripheral diagnosis and chiropractic intervention.” Research articles were excluded “if (1) pain was referred from proximal or spinal sites, (2) the patient was referred for surgical intervention, (3) the condition was not amenable to chiropractic...
treatment, or (4) a red-flag condition or diagnosis was present (unless post-surgical rehabilitation occurred)." The authors also required that treatment had to be either "peripheral or spinal or a combination of both." They further wrote "there is a paucity of literature that describes the singular use of high-velocity, low-amplitude (HVLA) thrust manipulation of the extremities."

A number of extremity mobilizations, manipulations, techniques, or "moves" were included in a textbook by BJ Palmer as long ago as 1911; and teaching the use of adjunctive extremity technique, including mobilization and adjunctive or multimodal therapies, such as exercise and/or what was later termed physical therapy, can be dated back at least 100 years. As others have posited, there is an apparent disconnect between the services chiropractors actually provide, the public perception of the services provided by chiropractors, and what some within the profession believe should be provided. Although many if not most chiropractors provide various physiotherapy modalities including exercise prescription, electrical modalities and ultrasound, and a range of soft tissue techniques as well as joint mobilization for extremity disorders, medicine and the public tend to focus solely on the traditional HVLA adjustment or manipulation applied to the spine. As many chiropractors actually use a broad multimodal approach to extremity care as outlined above, research should be directed to this broader, more inclusive definition of chiropractic care.

Building upon the work of McHardy et al and using similar methodology, structure, and format, this is an expansion and update of that seminal work. The present research review includes additional chiropractic studies subsequently published as well as other similar manual and/or manipulative therapy research.

For the purposes of this updated and expanded literature review, the term chiropractic has been replaced by manipulative therapy to facilitate inclusion of all similar, related, peer-reviewed literature. For this review, the authors define manipulative therapy as inclusive of all "manual" or "adjunctive" procedures and/or therapy that includes grades I to IV++ of mobilization techniques and procedures and grade V manipulation, or HVLA thrust manipulation, with and without adjunctive or multimodal therapy.

Since the publication of the McHardy et al review, Bronfort et al. (2010) have published a comprehensive summary of the scientific evidence regarding the effectiveness of manual therapy in the management of a broad spectrum of common musculoskeletal conditions seen by chiropractors including disorders of the spine and the lower and upper extremities, and nonmusculoskeletal complaints. Of interest, Bronfort et al. appraised literature regarding manual therapy for the shoulder. However, Bronfort et al restricted their selection of evidence to only the largest, highest-quality, and methodologically "best" randomized controlled and/or clinical trials (RCTs). They did not consider research that did not meet a stringent level for RCTs nor other types of studies. Although the Bronfort review is of undoubted value to some, using such a limited number of studies does not fully align with evidence-based medicine or care (hereafter EBC) as conceived by Sackett et al. For example, the efficacy of a new drug therapy, initially tested in narrowly defined and stringent RCTs, may be later determined to be less effective in clinical practice because of the complexity of the heterogeneity of patient populations, comorbidities, as well as patient compliance. Furthermore, patient and practitioner preferences cannot be taken into account solely through RCTs; yet these variables are often found in different degrees in a variety of other studies. There are flaws in most every research study and all research designs; one must be cognizant of these limitations and interpret the findings carefully, not discounting all findings outside of the most stringent of RCTs. Therefore, in the interest of painting as broad a view of the existing evidence, this review will accept a broader range of RCTs, as well as single-group pretest posttest designs (SGPPDs), case series, and case reports, with a consensus view that all are still needed in the context of a larger review as vital components in guiding the delivery of “best patient care” and in developing new lines and areas of research.

As Johnson suggests, Sackett et al. originally developed EBC to improve practice and best patient care, improved practice and best patient care never being intended to be derived solely from RCTs, but rather derived from “tracking down the best external evidence.” Regrettably, one large, apparently well-designed RCT can be misleading, skew and distort knowledge, and do much harm when used unscrupulously out of context. In this regard, Manchikanti et al. have suggested that “the hierarchy of evidence has done nothing more than glorify the results of imperfect experimental designs on unrepresentative populations in controlled research environments above all other sources of evidence that may be equally valid or far more applicable in given clinical circumstances.”

Haldeman et al. and others have suggested that up to 80% of the practice of medicine is still based on and supported by sources with lesser levels of evidence than only large, high- or very high quality, methodologically faultless RCTs. Where then, or from what other studies, can such types of evidence be found: information “to improve practice and best patient care … for each individual, taking into account singular, individual clinical characteristics, co-morbidities and personal values and preferences for each particular individual…” As Shacklock notes in a commentary about a systematic review of manual therapy for neural mobilization “patient-therapist interactions are critical in affecting patient compliance which inevitably produces physical effects in the tissues. So even though this systematic review is appropriately directed at the holy grail (high level
evidence), the therapist should not be deterred from using their clinical acumen in dealing with subtle nuances that have not yet been measured. There is simply much more research to be done before we can base treatment on randomized controlled trials and I am not aware of any systematic review or meta-analyses system for evaluating large scale qualitative phenomena, yet.”

A variety of reviews and research looking at current interventions and how often such interventions are actually “evidenced based” has been forced to admit the lack of RCTs, particularly high-level RCTs, in the majority of cases, with consensus-based expert opinion required for best evidence guidelines. However, so-called experts can be wrong. It must also be acknowledged that, although it appears to be improving, there is as of yet no comprehensive consensus of internationally accepted and fully agreed upon gradated levels of EBC.

How is it possible then to practice without RCTs, or to develop a linear understanding of literature gaps, or to develop research to fill those gaps and develop better designed trials and studies to improve best patient care without listing or reviewing all levels of evidence and RCTs? In fact, most diagnoses have no RCTs undergirding them to guide practitioners. Indeed, one of the RCTs listed in this study was developed directly and indirectly from the McHardy et al review and was further dependent on information generated through the included case series and reports (studies now often and/or generally excluded). The answer is that all levels of evidence, as intended by Sackett et al and others, must be considered.

Therefore, building upon the McHardy et al seminal effort and the recent work by Brantingham et al, this review has adopted similar methodology using a parallel structure. This present review expands on and updates this work by reviewing all relevant professional sources, including chiropractic literature. In addition, this review uses Bronfort et al and other systematic reviews yet, unlike either previous study, will examine the shoulder alone. While acknowledging the previous work of these groundbreaking 2008 and 2010 reviews, the conclusions in this article are solely those of the included authors.

Various treatments included in this review of manipulative therapy suggest possible alternatives for (a) those who may not or should not have surgery, (b) those who may not or should not chronically use nonsteroidal anti-inflammatory drugs (NSAIDS), and (c) those for whom exercise alone has not been effective. Research into the application of manual therapy techniques has erupted, including intensive investigation by nearly all professions that treat the shoulder with manual and manipulative therapy (MMT) techniques. These investigations with and without multimodal or rehabilitative care include exploration into the most common manipulative method used by chiropractors, HVLA manipulation or thrust technique. Broadly revisiting MMT studies to review the quantity, quality, and types of research published is needed, with the goal of ranking, grading, and presenting common characteristics. The purpose of this study to provide an update and a fuller, broader, general, and more expansive review of past, current, new, and innovative multimodal MMT approaches being developed to treat common shoulder disorders, pain, and dysfunction.

**METHODOLOGY**

For this systematic review, a search of the literature was conducted using the Cumulative Index of Nursing Allied Health Literature; PubMed; Manual, Alternative, and Natural Therapy Index System; Physiotherapy Evidence Database (PEDro); and Index to Chiropractic Literature inclusive of literature dating from January 1983 to July 7, 2010. Search limits were set to include the English language, abstract, and human studies. Search terms included shoulder and spinal adjustments, spinal manipulation, mobilization and peripheral diagnosis or diagnosis, and randomized clinical trials and/or randomized controlled trials. Other search terms used were manipulation and one of the following terms: chiropractic, osteopathic, orthopedic, musculoskeletal, physical therapies, and manual therapies. There were 84 citations retrieved from the Cumulative Index of Nursing Allied Health Literature, 64 citations were retrieved from PubMed, 49 citations were
retrieved from the Index to Chiropractic literature; 11 citations were from the Manual, Alternative, and Natural Therapy Index System; and 3 citations were taken from current review, osteopathic, physical therapy, and other medical literature, including a doctoral dissertation, were included; however, review-type articles were excluded. Non-peer-reviewed literature, conference proceedings, grand rounds, and discussion articles that did not render treatment were also excluded.

Data were abstracted independently by 3 of the authors (independent assessment and combined agreement regarding the PEDro and whole systems research [WSR] scores). Most articles were obtained as electronic PDFs, with a few hard-copy articles scanned and shared from the Cleveland Chiropractic College Los Angeles library.

### Table 1. Whole systems research considerations scale

<table>
<thead>
<tr>
<th>Point if “yes”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Intervention included entire clinical encounter (rather than single procedure only)</td>
</tr>
<tr>
<td>1a Intervention tested “package” of care</td>
</tr>
<tr>
<td>2 Patient preferences/expectations assessed</td>
</tr>
<tr>
<td>2a Treatment preference or expectations assessed</td>
</tr>
<tr>
<td>3 Intervention individualize to the patient</td>
</tr>
<tr>
<td>3a Practitioner could use clinical judgement to modify procedures</td>
</tr>
<tr>
<td>3b Practitioner could use clinical judgement to modify number of visits, duration of care</td>
</tr>
<tr>
<td>4 Intervention representative of usual practice</td>
</tr>
<tr>
<td>4a Delivered by experienced by practitioners</td>
</tr>
<tr>
<td>4b Procedures/protocols based on usual practice, as documented by case reports, case series of large observational studies</td>
</tr>
<tr>
<td>4c Principal investigator delivered treatments (−1)</td>
</tr>
<tr>
<td>4d Fees for services were representative of usual practice</td>
</tr>
<tr>
<td>5 Comparison group representative of “real life”</td>
</tr>
<tr>
<td>5a “Real-life” comparisons such as no treatment, waiting list, or standard medical care use</td>
</tr>
<tr>
<td>5b Sham/placebo procedure same as procedures used in usual practice (such as soft tissue therapy) (−1)</td>
</tr>
<tr>
<td>6 Outcome assessments measured effects important to patients</td>
</tr>
<tr>
<td>6a Primary outcomes were patient-based measures (pain, function, health status)</td>
</tr>
<tr>
<td>6b Satisfaction assessed</td>
</tr>
<tr>
<td>7 General/systemic/QOL effects assessed</td>
</tr>
<tr>
<td>7a Health status or QOL instrument administered pre- and postintervention</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Total maximum score = 11, with 0 to 3 rated “low,” 4 to 7 rated “medium,” and 8 to 11 rated “high.” QOL, Quality of life.

### INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria were based upon but modified from McHardy et al and Brantingham et al and required a shoulder peripheral diagnosis and some form of manipulative therapy with and/or without multimodal or adjunctive therapy. Articles were excluded when (1) pain was referred from spinal sites (without a peripheral shoulder diagnosis), with a minimum requirement of diagnoses such as “shoulder pain and/or dysfunction”; (2) there was referral for surgical intervention (unless there was documented full postsurgical healing with or without rehabilitation); (3) the condition was not amendable for manipulative therapy (RA, fracture, ligament tear with instability, etc), (4) a red-flag diagnosis (signs of infection, drug abuse, weight loss, previous malignancy, chronic nonmechanical pain, bone deformities, widespread neurological symptoms, violent trauma, swelling, pain at rest, night sweats, HIV, etc) was identified; or (5) there was a peripheral diagnosis absent a description of management or intervention. In the current review, osteopathic, physical therapy, and other medical literature, including a doctoral dissertation, were included; however, review-type articles were excluded. Non–peer-reviewed literature, conference proceedings, grand rounds, and discussion articles that did not render treatment were also excluded.

In the McHardy et al review, when describing chiropractic treatment, they noted that there was a paucity of studies using HVLA thrust manipulation for the upper extremity, including the shoulder. In addition, it was found that, with manipulative or manual therapy treatment of shoulder pain and disorders, chiropractors generally used the “multimodal” approach. However, as will be demonstrated, use of HVLA manipulation is beginning to incrementally increase in research. Multimodal procedures include the use of exercise, strengthening, and stretching (rehabilitation), along with numerous soft tissue therapies, manual or instrument assisted, splinting, electrical, and mechanical modalities and techniques. Multimodal procedures are most often combined with manipulation and/or mobilization, and/or other manual, functional, or rehabilitative procedures such as proprioceptive neuromuscular facilitation (PNF). Very few peer-reviewed articles reviewed by McHardy et al used what they called the “classic” approach, spinal or extremity manipulation only; most used the “multimodal” approach. Reflecting the more common multimodal practice that at least three quarters of the chiropractic profession use, this literature review replaces the term chiropractic by the term manipulative therapy to facilitate inclusion and review of all literature from accessible peer-reviewed sources.
Table 2. Levels of evidence, RCTs, CTs and other studies

The levels of evidence used below are primarily derived from Harbour and Miller. Grade A: good evidence from relevant studies
- Studies with appropriate designs and sufficient strength to answer the questions.
- Results are both clinically important and consistent with minor exceptions at most.
- Results are free of significant doubts about generalizability, bias, and design flaws.
- Negative studies have sufficiently large sample sizes to have adequate statistical power.

Grade B: fair evidence from relevant studies
- Studies of appropriate designs of sufficient strength, but with inconsistencies or minor doubts about generalizability, bias, design flaws, or adequacy of sample size.
- Evidence solely from weaker designs, but confirmed in separate studies.

Grade C: limited evidence from studies/reviews
- Studies with substantial uncertainty due to design flaws or adequacy of sample size.
- Limited number of studies weak design for answering the question addressed.

Grade I: No recommendation can be made because of insufficient or nonrelevant evidence.
- No evidence that directly pertains to the addressed question either because studies have not been performed or published, or are nonrelevant.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Quality</th>
<th>Grade of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCIDs a</td>
<td>RCTs or CTs a</td>
<td>Systematic reviews</td>
</tr>
<tr>
<td>2 VHQ</td>
<td>Systematic reviews with minimal and/or greater support for MMT combined with (and/or a few RCTs/studies without) exercise/rehab and/or multimodal care for treatment of RCID</td>
<td></td>
</tr>
<tr>
<td>5 HQ</td>
<td>Bronfort et al12</td>
<td></td>
</tr>
<tr>
<td>3 MQ</td>
<td>Green et al39</td>
<td></td>
</tr>
<tr>
<td>1 LQ</td>
<td>Desmuesles et al40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ho et al46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>McHardy et al1</td>
<td></td>
</tr>
</tbody>
</table>

Supportive case report(s) and series (CR, CS):
- SGPPDs:
  - Mintken et al96 (2010) WSR (CR) 7
  - Struance et al103 (2009 WSR (SGPPD)
- Lynch et al104 2008 WSR

SCDP a | RCTs or CTs | Systematic reviews |
| 2 VHQ | Systematic reviews with minimal and/or greater support for MMT combined with (and/or a few RCTs/studies without) exercise/rehab and/or multimodal care for treatment of SCDPs |
| 4 HQ | Bronfort et al12 |
| 1 MQ | Ho et al46 |
| | McHardy et al1 |

Supportive SGPPDs or studies and/or (CR) case report(s) and series (CS):
- SGPPDs:
  - Mintken et al96 2010 WSR
  - Struance et al103 2009 WSR (SGPPD)
- Lynch et al104 2008 WSR

FS a | RCTs or CTs | Systematic reviews |
| 1 VHQC | Systematic reviews with minimal and/or greater support for MMT combined with (and/or a few RCTs/studies without) exercise/rehab and/or multimodal care for treatment of FS |
| 2 HQ | Bronfort et al12 |
| 3 MQ | Green et al39 |
| | Ho et al46 |
| | McHardy et al1 |

Supportive case report(s) and series (CR, CS):
- Krenner and Fung101 (2005) WSR (CR)
- Pribicevic and Pollard102 (2005) WSR (CS)

B There is fair evidence (B) for the treatment of a variety of RCIDs using MMT to the shoulder, shoulder girdle, and/or the FKC usually combined with (and in some cases without) exercise and/or multimodal therapy (see individually cited studies and/or Tables 3-7).

FS a | RCTs or CTs | Systematic reviews |
| 1 VHQC | Systematic reviews with minimal and/or greater support for MMT combined with (and/or a few RCTs/studies without) exercise/rehab and/or multimodal care for treatment of FS |
| 2 HQ | Bronfort et al12 |
| 3 MQ | Green et al39 |
| | Ho et al46 |
| | McHardy et al1 |

Supportive case report(s) and series (CR, CS):
- Krenner and Fung101 (2005) WSR (CR)
- Pribicevic and Pollard102 (2005) WSR (CS)

B There is fair evidence (B) for the treatment of FS (adhesive capsulitis) using MMT to the shoulder, shoulder girdle, and/or the FKC usually combined with (and in some cases without) exercise and/or multimodal therapy (see individually cited studies and/or Tables 3-7).
First, relevant articles were read, reviewed, and assessed with the valid and reliable PEDro scale or ranking system. It uses an 11-point scale (the first point being the worst). For PEDro, methodological scores of 9 to 10 are considered excellent, 6 to 8 as good, 4 to 5 as fair, and 3 or less as poor methodological quality. However, for this review, we have used guideline and scoring recommendations per Harbour and Miller, a previous review, and the SIGN and CCGPP guidelines. It is suggested that PEDro...
<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro/WSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bennell et al, 2010</td>
<td>RCT</td>
<td>RCID</td>
<td>N = 112, 93% completed</td>
<td>MT, Exercise and Education vs Placebo: sham ultrasound with nontherapeutic gel lightly for 10 min</td>
<td>SPADI</td>
<td>Power calculated and full sample size</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave age 60 ± 12.4, 10 tc/8wk</td>
<td>MT: soft tissue massage, A and P shoulders 6 min</td>
<td>Likert</td>
<td>Blinding: adequate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11 and 22 wk follow-ups</td>
<td>Supine GH joint grade IV (into 50% resistance): shoulder abducted at 45° and then 90° with A-P and Inf Mbl 4×/30 s each</td>
<td>SF-36 and AQoL instruments</td>
<td>ITT: adequate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Spinal Mbl (lower c/s and t/s-4 min each) grade IV</td>
<td>Isometric mm shoulder strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exercises: scapular retraining (adducted/ depressed held 10 s/5×, first week 15× 5 then 5×); doctor passively puts scap and shoulder through elevation/protrac</td>
<td>Adherence to tx protocol</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>tion then retraction/ depression, then assist pt, then pt does independently</td>
<td>Results: At 11 wk no significant difference between groups but with 2nd outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taping: to keep scap retracted and thoracic spine in extension</td>
<td>MT significantly better in self reported and objective measures of strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Home exercises: scap retraining W/ strengthening of rot cuff mm’s</td>
<td>(CI 0.87-2.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>with good posture—with elastic band: 1st week 2×/d then once daily</td>
<td>At 22 wk: MT significantly better in SPADI</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Home exercise program (details, see Bennell15 2007): isometric scap setting,</td>
<td>(7.1 points, CI 0.3-13.9) and within group changes sig (P &lt; .001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>isometric ext rot against wall, active ext rot, pec minor stretch, wall push</td>
<td>Secondary SPADI outcomes sig better</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>up, chin tuck, resisted (band) ext rot, thor ext lying over rolled towel, resisted (elastic band): scap, ext rot, int rot, and horizontal rowing, and ext and int rot at 90° abduction, Corner or anterior shoulder stretch</td>
<td>too (mm strength, interference with activity, and AQoL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Resisted (band) ext and int rot at 45° abd in scap plane</td>
<td>No difference between those who did all exercises and those that did exercises</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>only 59% of time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trial Completion: MT = 52/57 or 91%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placebo = 57/61 or 93%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pribicevic et al, 2010</td>
<td>RCT</td>
<td>RCID see SIS below</td>
<td>N = 60</td>
<td>MT vs Sham or Placebo Laser</td>
<td>Sig in favor of MT for ALG and goniometry (ROM) P &lt; .05</td>
<td>Power calculated</td>
<td>7</td>
</tr>
<tr>
<td>Atkinson et al, 2008</td>
<td>RCT</td>
<td>RCID</td>
<td>N = 60, Ave age 42, Range 18-76</td>
<td>MT to GH: shoulder girdle mostly</td>
<td>Clinically meaningful ↓ NRS 20 points</td>
<td>Blinding: single</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HVLA to GH, AC, or SC</td>
<td>Sample underpowered,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6 txs
2×/wk for 3 wk

| MT and Exercise vs Exercise
MT: GH Cyriax-Mbl and TFM of supraspinatus PNF (including rhythmic stabilization and hold-relax)
Mbl of the scapula lat to med under med edge (prone)
Exercise and stretching at the clinic and training for home SIS exercise program (see below)
Exercise:
Trained by physical therapist
Home SIS program (rotator cuff, rhomboids, lev scap, and serratus ant) with elastic band
Cyriax Technique (ref 1984): restoration of “accessory motions” are described but pictures in paper of the GH joint give no directions

MM tests: flexion, abduction, int and ext rot strength and trigger points located by ALG
Results:
VAS, sig for both groups (night pain, with motion, with rest)
MT appeared to be sig better for overall pain
MT ROM was sig improved in flex, abd, ext rot and sig improvement in Neer FAQ all ~ P < .05
MM tests not commented on specifically
Adverse effects not mentioned

Significant:
1st 24 h only:
↓ shoulder pain
↓ pain on impingement test
Otherwise no difference between groups: both significant for ROM and functional tests
Adverse effects: none

Power calculated and sample size small = low power
Blinding: single (assessors)
ITT: inadequate
1 drop out from control/rehab

Senbursa et al, 2007
N = 30
Ave age 48.8 ± 7.9
MT 3 tx/wk for 4 wk
~12 txs
Ex 1/d for 4 wk
12th tx, follow-up

MT and Exercise vs Exercise
MT: GH Cyriax-Mbl and TFM of supraspinatus PNF (including rhythmic stabilization and hold-relax)
Mbl of the scapula lat to med under med edge (prone)
Exercise and stretching at the clinic and training for home SIS exercise program (see below)
Exercise:
Trained by physical therapist
Home SIS program (rotator cuff, rhomboids, lev scap, and serratus ant) with elastic band
Cyriax Technique (ref 1984): restoration of “accessory motions” are described but pictures in paper of the GH joint give no directions

MM tests: flexion, abduction, int and ext rot strength and trigger points located by ALG
Results:
VAS, sig for both groups (night pain, with motion, with rest)
MT appeared to be sig better for overall pain
MT ROM was sig improved in flex, abd, ext rot and sig improvement in Neer FAQ all ~ P < .05
MM tests not commented on specifically
Adverse effects not mentioned

Significant:
1st 24 h only:
↓ shoulder pain
↓ pain on impingement test
Otherwise no difference between groups: both significant for ROM and functional tests
Adverse effects: none

Power calculated and sample size small = low power
Blinding: single (assessors)
ITT: inadequate
1 drop out from control/rehab

Conroy and Hayes, 1998
N = 14
Ave age 52
50.7-55.0 y/o
9 txs
3tx/wk/3 wk

MT: MPT + Rehab vs Rehab
Both had a standard flexibility and strengthening program + heat + ST+ patient education
Exercises: pendulum, postural correction, physiological stretching with cane, and towel assisted ext and int rot, and noninvolved arm assisted horiz add
Rot cuff strengthening and chair press and int and ext rot isometrics
Correction of asym scapulothoracic motion and rhythm
Avoid painful overhead work, etc.
MT: Maitland technique for accessory motion: inf (in flex) glide, post glide, ant glide, and long axis traction glide
Note: Mbl at mid not end ROM
Table 3. (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro/WSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bang and Deyle, 2000</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 52 Ave age 43 ± 9.1 6 tx/3 wk 1 m follow-up 2 m mail follow-up</td>
<td>MT: MPT + Exercise vs Exercise Both had a standard flexibility and strengthening program MT (Maitland) (grades I-V) most used: Mbl: caudal glide in flex and abd Mbl to ↑ flex and int rot C/s, T/s and upper rib Mbl and manipulation Stretches: Ant/Pos mm and capsule ST to invaded mm Strength: elastic band Encore: 1. Flexion elbow extended 2. Scapion 3. Rowing (flex elbow ext) 4. Horizontal abduction 5. Seated press ups 6. Elbow push ups</td>
<td>Sig effect size for MT Functional assess questionnaire (modeled on Oswestry scale) = 9 worst scale Maximum Best = 45 Worst = 0 Use of electric dynamometer to test pre and post isometric strength For: internal and external rotation and abductionVAS with orthopedic tests and resisted muscle “break” tests However, without power calculations not definitive or generalizable</td>
<td>Power not calculated Blinding: single (assessors) ITT: not clearly/adequately described 3 dropouts</td>
<td>7</td>
</tr>
<tr>
<td>Dickens et al, 2005</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 85 Ave age 54.5, 26-73 y/o All: 1. 3 failed steroid injections 2. scheduled for surgery Tx 1-2/wk at hospital until pt capable of maintaining therapy on their own 6 mo follow-up</td>
<td>MT + Exercise + Advice (45 pts) vs Control (Control = waiting list/no tx/normal activities) (40 pts) MT: C/s, T/s glenoid Mbl Exercise: Nonstandardized Strengthen rotator cuff and scapulohumeral muscles and scapular stabilization Good posture with exercise and work MT per Corrigan and Maitland tech Only for restricted accessory motion for: GH joint, A-P, long axis caudal glide, AC joint A-P and long and long axis caudal glide, cerv (P-A), thoracic (P-A, transverse) Also ↓ physiologic ROM mobilized to ↑ pain free ROM</td>
<td>Significant for C-MFS for functional recovery (100 best/0 worse) C-MFS: MT: increased avgas 20 pts Control: increased 0.65 pts Significant: MT: 11 pts did not need surgery (χ^2 = 11.2, P = .0008) Remainder → surgery Control: 100% surgery Adverse effects: none reported</td>
<td>Adequate power Blinding: single (assessors) ITT: covered</td>
<td>8</td>
</tr>
<tr>
<td>Citaker et al, 2005</td>
<td>CT</td>
<td>SIS</td>
<td>N = 40 Ave age = 54.2 ± 9.86 Used Stage II patients (per Neer) Thickening and fibrosis ages 25-40 Syndrome is described patho/clear eligibility</td>
<td>Mobilization vs PNF No treatment description Both groups: hot packs, exercises with elastic band for concentric and eccentric strengthening of the shoulder muscles and Codman’s pendular exercises (all 5 planes less than 45° ROM)</td>
<td>Goniometry VAS No sig diff between groups for VAS Both had sig and ↑ VAS changes for intragroup at Night/Day and Active/ Motionless measurements Mbl Active Day VAS ↓ 5.8 cm, P = .001 PNF Active Day VAS ↓ 5.9 cm, P = .001</td>
<td>Randomization is stated but is not described Concealed allocation not described Power not calculated Blinding: none ITT: not addressed</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 3. (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro/WSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bang and Deyle, 2000</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 52 Ave age 43 ± 9.1 6 tx/3 wk 1 m follow-up 2 m mail follow-up</td>
<td>MT: MPT + Exercise vs Exercise Both had a standard flexibility and strengthening program MT (Maitland) (grades I-V) most used: Mbl: caudal glide in flex and abd Mbl to ↑ flex and int rot C/s, T/s and upper rib Mbl and manipulation Stretches: Ant/Pos mm and capsule ST to invaded mm Strength: elastic band Encore: 1. Flexion elbow extended 2. Scapion 3. Rowing (flex elbow ext) 4. Horizontal abduction 5. Seated press ups 6. Elbow push ups</td>
<td>Sig effect size for MT Functional assess questionnaire (modeled on Oswestry scale) = 9 worst scale Maximum Best = 45 Worst = 0 Use of electric dynamometer to test pre and post isometric strength For: internal and external rotation and abductionVAS with orthopedic tests and resisted muscle “break” tests However, without power calculations not definitive or generalizable</td>
<td>Power not calculated Blinding: single (assessors) ITT: not clearly/adequately described 3 dropouts</td>
<td>7</td>
</tr>
<tr>
<td>Dickens et al, 2005</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 85 Ave age 54.5, 26-73 y/o All: 1. 3 failed steroid injections 2. scheduled for surgery Tx 1-2/wk at hospital until pt capable of maintaining therapy on their own 6 mo follow-up</td>
<td>MT + Exercise + Advice (45 pts) vs Control (Control = waiting list/no tx/normal activities) (40 pts) MT: C/s, T/s glenoid Mbl Exercise: Nonstandardized Strengthen rotator cuff and scapulohumeral muscles and scapular stabilization Good posture with exercise and work MT per Corrigan and Maitland tech Only for restricted accessory motion for: GH joint, A-P, long axis caudal glide, AC joint A-P and long and long axis caudal glide, cerv (P-A), thoracic (P-A, transverse) Also ↓ physiologic ROM mobilized to ↑ pain free ROM</td>
<td>Significant for C-MFS for functional recovery (100 best/0 worse) C-MFS: MT: increased avgas 20 pts Control: increased 0.65 pts Significant: MT: 11 pts did not need surgery (χ^2 = 11.2, P = .0008) Remainder → surgery Control: 100% surgery Adverse effects: none reported</td>
<td>Adequate power Blinding: single (assessors) ITT: covered</td>
<td>8</td>
</tr>
<tr>
<td>Citaker et al, 2005</td>
<td>CT</td>
<td>SIS</td>
<td>N = 40 Ave age = 54.2 ± 9.86 Used Stage II patients (per Neer) Thickening and fibrosis ages 25-40 Syndrome is described patho/clear eligibility</td>
<td>Mobilization vs PNF No treatment description Both groups: hot packs, exercises with elastic band for concentric and eccentric strengthening of the shoulder muscles and Codman’s pendular exercises (all 5 planes less than 45° ROM)</td>
<td>Goniometry VAS No sig diff between groups for VAS Both had sig and ↑ VAS changes for intragroup at Night/Day and Active/ Motionless measurements Mbl Active Day VAS ↓ 5.8 cm, P = .001 PNF Active Day VAS ↓ 5.9 cm, P = .001</td>
<td>Randomization is stated but is not described Concealed allocation not described Power not calculated Blinding: none ITT: not addressed</td>
<td>4</td>
</tr>
<tr>
<td>Study</td>
<td>Study Type</td>
<td>Outcome Measure</td>
<td>Group Details</td>
<td>Findings</td>
<td>Methodology Details</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>------------</td>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Munday et al, 2007</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 30 Ave age 22.5 16-38 y/o 8 txs/3 wk 1 mn follow-up</td>
<td>Both groups: Post ROM ↑ sig all P ≤ .05, as did their post within group UCLA post treatment Pain, function, ant flex range and power and pt satisfaction all P ≤ .05 UCLA score of fair/poor to good/excellent: Mbl 33.22 ± 2.95 pts PNF 29.97 ± 4.60 pts Adverse effects: not reported Drop outs: not reported Power not calculated Blinding: single (participants) ITT: adequate</td>
<td>MT: HVLA/Grade 5 vs Sham Ultrasound MT: for ↓ accessory motions/end feel (Shafer and Faye techniques) Adjust: AC joint: GH flexed ~90° then A-P any I-S contra-indicated (distracts AC joint) or supine A-P directly on humeral head; stabilize with other hand (ditto); or bilat reinforced pisiform contact; standing practitioner behind standing patient; lift I to S on AC joint. GH: per ↓ accessory motions (caudal or lat distraction, S-I in flex or ABD, etc) 1st/upper ribs/scapula: mobilization/ manipulation C-T spines not treated VAS SFMPQ ALG Significant in favor of MT VAS and SFMPQ at the 1 mo follow-up ALG (PPT) at the 8th visit and 1 mn follow-up However, small sample size is not definitive nor generalizable Drop outs: none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surenkok et al, 2009</td>
<td>RCT</td>
<td>SIS; 12 cases, RCID: 10 cases, FS: 7 cases</td>
<td>N = 39: 13 per Ave age 54.3 ± 14.6 1 tx</td>
<td>MT vs Placebo vs Control MT: Scap Mbl sup-inf gliding, rot gliding, and distraction of scapula Sets of 10 mobs with 30 s between Sham = taking up the “hand position” only Control = no treatment C-MFS VAS Pain ROM Scapular position (digital inclinometer) Results: Sig in favor of scap Mbl: ↑ flex, ↑ ABD, and overall ↑ ROM Scap upward rot, and for improvement in the C-MFS Comparing baseline to posttreatment Power calculated: fully powered for primary outcome measures Blinding: double (assessors and subjects) ITT: covered</td>
<td>Apparent post hoc power inadequate Blinding: double (patients and assessors) ITT: adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pribicevic et al, 2010</td>
<td>RCT</td>
<td>SIS</td>
<td>N = 42 Ave age 42 (range 18-45) 8 txs/4 wk 4 mn follow-up</td>
<td>Manipulation vs Multimodal MT + Exercise + ST + Modalities vs Placebo Sham Ultrasound MT: HVLA grade 5 for ↓ accessory motions/end feel C-T spine, SC, AC manipulation GH joint: seated flexion with A-P or inferior thrust VAS ROM Orthopedic examinations Results: significantly in favor of the multimodal manipulative therapy Power calculated: fully powered for primary outcome measures Blinding: double (assessors and subjects) ITT: covered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bergmann et al, 2004</td>
<td>RCT</td>
<td>SCDP d</td>
<td>N = 150 UC = 71 UC+AMT = 79 Ave 48.1 ± 11.8-12.4</td>
<td>Outcome Measures: 1° 7 Point Likert Scale Also asked dichotomous “Cured?” Power calculated and full sample size Blinding: adequate ITT: adequate</td>
<td>Pain between neck and elbow at rest or w/ UC vs UC + AMT No GH MT UC: info, advice, meds (acetaminophen/ paracetamol or NSAIDs), repeat if</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3. (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro&lt;sup&gt;7&lt;/sup&gt; WSR&lt;sup&gt;7&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bergmann et al&lt;sup&gt;17&lt;/sup&gt; 2010</td>
<td>RCT</td>
<td>SCDP</td>
<td>N = 150</td>
<td>2nd</td>
<td>1. Shoulder pain</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DG for shoulder complaints: 1. Shoulder pain w/ ↓ ABD (~ related to subacromial structures) 2. SP with ↓ ext rot ~ GH joint 3. SP w/ C-T spine and adjacent ribs w/ joint dysfunction</td>
<td>UC = 71 UC + AMT = 79 Ave age 48.1 ± 12.4 Duration shoulder complaint: &lt;6 to &gt;26 mo</td>
<td>improvement, if no or min improve, steroid injections up to 2×, if no improve at 6 wk then physical therapy (exercise therapy, massage, modalities) UC + AMT: up to 6 MT treatments: Cyriax, Greenman (osteopathic), Lewit MT techniques: HVLA manipulation/thrust and specific mobilization techniques Also Cerv and Thor spines (and up ribs) examined for joint dysfunction and pain in shoulder on move of C-T spines (and ribs) MT: no other tx such as exercise, massage, advice, etc.</td>
<td>UC vs UC + AMT (No GH MT) DG: 1. Shoulder ROM in a) Active ABD to head b) Passive ABD to head c) External Rotation grade with 4 point scale: pain (p) no p, lite p, p and severe p If no abnormalities then physical examination of C-T spine: pain, ↓ passive ROM w/out overpressure, radiation, and hand over/under tests, impingement test, rib mob test, AC joint stress test and C-T spine jt dysfunction (same p scale) UC + AMT Advice, therapy—1st 2 wk info re shoulder complaints and prognosis, advice on ADL, oral analgesics (or NSAIDs); up to 3 corticosteroid injections If sx’s &gt;6 wk add PT = 9 txs/3 mns (Exercises, massage and modalities for both groups) MT: 6 txs grade IV Mbl and HVLA grade V thrust to the C-T spines and upper ribs UC: 6 MT txs/12 wk added</td>
<td>Blinding: adequate ITT: adequate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DG for shoulder complaints: 1. Shoulder pain w/ ↓ ABD (~ related to subacromial structures) 2. SP with ↓ ext rot ~ GH joint 3. SP w/ C-T spine and adjacent ribs w/ joint dysfunction</td>
<td></td>
<td>2nd</td>
<td>1. Shoulder pain</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
<td>2. Shoulder function disability</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
<td>3. General health</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
<td>Results: At 6 wk: no significant difference between groups At 12 (43% v 21%) and 52 (52% v 35%) wk: Stat Sig more “cured” or “recovered” in MT group</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
<td>Significantly more improved in main complaint and all outcomes consistently favored MT</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
<td>Adverse effects: not reported</td>
<td>Power calculated and full sample size</td>
<td>7</td>
</tr>
</tbody>
</table>

PMR for shoulder pain:

1. Shoulder pain w/ ↓ ABD (~ related to subacromial structures) 2. SP with ↓ ext rot ~ GH joint 3. SP w/ C-T spine and adjacent ribs w/ joint dysfunction

N = 150
UC = 71
UC + AMT = 79
Ave age 48.1 ± 12.4
Duration shoulder complaint: <6 to >26 mo

UC: 2.3-2.5 v w/ GP Follow-ups: 6, 12, 26 and 52 wk after 1st tx

UC vs UC + AMT (No GH MT) DG:
1. Shoulder ROM in
   a) Active ABD to head
   b) Passive ABD to head
   c) External Rotation grade with 4 point scale: pain (p) no p, lite p, p and severe p
2. Neck pain
3. Shoulder mobility
4. Neck mobility

If no abnormalities then physical examination of C-T spine: pain, ↓ passive ROM w/out overpressure, radiation, and hand over/under tests, impingement test, rib mob test, AC joint stress test and C-T spine jt dysfunction (same p scale)

UC + AMT

Advice, therapy—1st 2 wk info re shoulder complaints and prognosis, advice on ADL, oral analgesics (or NSAIDs); up to 3 corticosteroid injections If sx’s >6 wk add PT = 9 txs/3 mns (Exercises, massage and modalities for both groups) MT: 6 txs grade IV Mbl and HVLA grade V thrust to the C-T spines and upper ribs UC: 6 MT txs/12 wk added

SPS: 4 “factors”
1. Shoulder pain
2. Neck pain
3. Shoulder mobility
4. Neck mobility

At 6 wk: no difference between groups
At 12 wk: MT: favored/significantly favored for shoulder and neck pain $P < .05$
At 26 wk: MT: favored for shoulder pain and mobility and neck mobility

Conclusion: MT with UC ↓ shoulder and neck pain severity and ↑ shoulder and neck mobility $P < .05$

Adverse effects: not reported

Power calculated and full sample size
Blinding: adequate
ITT: adequate

Table 3. (continued)

324 Journal of Manipulative and Physiological Therapeutics
McClatchie et al.85 2009
RCT Cross-over trial
Coin toss: 1st tx MT or placebo, next tx: opposite tx
SCDP SD: unilateral insidious onset shoulder pain w/ painful arc of Abd
Secondary to joint dysfunction in asymptomatic C-spine (no sx’s from C-spine ≥ 1 y)
57% reported having had C-spine pain in the last year
N = 21 Ave age 49.8 ± 9.8 Duration: ≥ 6 wk
Pt seated, no rot or lat flex of neck; operator contacts SP’s of C5,6,7 on side of shoulder pain and mobilizes grade IV toward nonpainful side (light oscillating end range gentle impulses (small amplitude) at end range (accessory) movements
(Mulligan technique 1995 cited)
Placebo: same set up w/ simply resting hand in the MT position, no application of force
MT vs Placebo MT: Lat glide grade IV+ Mbl of C5, C6 and C7 for 2 min Pt seated, no rot or lat flex of neck; operator contacts SP’s of C5,6,7 on side of shoulder pain and mobilizes grade IV toward nonpainful side (light oscillating end range gentle impulses (small amplitude) at end range (accessory) movements
(Mulligan technique 1995 cited)
Placebo: same set up w/ simply resting hand in the MT position, no application of force
VAS for pain after abd C-spine ROM (CROM) MM testing of ABD at 90° Results: MT: Sig ↓VAS for shoulder pain P < .05-v-no change in VAS for placebo No significant difference between groups for C-ROM or MM strength Abd
No significant difference between groups
Claim 1st study to demonstrate immediate ↓ pain per asymptomatic MT of the C-spine (C5,6,7)
Adverse effects: not reported
Power calculated Sample size adequate
Blinding: double (participants and assessors) ITT: adequate
7

Chen et al.24 2009
RCT SCDP Shoulder pain and disability
Duration avg: 10.2 mo Unilateral shoulder pain and stiffness
> 1 mo < 140° flex or abd or ↓ 10 cm hand behind back deficit and pain or stiffness during accessory motions
N = 90 Ave age 65.1 ± 12.7 Up to 10 txs/8 wk; average 8; minimum 6 Initially 2/>/wk then 1x/wk
MT + Exercise vs Exercise ~ Control MT: grades II-IV, but only grades II and III used (passive accessory motions for the GH, AC and SC; the shoulder girdle, either in oscillation or a sustained stretch with or without tiny amplitude oscillations (Maitland 1991)) GH: 70% received A-P glide in Abd; most common AC: 10% received A-P and P-A glide SC: 0%/no joint dysfunction or pain Advice on ADL + exercises aimed at restoring neuromuscular control, dynamic stability and ↑ function.
Exercises specific to each pt in a pain free manner w/ gradually ↑ complexity 2/>/d
Control group: same exercise and advice/no MT
Outcome measures
Primary: SPADI
Secondary: Likert (completely recovered to significantly deteriorated) ROM: active flex and abd (with photography)
Hand behind back ROM with tape measure At 1 and 6 mo both groups SPADI was significant and had MCID beneficial change
No significant difference between groups All other outcomes significant but no difference between groups but continuing improvement in both at 6 mo
No adverse effects noted
Power calculated Full sample size ITT: adequate
1 patient withdrew due to ↑ pain
7

Teys et al.86 2008
RCT SCDP Shoulder pain w/ movement
Shoulder pain with <100° flexion elevation
Duration >1 mo <1 y
N = 24 Ave age 46.1 20-64
24×3 txs Mulligan’s MWM Each patient received all 3 treatments
MWM vs Sham ~ mimic of MWM vs Control ~ no treatment GH only based on research many shoulder disorders cause head of humerus on flex to translate excessively anterior and superior MWM: Thernar eminence placed on humeral head A to P glide while stabilizing scapula, pt flex arm to pain onset while a careful post gliding force (at a right angle to flexion) is applied. 3×/10 reps, 30s between sets
Outcome measures:
ROM: Scapular plane in flexion ALG with PPT
Significant in favor of MWM for ROM vs sham and control, with increase of 16° compared with 4° sham and 0° with control P = .000
Significant in favor MWM for ALG for ↑ PPT vs sham and control No adverse effects reported
Power calculated Randomization
Full sample size
Blinding: Teys was a repeated measures, crossover, double-blinded randomized placebo controlled trial (found in paper in methods)
ITT: adequate
9

(continued on next page)
Table 3. (continued)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro/WSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winters et al.</td>
<td>RCT</td>
<td>SCDP</td>
<td>N = 172</td>
<td>Sham: one hand placed on clavicle and sternum, other hand on post humeral head with min pressure and simulated A to P glide on clavicle; pt flex arm only half way</td>
<td>SPS: 6 item questionnaire with a NRS-101 pain scale</td>
<td>Power calculated</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SGG: shoulder girdle: pain and sometimes slightly ↓ GH movement not related to synovial structures but due to functional disorders of the C, T spines or upper ribs</td>
<td>SGG N = 58</td>
<td>Control: Seated for same time period</td>
<td>Pain at rest during motion, at night, sleeping problems, inability to lie on affected side and radiating pain</td>
<td>Full sample size</td>
<td>Adequate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SG N = 114</td>
<td>SGG intervention = corticosteroid injection (SInj), MT or PT</td>
<td>Converted to a 7-28 points score (no pain to severe pain)</td>
<td>ITT: Adequate</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave age 49.1 ± 14.4</td>
<td>MT: manipulation (grade V) or mobilization (grade I-IV) only</td>
<td>Significant for MT over PT in the SGG: greater ↓ SPS (pain) and ↑ numbers feeling “cured” at 11 wk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Duration 3-9 mo</td>
<td>To the cervical, thoracic spines and upper ribs, AC and GH joints</td>
<td>Significant for SInjs for SG over MT and PT at 11 wk for ↓ pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MT or PT: 1×/wk for 6 tx’s</td>
<td>No additional exercise therapy</td>
<td>MT and PT &gt; SInj “cured” and both had significant ↓ in pain in SPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for 6 tx’s (2.75 mo)</td>
<td>“Eindhoven” techniques not described</td>
<td>2 y follow-up: no significant differences between groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Steroid Inj: 1-3</td>
<td></td>
<td>MT &gt; “cured”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up: 2, 6, and 11 wk</td>
<td></td>
<td>SInj &lt; “cured” = 95%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outcome measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1. ROM</td>
<td>Double blind: patients and assessors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Physical functioning: A “functional scale” assessing ADL such as “put on shirt, brush hair, or take a shower.”</td>
<td>No description of randomization technique or concealed allocation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This scale is not referenced, validity and reliability unknown, but at least 1 ADL had to be negatively affected by ↓ shoulder ROM and/or pain for inclusion. Not used in the follow-up or after 5th tx</td>
<td>Power not calculated</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Pain 0-10 (10 worst)</td>
<td>ITT: not adequate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ROM: significant ↑ (P &lt; .05) within group change for both groups</td>
<td>Two dropped out (1 died).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MTST maintained the significant ↑ after the 6 wk follow-up</td>
<td>No report regarding this data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pain: significantly ↓ (P &lt; .05) in both groups and descriptively &gt; in the tx group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knebl et al.</td>
<td>CT</td>
<td>SCDP</td>
<td>N = 29</td>
<td>MTST: Side-lying affected shoulder up. The shoulder is placed in 7 positions Extension with elbow flexed, flexion with elbow extended, compression of humeral head-arm abducted, then head compressed into G cavity, then circumducted or mobilized, then in the same position, tractioned and circumducted, then adducted with external rotation w elbow flexed, adduction w/ ext rot and elbow flexed, arm abducted with pumping or oscillating inferior pump or glide mobilization = mobilization and muscle energy technique or another form of mobilization = (stretch to barrier and patient resists or holds isometrically 5-10 s, patient relaxed and operator</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
therapeutically stretches 10 s, release and repeat). See Knebl 2003
Placebo: putting the shoulder into the 7 positions and then doing nothing
a) SInj
b) MMT
c) Ice therapy with PNF stretching
d) No treatment
All groups: Pendular exercises and option of NSAIDs and diazepam

5 mg at night

Temporary adverse effects of soreness/stiffness reported by tx group but resolved. Numbers not noted
Nonstatistical report that all had a decrease in pain and a general decrease in use of pain medication but 17 continued to have mild residual pain > “ice” group
ROM: Significant overall ↑ at 6 wk for steroid (P = .02)
At the end of 6 mo all equally and significantly increased (P ≤ .02)
Note: significant loss of overall ROM remaining for all at 6 mo

Significant in favor of MT + exercise at 4 wk for ↑ in passive abduction
Both groups significantly ↑ ROM and ↓ pain
Self report by patients: MTex: 9/10 stated shoulder felt better after treatment
EG: 5/10 stated shoulder felt better after treatment
Adverse effects: 1 pt temporarily aggravated

Power calculated
Full sample size
Randomized
Concealed allocation
ITT: adequate
Blinding: assessors

Power not calculated
ITT: adequate
Blinding: assessor
Randomization: stated but not described

Power not calculated
Randomization: coin toss with next pt auto assigned, repeated
Allocation: concealment not apparent
Blinding: assessor
ITT: not addressed

Power calculated
Full sample size
Randomized
Concealed allocation
ITT: adequate
Blinding: assessors

(continued on next page)
<table>
<thead>
<tr>
<th>Author</th>
<th>Study</th>
<th>Condition</th>
<th>Participants/length of study</th>
<th>Intervention</th>
<th>Outcome measures/results</th>
<th>Methodology</th>
<th>PEDro Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buchbinder et al.</td>
<td>RCT</td>
<td>FS</td>
<td>N = 144</td>
<td>Both groups received steroid-joint distention injections first</td>
<td>SPADI Overall pain (0-10)</td>
<td>Power calculated</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Duration pain:</td>
<td>This has been shown to significantly ↓ pain and ↑ function/ROM up to 6 wk but</td>
<td>Active shoulder ROM SF-36</td>
<td>Full sample size</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Avg 6 mo Range 3-60 mo</td>
<td>not sustained at 12 wk. Question: Would MT help after 12 wk?</td>
<td>AQoL Patient perceived recovery</td>
<td>ITT: adequate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8 txs/6 wk 2/wk for 2 wk</td>
<td>Then randomized to either: MT</td>
<td>SPADI and overall pain: sig and clin meaningful within-group changes for both at 6, 12 and 26 wk</td>
<td>5-point Likert scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1/wk for 4 wk</td>
<td>(mobilization with “PT” or exercise therapy) vs Sham/placebo ultrasound and nontherapeutic gel (no exercise)</td>
<td>AQoL ↑ equally for all</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Manual therapy: cervical, thoracic and GH mobilization with end ROM and accessory motions + rotator cuff strength and coordination exercise, stretching GH joint, scapular stabilization and proprioception exercise</td>
<td>Sig ↑ in flex, abd and ext rot for MT at 6 and 12 wk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medication allowed and recorded</td>
<td>ROM was greater at all points in the MT group</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant difference in favor of MT for PPR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>At all time points ( P = .002 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adverse effects: mod-marked worsening</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: LGMT: Same mobilizations but grade II only or within the pain free ROM (below discomfort or painful restriction, not at “end feel,” ROM). However after LGMT used PNF patterns within pain-free ROM and had the pts do Codman pendular exercises.

Advers effects: minor temporary soreness reported only.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>FS Phase</th>
<th>N</th>
<th>Mean Age</th>
<th>Range</th>
<th>Duration</th>
<th>Groups</th>
<th>Treatments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yang et al, 2007</td>
<td>RCT</td>
<td>2nd or stiffness</td>
<td>23</td>
<td>55.7</td>
<td>46.8-68.1</td>
<td>10-32 mo</td>
<td>2 groups: Group 1: A-B-C; Group 2: A-C-A-B</td>
<td>Each treatment 3 wk, 2×/wk for 12 wk for a total of 24 treatments</td>
<td>Three mobilization techniques (grade III or IV): 1. MRM = shoulder moved to about 40° abduction or a “testing position” and 10-15 repetitions of mobilization (either ROM oscillation below pain or end ROM or accessory motions) 2. ERM techniques at end of full ROM both end feel spring (or over pressure) and/or at ERM accessory motions with 10-15 repetitions 3. MWM or MWM...Mulligan Combines sustained manual technique of “gliding” or accessory motion with combined and concurrent physiologic (assisted) or passive (operator) ROM 3×10 reps with 1 min between Mulligan based the technique on “repositioning” bone positional faults</td>
</tr>
<tr>
<td>Rainbow, 2008</td>
<td>CT</td>
<td>1st subject randomized</td>
<td>8</td>
<td>30-65</td>
<td>≥6 mo</td>
<td>≥6 mo</td>
<td>Group 1: Manipulation to the C-T spines and shoulder (GH) joint (grade 5 HVLA thrust) + exercise vs Group 2: Grade 3-4 Mobilization + exercise Exercises 3× per day: Pendulum and Wall walking Manipulation to the C-T spines and GH joint per Bergman et al, 2002 and motion palpation using PARTS and provocation testing per Shafer and Faye, 1990 Limit 2 GH manipulations per tx (frequently A-P in flexion or flexion with inferior glide; other techniques per examination) If co-morbidity: no I-S with A-P moves or testing through provocation</td>
<td>Both reported significant improvement with SPADI Descriptively: Group 1: decreased 54.2 pts Group 2: decreased 24.0 pts Group 1 appeared significantly better ( P = .029 ) Intragroup + outcome for both groups descriptively larger for manipulation With small sample, no generalization can be made between group differences Adverse effects: none reported</td>
<td></td>
</tr>
<tr>
<td>Surenkok et al, 2009</td>
<td>FS</td>
<td>N = 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>See above in SIS section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Study</td>
<td>Condition</td>
<td>Participants/length of study</td>
<td>Intervention</td>
<td>Outcome measures/results</td>
<td>Methodology</td>
<td>PEDro&lt;sup&gt;e&lt;/sup&gt;/ WSR&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andersen and Parkin-Smith, 2003</td>
<td>RCT</td>
<td>MPDS/ST</td>
<td>N = 30</td>
<td>Group A: Ice + gentle passive stretch (per Travel and Simmons 1992)</td>
<td>Intragroup: no significant differences P &gt; .05</td>
<td>Power essentially adequate</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Age range: 18-55</td>
<td>Group B: Heat + gentle passive stretch (per Travel and Simmons 1992)</td>
<td>Inttragroup: both groups NDI beneficial/ significant change: &gt; MCID of 7.5 pts</td>
<td>Sample adequate for subjective measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tx: 5 tx over 3 wk</td>
<td></td>
<td>NRS and SFMPQ significant and clinically meaningful beneficial change ROM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 mo follow-up</td>
<td></td>
<td>some significant change at 3 wk (P &lt; .05)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dx: Shoulder girdle mm’s</td>
<td></td>
<td>ALG significant at 3 wk and 1 mo P &lt; .05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(trap, lev scap and infraspinatus, dx; per Simmonds 92, confirmed by ALG)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Van den Dolder and Roberts, 2003</td>
<td>RCT</td>
<td>(MPDS/STD)</td>
<td>N = 29</td>
<td>MT: massage while muscles stretched</td>
<td>PSFS</td>
<td>Power not calculated</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave age 64.4</td>
<td>Massage to lateral border of scapula, in full shoulder flexion, posterior (p)</td>
<td>SFMPQ</td>
<td>ITT: not adequate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 18-80 y</td>
<td>deltoid, at end ROM horizontal flex, at end range of back a deltoid, and</td>
<td>VAS</td>
<td>Blind assessors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Duration 26-30 mo</td>
<td>pectoralis major in the stretch position all 15-20 min</td>
<td>PPI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MT group: 6 txs/2 wk</td>
<td>Control: Waiting list</td>
<td>ROM: abd, flex, hand behind back</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant and clinically meaningful in favor of massage for essentially all</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>outcomes: all P &lt; .05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without sham, part of improvement may be</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hawthorne effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hains et al, 2010</td>
<td>RCT</td>
<td>MPDS/ST</td>
<td>N = 41 MT</td>
<td>MT: TrP to shoulder muscles vs Control:</td>
<td>SPADI and NRS: significant and clinically in favor of MT (↓44 pts and ↓75% compared</td>
<td>Power not calculated</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N = 18 Control</td>
<td>TrP to Cerv and Thor spines</td>
<td>with Control (↓ 13.1 pts and ↓29%) after 15 txs</td>
<td>Crossover treatment of control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N =16 Crossover</td>
<td>Trigger points: 15 s of pressure per point</td>
<td>MT significant and similar at 30 d and 6 mo</td>
<td>ITT: not adequate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave age 46.5</td>
<td></td>
<td>Crossover at 6 mo: Control 15 txs: SPADI sig and clin improved</td>
<td>Blind assessor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Duration :4-80 y</td>
<td></td>
<td>an add ↓ 26.8 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Outcomes: 15 txs, 30 d</td>
<td></td>
<td>Adverse effects: none reported</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and 6 mo posttreatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>At 6 mo control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“crossed-over”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Outcome measures for control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>that crossed over after 15 txs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coppieters et al, 2003</td>
<td>RCT</td>
<td>NSP and/or MPNID</td>
<td>N = 20</td>
<td>MT vs Therapeutic Ultrasound (US)</td>
<td>Shoulder raise and pressure</td>
<td>Power not calculated</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave age 45.3 ± 13.8</td>
<td>MT: lateral glide to C5, C6, C7</td>
<td>NRS pain</td>
<td>Small sample size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Duration: 2.7-3.1 m</td>
<td>3× for 4.5 min each</td>
<td>ROM</td>
<td>ITT: adequate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. (continued)
unpleasant feeling of stretch [forearm and hand pins and needles] and not loss of sensation
Rule out diabetes and serious systemic/neurologic disorders not amenable to MT
Neural tissue provocation test 1 (NTPT1) for median nerve:
1. ABD and lat rot of arm (shoulder)
2. Shoulder (girdle) gently depressed
3. Supination of initially flexed forearm
4. Ext of wrist and elbow (and involuntary raising of shoulder) = test
5. + = ↑ symptoms and pain

Mobilization grades II and III with slow oscillation
Patient supine with no lateral flexion or rotation of C-spine
US dose: 0.5 W/cm² for 5 min

MT: all OM sig P < .05
Shoulder raise and pressure ↑ (unclear as to what this means)
NRS ↓ significantly 1.5 pts
ROM of elbow extension ↑ ~20° (with NTPT1) significantly and clinically meaningful
US: all nonsignificant P > .05

Coppieters et al, 2003
RCT NSP and/or MPNID
Rule out diabetes and serious systemic/neurologic disorders not amenable to MT
N = 20
Ave age 47.8 ± 14.1
Duration: 2.7-3.2 m
+ NTPT1
+ C-T spines
+ joint dysfunction
1 Treatment with pre and post OM

MT vs Therapeutic Ultrasound (US)
Grades I and IV
Mobilization C5-T1
Patient supine with no lateral flexion or rotation of C-spine
US dose: 0.5 W/cm² for 5 min

Pain drawing %
MT: all OM sig P < .05
NRS: ↓ sig 1.5 points
ROM: elbow extension ↑ 19.4° (with NTPT1) significantly and clinically meaningful
NTPT1: sx provocation significantly ↓ 43.4%
US: all nonsignificant

Power not calculated
Small sample size study
ITT: adequate
Blind assessor
Table 4. Summary of research on case series and case reports

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Treatment/management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pribicevic and Pollard,</td>
<td>SIS and associated ST disorders</td>
<td>Treatment all:&lt;br&gt;MT:&lt;br&gt;1. HVLA: for restricted motions. Shoulder: gradual ↑ amplitude to GH joint in ext rot, also Inferiorly to the A/C joint and A-P to S/C joint&lt;br&gt;Activator 2 apparatus applied to increase GH external rot, or inferior movement of AC joint (1 patient concern and request after 1st treatment.&lt;br&gt;Diversified spinal manipulations to typically T3/4 and C5/6. &lt;br&gt;2. Ischemic pressure or TrP tx to SITS mms as appropriate (using T-bar), or rhomboids, up trap, lev scap. &lt;br&gt;3. Transverse friction massage to: Post tenomuscular jnx infraspinatus, coracoacromial lig, insert supraspinatus on gr tuberosity. &lt;br&gt;4. Phonophoresis [1% steroid cream] 7 min 2.2 W/cm² &lt;br&gt;Basic exercise program:&lt;br&gt;5. Emphasis on isomet strength of supraspinatus and infraspinatus mms (after initial pain relief)&lt;br&gt;a. Isometrics: 4X10 reps, 2-3X/d.&lt;br&gt;b. Elastic band exercises also implemented shortly after isometrics at same frequency.&lt;br&gt;c. + shoulder shrugs, wall push-ups and scap retraction exercises.&lt;br&gt;Average number of txs: 4.5 txs</td>
</tr>
<tr>
<td>2005</td>
<td>4 cases of SIS</td>
<td>Pribicevic (2005) WSR (CS) 8&lt;br&gt;Outcomes and Treatment Multi-modal MT approach to shoulder: MT + Rehab (exercise therapy, soft tissue treatment, modification of ADL) + Modalities (ultrasound + 1% steroid cream: phonophoresis) + advice/education&lt;br&gt;4.5 visits average per patient (end of care=EOC)&lt;br&gt;Outcomes: at EOC, and 2 at 1 mo, 2 at 2 mo: VAS: ABD/other from VAS −3-8. EOC all clinically large ↓ in VAS ending at or about ~0&lt;br&gt;ROM (goniometry): Large ↑ with full restoration of passive and active ROM (as noted)&lt;br&gt;Return to normal ADL work, and sport (RAWS): All returned to RAWS with no restrictions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Reported outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(RCIDs): SIS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and associated ST disorders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RCID disorders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 cases of SIS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generally:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Pain, shoulder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Pain, arc of abduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. ↓ ABD and ext rot ROM with pain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. + Impingement tests Hawkins, Neers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. + Common: resisted supraspinatus tests for pain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Trigger points/mm tightness/tenderness in SITS and shoulder muscles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. ↑ VAS, ↓ ROM, ↓ ADL and work, sports activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. 1st patient 42 y ♂: injury from overhead lifting/work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restricted C5/6, T2/3, and AC inferior glide: 5 txs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd ♂ 32 y overweight, shoulder injury from adjutive technique.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restricted C5/6, T3/4, A/C, S/C: 4 txs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. 3rd patient 29 y ♂: factory worker. Inj repetitive shoulder movements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and keyboard work. Restricted C5/6 and T2/3, A/C. ↑Kyphosis : 5 txs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. 4th patient 40 y ♂: Pain over scapula. Injury after cleaning walls at</td>
<td></td>
</tr>
<tr>
<td></td>
<td>home before painting. Restricted C5/6, T3/4, A/C and Scapula. 4 txs</td>
<td></td>
</tr>
</tbody>
</table>
table 5. a summary of research on miscellaneous case series, case reports, and SGPPDs

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Treatment/management</th>
<th>Reported outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermeulen et al.</td>
<td>FS</td>
<td>MT: 18 txs (SD 14-22) over 3 mo. Tx 2×/wk for 12 wk</td>
<td>WSR (CS) 7</td>
</tr>
<tr>
<td>2000</td>
<td>Duration: Ave 8.4 mo (range 3-12 mo) 7 patients: 4♂, 3♀ (6 had previous GP+ physical therapy, 1 no tx. All with unsatisfactory outcomes) Generally: 1. Painful stiff shoulder ≥3 mo 2. 50% ↑ ROM of GH in ABD of Flex, or in Ext Rot (compared with opposite) 3. Max GH joint space 15 cm² per injection capacity 4. Exclude diabetes mellitus, recent severe trauma or deformity/damage due to past trauma, osteoporosis, 5. Rule out other systemic disorders such as cardiovascular disease, RA, etc</td>
<td>Outcomes and treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-mo follow-up and 9-mo FU) for ADL</td>
<td>ROM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Flex ↑ from 113° to 147°</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. ABD↓ 91° to 151°</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Ext Rot ↑ 13° to 31°</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Passive ROM: similar ↑ in the above 3 planes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At 6 mo, all patients maintained ROM at 6 mo</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Functional Scale: At 3 mo: 3 “much improved” and 3 “improved” and 4 reported shoulder function as “excellent”, 2 as “good” and 1 as “moderate”, 1 not reported. At 12 mo: 3 “much improved”, 3 “improved”, 1 “no change.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pain: at 3 and 6 mo, 5 reported no pain, 2 reported pain.</td>
<td></td>
</tr>
</tbody>
</table>

rankings are better clarified and rated with this slightly more rigorous scoring: a very high quality RCT (VHQ) is a 9 to 10 with a very low risk of bias, a high-quality RCT (HQ) is a 7 to 8 with low risk of bias, a moderate-quality RCT (MQ) is a 4 to 6 with a high risk of bias, and low- or poor-quality RCTs (LQ) are rated a 1 to 3 with very high risk of bias.7,56,59

As part of our desire to survey a broad evidence base, WSR was used, which is especially relevant to observational study of “body-based” usual practice, studies difficult to blind.60 Whole systems research assessment was developed to analyze Complementary and Alternative Medicine (CAM) and for commonly used, but minimally researched, treatments or therapies.61,62 Whole systems research emphasizes the value of assessing model validity; and model validity encompasses the need for research to adequately address the unique healing theory and therapeutic context of a CAM or new intervention in a variety of studies such as SGPPDs, prospective case series, and reports, as well as pilot and other designs and studies, central to the development of WSR.61,62 Whole systems research analyzes the congruence between the paradigm of the system being investigated and the research methodology being used with observation of the full intervention and clinical encounter, individualized treatment, patient preferences and clinical judgment, practitioner experience, comparison to “real-life treatment” such as waiting list or standard care, use of valid and reliable outcome measures, and so forth.61,62 Whole systems research uses a developed checklist; and in this study, the original WSR was used and slightly modified for case series and reports.60,62 The WSR assessment system or tool has not yet been demonstrated to be valid and reliable, although significant work is developing in this direction and may allow a minimal ranking possibly beyond simple subjective opinion.60-64 Whole systems research’s ratings are as follows: 8 to 11 points are ranked as HQ, 4 to 7 points are rated as MQ, and finally 0 to 3 points are rated as LQ (Table 1).

Using the guidelines per PEDro, some of the earliest shoulder chiropractic trials used computerized randomization procedures. Precomputerized randomization and concealed allocation were achieved by means of placing equal numbers of folded and obscured sheets of paper (15 or 30 per group, marked group 1 or 2) into a container. The sheets of paper were then thoroughly mixed to achieve discontinuity and were then retrieved carefully and blindly from the container. At each additional subject randomization point, containers were again held in such a manner that folded sheets and group allocation were concealed, and obtained to achieve randomization and concealed allocation. This technique, long used by medicine, has largely been replaced by new, easier computerization techniques.65 Slow adoption of the computerized system was due in part to financial barriers (particularly for the chiropractic profession) and lack of
Table 6. A summary of research on SCDP, SGPPDs

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Treatment management</th>
<th>Reported outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mintken et al, 2010</td>
<td>SCDP</td>
<td>MT 3 txs. MT + simple cervical and thoracic mobility exercises.</td>
<td>WSR (SGPPD) 8</td>
</tr>
<tr>
<td></td>
<td>N = 80</td>
<td>1. Lower cervical mobilization 30 s lateral translation of C5-7 6X each side</td>
<td>Outcome measures:</td>
</tr>
<tr>
<td></td>
<td>Average age: 41.5 ± 13.5</td>
<td>2. HVLA thrust seated midrange distraction to midthoracic spine (seated, patient with arms crossed, operator distraction/axial elongation by operator chest and/or light added P-A motion)</td>
<td>Primary GROC = success</td>
</tr>
<tr>
<td></td>
<td>‘Shoulder pain’</td>
<td>3. HVLA thrust, supine A-P thrust through patient elbows for cervicothoracic junction or spine</td>
<td>After second tx if +4 GROC tx stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. HVLA thrust, supine A-P through elbows to upper thoracic spine</td>
<td>After 3rd tx if +4 GROC = success, if &lt; than +4</td>
</tr>
<tr>
<td></td>
<td>Extensive orthopedic tests provided (see article). Most negative; particularly instability and ruled out other serious pathology such as fracture, etc.</td>
<td>5. HVLA thrust, supine A-P thrust to mid or lower thoracic spine</td>
<td>GROC = failure.</td>
</tr>
<tr>
<td></td>
<td>+ GH/synovial pathology essentially ruled out</td>
<td>All MT was delivered (each subject received 2 thrusts with each technique or the mobilization as described).</td>
<td>The 5 variables that predict success with this treatment:</td>
</tr>
<tr>
<td></td>
<td>A prospective single-arm trial to determine a priori prognostic variables that predict a successful outcome for patients with shoulder pain who receive only cervical and thoracic HVLA manipulation and mobilization</td>
<td>Exercises: supine AROM exercises</td>
<td>The 5 variables (out of many more including all outcome measures, examination procedures, etc) that predict success with &quot;shoulder pain&quot; patients (who do not have an apparent or apparent GH pathology or serious disorder):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cervical (the “3 finger ROM exercise”) appears to be AROM in rotation (neutral or slight flexion) to either side 10 reps, 3-4×/d</td>
<td>1. Pain-free shoulder flexion &lt;127°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thoracic (supine, hands behind neck with fingers interlaced, lie on rolled towel at apex of thoracic kyphosis) slightly flex and then extend over towel 10 reps, 3-4×/d</td>
<td>2. Pain-free internal rotation &lt;53°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No adverse reactions reported</td>
<td>3. Negative Neer impingement test result</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technique as described by Mintken et al. (appear similar to “diversified procedures or techniques” per Bergman 2002)</td>
<td>4. Not taking any type of medication for shoulder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MT 3 txs. MT + simple cervical and thoracic mobility exercises.</td>
<td>5. Duration &lt;90 d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 group immediate pre-post test</td>
<td>If 4/5 = 100% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Lower cervical mobilization 30 s lateral translation of C5-7 6X each side</td>
<td>If 3/5 = 95% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. HVLA thrust seated midrange distraction to midthoracic spine (seated, patient with arms crossed, operator distraction/axial elongation by operator chest and/or light added P-A motion)</td>
<td>If 2/5 = 78% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. HVLA thrust, supine A-P thrust through patient elbows for cervicothoracic junction or spine</td>
<td>For all that achieved &gt; +4 = 61% of 80 patients with shoulder pain had a successful outcome as described above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. HVLA thrust, supine A-P through elbows to upper thoracic spine</td>
<td>Those with success had significantly more shoulder flexion ROM, and significant and clinically meaningful decrease in SPADI and NRS all p &lt; .01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. HVLA thrust, supine A-P thrust to mid or lower thoracic spine</td>
<td>Must be cautious with extrapolation of these findings as there was no control and these findings need to be confirmed in future research.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MT 1 treatment: cervicothoracic, thoracic and upper ribs</td>
<td>WSR (SGPPD) 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HVLA thrust manipulation only for tx of “shoulder pain”</td>
<td>Outcome measures:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 tx: VAS outcome measure taken after a repeat of H-K and Neer’s tests. Other outcome tests then collected.</td>
<td>Primary:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Treatments:</td>
<td>GROC: +4.2 points (median +5 points) = average moderate improvement (range 0-7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Seated distraction manipulation for the cervicothoracic junction; subject’s arm behind neck – axial elongation or distraction with slight P-A or extension thrust with operator’s chest (seated general cervicothoracic thrust/applied whether dysfunction palpable or not).</td>
<td>Secondary:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For restricted extension</td>
<td>VAS: ↓ 32 mm (or 51% decrease in pain)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Supine unilateral upper rib A-P thrust</td>
<td>ROM (GH or shoulder); ↑ global ROM of 30-38°</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>↑ flexion, abduction and rotation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Author</td>
</tr>
</tbody>
</table>

Struance et al, 2009

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Treatment management</th>
<th>Reported outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mintken et al, 2010</td>
<td>SCDP</td>
<td>MT 3 txs. MT + simple cervical and thoracic mobility exercises.</td>
<td>WSR (SGPPD) 8</td>
</tr>
<tr>
<td></td>
<td>N = 80</td>
<td>1. Lower cervical mobilization 30 s lateral translation of C5-7 6X each side</td>
<td>Outcome measures:</td>
</tr>
<tr>
<td></td>
<td>Average age: 41.5 ± 13.5</td>
<td>2. HVLA thrust seated midrange distraction to midthoracic spine (seated, patient with arms crossed, operator distraction/axial elongation by operator chest and/or light added P-A motion)</td>
<td>Primary GROC = success</td>
</tr>
<tr>
<td></td>
<td>‘Shoulder pain’</td>
<td>3. HVLA thrust, supine A-P thrust through patient elbows for cervicothoracic junction or spine</td>
<td>After second tx if +4 GROC tx stopped</td>
</tr>
<tr>
<td></td>
<td>Extensive orthopedic tests provided (see article). Most negative; particularly instability and ruled out other serious pathology such as fracture, etc.</td>
<td>4. HVLA thrust, supine A-P through elbows to upper thoracic spine</td>
<td>After 3rd tx if +4 GROC = success, if &lt; than +4</td>
</tr>
<tr>
<td></td>
<td>+ GH/synovial pathology essentially ruled out</td>
<td>All MT was delivered (each subject received 2 thrusts with each technique or the mobilization as described).</td>
<td>GROC = failure.</td>
</tr>
<tr>
<td></td>
<td>A prospective single-arm trial to determine a priori prognostic variables that predict a successful outcome for patients with shoulder pain who receive only cervical and thoracic HVLA manipulation and mobilization</td>
<td>Exercises: supine AROM exercises</td>
<td>The 5 variables that predict success with this treatment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cervical (the “3 finger ROM exercise”) appears to be AROM in rotation (neutral or slight flexion) to either side 10 reps, 3-4×/d</td>
<td>The 5 variables (out of many more including all outcome measures, examination procedures, etc) that predict success with “shoulder pain” patients (who do not have an apparent or apparent GH pathology or serious disorder):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thoracic (supine, hands behind neck with fingers interlaced, lie on rolled towel at apex of thoracic kyphosis) slightly flex and then extend over towel 10 reps, 3-4×/d</td>
<td>1. Pain-free shoulder flexion &lt;127°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No adverse reactions reported</td>
<td>2. Pain-free internal rotation &lt;53°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technique as described by Mintken et al. (appear similar to “diversified procedures or techniques” per Bergman 2002)</td>
<td>3. Negative Neer impingement test result</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MT 1 treatment: cervicothoracic, thoracic and upper ribs</td>
<td>4. Not taking any type of medication for shoulder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HVLA thrust manipulation only for tx of “shoulder pain”</td>
<td>5. Duration &lt;90 d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 tx: VAS outcome measure taken after a repeat of H-K and Neer’s tests. Other outcome tests then collected.</td>
<td>If 4/5 = 100% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Treatments:</td>
<td>If 3/5 = 95% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Seated distraction manipulation for the cervicothoracic junction; subject’s arm behind neck – axial elongation or distraction with slight P-A or extension thrust with operator’s chest (seated general cervicothoracic thrust/applied whether dysfunction palpable or not).</td>
<td>If 2/5 = 78% success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For restricted extension</td>
<td>For all that achieved &gt; +4 = 61% of 80 patients with shoulder pain had a successful outcome as described above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Supine unilateral upper rib A-P thrust</td>
<td>Those with success had significantly more shoulder flexion ROM, and significant and clinically meaningful decrease in SPADI and NRS all p &lt; .01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Must be cautious with extrapolation of these findings as there was no control and these findings need to be confirmed in future research.</td>
</tr>
</tbody>
</table>
(serious pathology, RA, infection, rot cuff tear, FS, serious spinal pathology such as infections, osteoporosis, fracture, nerve root, neurogenic or neurological disorders, etc)

Prospective single arm study: to determine effects of cervicothoracic and thoracic HVLA thrust in tx of “Shoulder pain”

Outcome measures:
GROC (15 point scale from +7 (« a very great deal better ») to −7 (etc)
GH ROM
VAS

MT 1 tx (a time-series pre-test and post-test study)
1. Weak ext rot
2. Cervical C5 “facilitated segment” (or joint dysfunction causing ext rot weakness)
3. Supine thoracic “flexion/opening” manipulation
   (for restricted flexion)
4. P-A thoracic bilateral thrust

No adverse reactions reported

Technique as described by Mintken et al96; appears similar to “diversified procedures or techniques” per Bergman 2002)

Wang and Meadows, 201098

Diagnostic category: NSP minor
A minor peripheral neurogenic (referred) shoulder (and arm) pain, injury and/or disorders (see above)
N = 13
Neck pain with or without referred C5 area (shoulder or arm) pain, increased by movement.
1. Had to have a facilitated segment (see below)
2. Had to be weaker and “give way” in either external rotation and/or ABD within 3 mm tests
Average age: 36 ± 9.76
Shoulder weakness due to current or past neck and/or shoulder pain and current associated cervical joint dysfunction (with an apparent “facilitated segment” C5-7)
Weak shoulder external rotation due to a C5-6 facilitated segment; per Korr (see Wang 2010)
↓ external rotation (and or ↓ elevation/ABD of the shoulder) ROM and/or strength common dx findings in most Shoulder Pain and/or Disorders.
Existing neck or shoulder pain? 8 yes, 5 no
Neck or shoulder pain intensity at baseline n = 8
(Ave NRS 3.25 ± 1.49)
Cervical, shoulder orthopedic and/or neurological tests to rule out/exclude serious pathology

Outcome measures:
Primary: Pre- and post-tx dynamometer ext rot mm strength tests:
Handheld strength dynamometer for testing shoulder external rotator strength (pre- and posttreatment).
Note: only ext rot tested.
Secondary: Facilitated Segment Screening tests: k inter-examiner agreement

WSR (SGPPD) 6
Outcomes
Post MT tested immediately after grade III mobilization and also:
1. immediately
2. at 10 minutes
3. at 20 minutes
4. and at 30 minutes for External Rotator mm strength with dynamometer.

Significant for an ↑ in Ext Rot strength immediately after mobilization only
P = .003
Not otherwise significant.

Dx and agreement on a “Facilitated Segment”
Interexaminer agreement for a facilitated segment in this study: Kappa = Good to fair for brisk reflex, tenderness, hypersensitivity and hypertonicity but, poor for trophic change)
Table 7. Summary of related and miscellaneous case reports

<table>
<thead>
<tr>
<th>Author</th>
<th>Diagnosis</th>
<th>Treatment/Management</th>
<th>Reported outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimbey, 2005</td>
<td>NSP (or MPNIDs) and SCDP</td>
<td>MT (DC): 6 Txs&lt;br&gt;Total tx over 10 wk&lt;br&gt;1. Cerv manual traction&lt;br&gt;2. HVLA: diversified spinal manipulations to typically C5/6 and C7/T1&lt;br&gt;3. Soft tissue/TriP tx to Pec MM: including myofascial release = light press over fascia/TriP in direction of restricted motion 30 s; ART tech = press TriP while Pec mm’s contract, stretched after in ABD and Ext Rot, held 3 times 20 s.&lt;br&gt;3. Postisometric relaxation (PNF). Patient supine, arm and elbow flexed and int rot (operators hand stabilizing elbow), press over fascia beneath coracoid process in inf direction; gentle sup to inf press applied to drive coracoid superior (patient lightly resists), after stretch 3 x 20 s.&lt;br&gt;Basic exercise program to focus on scapular retraction and strengthening of upper quadrant:&lt;br&gt;1. Scapula retraction /depression (scp rt) 10X held 15 s each&lt;br&gt;2. Wall angles. Patient’s back up against wall, shoulders rot backward to touch wall with scp rt then ABD arms to 90°&lt;br&gt;3. Seated rows (band) around feet pull back flexing elbow and ext arms = retract scap, stretches pec mm’s.&lt;br&gt;4. Patient sets and maintains scap rt while taught to push, lift and elevate</td>
<td>WSR (CR) 7&lt;br&gt;Outcomes and treatment&lt;br&gt;ROM 9th wk:&lt;br&gt;1. Joint dysfunction resolved&lt;br&gt;2. TrP in Pec mm’s resolved&lt;br&gt;3. Posture slightly improved&lt;br&gt;4. Ortho tests&lt;br&gt;5. VAS appears resolved to 0</td>
</tr>
<tr>
<td>Cibulka and Hunter, 1985</td>
<td>ACOA</td>
<td>Mobilization grade IV (Kaltenborn technique-see paper) 6 txs over 5 weeks&lt;br&gt;1. Patient supine with arm along side in neutral.&lt;br&gt;Operator grasps distal aspect of arm, other hand is placed on anterior (the up portion of the humeral head) and mobilizes, oscillating in A-P 4-5x, then repeated in 2 minutes&lt;br&gt;2. Passive stretching in internal rotation (statically held for ~2 minutes). Arm was</td>
<td>WSR (CR) 6&lt;br&gt;Outcomes and treatment:&lt;br&gt;After 6 weeks and after 5 months:&lt;br&gt;1. No pain in shoulder reported at rest or with activity</td>
</tr>
</tbody>
</table>
4. Full shoulder ROM but pain with int rot and add
5. Full passive ROM but active or passive internal rot of the humerus caused the coracoid process to move P-A and inferior and the clavicle to rotate forward (earlier than opposite side)
6. Crepitus AC with active ABD
7. Pain to palpation AC joint and ↓ length of pectoralis maj and lat dorsi mms
8. x-ray confirmed OA at the AC joint

Summarized their major finding of ↓ passive internal rotation in left GH joint

MT
Patient 1:
Manipulation of T3/4, T12/L1
Rehabilitation emphasized:
1. Proprioceptive stretching and strengthening of rotator cuff mms.
2. ART® and Nimmo for shoulder muscles with rhythmic stabilization
3. Later home exercise program with tubing for rot cuff mms and additional isotonic for int and ext rot and concentric and eccentric exercise included.

Patient 2:
1. Mobilization of the AC and GH joints
2. ART®
3. Later home exercise program with tubing for rot cuff mms and additional isotonic for int and ext rot and concentric and eccentric exercise included
4. At 5 weeks additional 4 weeks of care

Lynch et al, 2008

Flattened, shallow and deformed glenoid fossa with left shoulder pain
2 patients

Patient 1
1. 27 yr ♀ athlete with gradual/insidious onset of left shoulder pain with overhead activities particularly with lifting weights. 10 yrs earlier hurt shoulder throwing javelin. Also previously hurt in football but resolved
2. Aggravated with bench press and overhead throwing but with no pain if arms kept at side for bench press.
3. Shoulder ROM slightly ↓ in flexion, add, int and ext rot in both shoulders; ↓ w/ post pain at abd 90°
4. + Apley’s scratch, + Speed’s test, Full and empty can +, Hawkins’ Impingement +, Lift off + (– a tight post capsule and weak subscapularis), + Jobe’s test, + apprehension and relocation tests bilat (– subtle instability), a sulcus sign + and Load and shift test + (all similar bilaterally)
5. VAS 9/10 when active

Initial diagnosis:
Secondary impingement
Rotator cuff tendinosis with mild instability
Biceps tendinosis
Diagnosis changed after bilateral shoulder x-rays: GHP

Outcome measures:
VAS, ROM, orthopedic tests

Patient 2
1. Left shoulder pain, 24 yr old ♂ chiropractic intern with pain after giving adjustment manipulation. Originally injured in football collision 4 yrs prior.
2. 3-4/10 NRS at the worst
3. Exacerbated after overhead activities, ext rot or abduction & lifting weights
4. Exam demonstrated slight ↓ ROM in active and passive flex and ext rot. + Neer’s, + Relocation, +Crank indicative of ant instability; + Apley’s scratch, pain on Abbott-Saunder’s ABD test with crepitus suggesting bicipital tenosynovitis.

Diagnosis: Tendinitis
After x-rays demonstrated GHP confirmed by MRI
Diagnosis of GHP added

ACOA, acromioclavicular osteoarthritis; GHP, glenoid hypoplasia.
Table 8. Exercises for specific conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>Anterior capsule restriction</td>
</tr>
<tr>
<td></td>
<td>Posterior capsule restriction</td>
</tr>
<tr>
<td></td>
<td>Pendulum</td>
</tr>
<tr>
<td>Shoulder</td>
<td>Shoulder serratus dynamic hug</td>
</tr>
<tr>
<td>impingement</td>
<td>Shoulder depression</td>
</tr>
<tr>
<td>syndrome</td>
<td>Long-sitting row</td>
</tr>
<tr>
<td>RCIDs*</td>
<td>Serratus press</td>
</tr>
<tr>
<td></td>
<td>Shoulder external rotation</td>
</tr>
<tr>
<td></td>
<td>Shoulder flexion</td>
</tr>
<tr>
<td></td>
<td>Shoulder extension</td>
</tr>
<tr>
<td></td>
<td>Shoulder adduction</td>
</tr>
<tr>
<td></td>
<td>Shoulder scaption</td>
</tr>
<tr>
<td></td>
<td>Internal rotation</td>
</tr>
<tr>
<td></td>
<td>Thoracic extension mobilization</td>
</tr>
<tr>
<td></td>
<td>Dynamic stabilization of the entire kinetic chain</td>
</tr>
<tr>
<td></td>
<td>including Scapular stabilization</td>
</tr>
<tr>
<td></td>
<td>PNF patterns</td>
</tr>
</tbody>
</table>

Table 8. Exercises for specific conditions

http://www.thera-bandacademy.com/. Login-free access to exercise and research with free account. Click on circular area under category—drop-down box—click on condition.

* Most authors used Kinesiotape in conjunction with the above exercises for RCID.

easy access to personal computers and randomization software allowing use of these techniques particularly in the last 5 to 10 years. Mechanical and manual randomization and concealed allocation derived from these procedures may in some circumstances be assigned a slightly decreased score or weight, although they will not be rejected, as similar and other significantly lower methodological studies have not been rejected in previous medical reviews, which of course calls for improvement in research methodology.

Keeping the above in mind, these methods follow sound research methodology as published in the PEDro guidelines. In particular, PEDro states that randomization is achieved if “a study is considered to have used random allocation if the report states that allocation was random. The precise method of randomization need not be specified. Procedures such as coin-tossing and dice-rolling should be considered random.”

The PEDro guidelines consider concealed allocation successful if “the person who determined if a subject was eligible for inclusion in the trial was unaware, when this decision was made, of which group the subject would be allocated to.” This study also considered intention-to-treat analysis (ITT) as per PEDro guidelines: “an intention to treat analysis means that, where subjects did not receive treatment (or the control condition) as allocated, and where measures of outcomes were available, the analysis was performed as if subjects received the treatment (or control condition) they were allocated to.” Furthermore, it is outlined in these guidelines that “this criterion is satisfied, even if there is no mention of analysis by intention to treat, if the report explicitly states that all subjects received treatment or control conditions as allocated.” Although ITT appears to be moving toward becoming a requirement and has broad general acceptance, it is nevertheless true that this has not been so in the past. Thus, randomization, concealed allocation, and ITT per the PEDro guidelines as outlined above were frequently accomplished in earlier chiropractic studies using admittedly older but what were formerly acceptable, commonly used methods, some of which are even now acceptable in smaller-sample-sized trials.

After reviewing abstracts, research was placed into 3 broad categories. Category 1 included randomized controlled or clinical trials with MMT that may have included adjunctive or multimodal therapy such as modalities, exercise/rehabilitation, NSAIDS, and/or activity modification. The Category 1 evidence table included (1) randomized controlled trials (RCTs) indicating studies that were placebo controlled; (2) randomized clinical trials (RCT’s) denoting a comparative study (treatment vs another treatment, usually either a “standard treatment” or a treatment with evidence superior to placebo); and/or (3) controlled or clinical trials (CTs) generally pseudo- or nonrandomized (with systematic assignment or purposive allocation), either an older study that used a now- unacceptable allocation methodology but was included because of prospectively controlled variables, accurate peripheral diagnosis, and usually a highly planned manipulative therapy protocol vs placebo, comparative treatment, or both; and also (4) studies that were prospective, measurable, and generally included valid and reliable outcome measures with appropriate statistical analyses (Tables 2 and 3).

Category 2 included SGPPDs and case series including 3 or more patients per study. Single-group pretest posttest designs often use a significantly more rigorous methodology with innovation or improvements in design believed by some to produce a higher level of research hierarchy evidence due to strengthened evidentiary results (Tables 4, 5, and 6).

Category 3 included case reports of 2 or less patients. However, only a few case reports (or other studies from any of the other categories) were included from the previous McHardy et al1 upper extremity systematic review, as these studies (mostly case reports and series) were adequately analyzed and need not be repeated in this systematic review (Tables 4, 5, 6, and 7). In this sense, it is suggested that this study is as an expansion of that previous review but limited to the shoulder; and the reader is directed to the McHardy review.

Within each of these categories, studies were further grouped according to the condition or conditions investigated in each article. This review used these diagnostic groupings: rotator cuff injuries, disorders, and/or diseases (RCIDs), which include partial tears, shoulder
impingement syndromes, subacromial bursitis, and tendinopathy of any of the rotator cuff tendons to include the bicipital tendon. Another diagnostic grouping was shoulder complaints, dysfunction, disorders, and/or pain (SCDP) per the Dutch Shoulder Guidelines and is defined as pain at rest or during movement of the upper arm in part or all of the area between the base of the neck and the elbow. Frozen shoulder (FS) normally denoting adhesive capsulitis, is characterized by a painful shoulder with significantly limited range of motion (ROM) that may eventually cause muscle weakness and atrophy. Soft tissue disorders (STs) include any myofascial pain, disorder, dysfunction, disease, or syndrome. Neurogenic shoulder pain (NSP) includes any referred pain from the cervical and/or thoracic spine and ribs that must include a specific diagnosis for referred shoulder pain, neuralgia, or neuropathy that is of a minor peripheral neurogenic injury.

For evaluation of SGPPDs, case series and reports (Category 2 and 3 studies), WSR assessment and group consensus were used, placing more weight on the value of appraising “model validity (as described above),” that is, assessing whether there is alignment between the framework of the system being investigated and the research methodology being used, with a consensus-developed checklist and, for case series and reports, use of a slightly modified WSR instrument. Many treatments delivered in private practice and CAM therapies combine a wide range of modalities to provide individualized treatment. The complexity of these interventions and their potential synergistic effects require innovative evaluative approaches, and the WSR attempts to accomplish this.

After ranking each study by either PEDro or WSR, the SIGN document, Considered Judgment on Quality of Evidence, was applied to all reviewed materials by the primary author and reviewed, discussed, and agreed upon through author consensus. The aggregate evidence for each condition was then given a score as level A, B, C, or I. I or “insufficient” was used in place of the earlier designation of D as outlined in the Handbook for the Preparation of Explicit Evidence-Based Clinical Practice Guidelines (Table 2).

**RESULTS**

Of 211 citations retrieved, 23 RCTs, 5 CTs, and 7 SGPPDs, case reports, and/or series were determined relevant (Fig 1). Of the RCTs, 4 were classified as RCID, 2 were classified as SCDP, 6 were listed as FS, and 2 were classified as ST. Of the RCTs (clinical trials), 3 were labeled as RCID, 4 were labeled SCDP, 4 were classified as FS, 1 was listed as a ST, and 2 were newly labeled and called NSP. Of the CTs, 2 were classified as RCIDs, 2 were FS, and 1 was labeled as SCDP. Finally, also assessed were 2 case series, 3 case reports, and 3 SGPPDs. Some were labeled SCDPs, ST, FS, and osteoarthritis (OA).

Before listing levels of evidence, certain definitions will be given. For this article, the shoulder includes only the glenohumeral joint (GHJ); the shoulder girdle includes the GHJ, thoracic spine, cervical spine, upper ribs, and/or the acromioclavicular (AC) and sternoclavicular (SC) joints. Shoulder full kinetic chain (FKC) treatment includes all of the above and any indicated upper extremity joint.

**LEVELS OF EVIDENCE**

**Rotator Cuff Injuries, Disorders, and/or Diseases**

This study found a level of B or fair evidence for MMT of the shoulder, shoulder girdle, and/or FKC combined with multimodal or exercise therapy for RCIDs (Tables 2, 3, 5, 7). Evidence was based on manual therapy studies of the shoulder, shoulder girdle, and/or FKC MMT combined with exercise and/or multimodal therapy.

Of the 11 studies that looked at RCIDs, 4 were placebo-controlled RCTs, 4 were comparative treatment RCTs, 2 were clinical trials that used SGPPD, and 1 was a case report of 2 cases only (Fig 1). Treatment varied between differing levels of mobilization (grades I-V) to the GHJ, shoulder girdle, or FKC. Some studies compared manipulation to no manipulation or exercise therapy. Some studies adequately detailed their exercise intervention, whereas others vaguely suggested general stretches and strengthening exercises. Generally, treatments that included manipulation combined with soft tissue treatment and exercise therapy produced better outcomes than those that did not use multimodal methods. However, even if manipulation only was performed, usually there was a better outcome than no manipulation.

Of interest regarding an RCID is the Dickens et al study that showed that 26% of patients in the multimodal treatment arm who were awaiting surgery were able to avoid surgery. Their population had been diagnosed with subacromial impingement and had failed after 3 steroid injections into the subacromial space. Of the control group, all had surgery. Treatment consisted of manipulation to the shoulder girdle and a supervised (moving to home care) exercise program.

**Shoulder Complaints, Dysfunctions, Disorders, or Pain**

There is a fair or B level of evidence for MMT of the shoulder/shoulder girdle and FKC combined with a multimodal treatment approach for SCDP (Tables 2, 5, 6, 7). Evidence was assessed for MMT of the cervical and thoracic spines with and without upper
rib manipulation, or shoulder/shoulder girdle and/or FKC
MMT combined with exercise or multimodal therapy (see
individual studies). 24,41,47,51,84-86,103

In 2009, Chen et al 24 published an RCT^ (n = 90)
comparing mobilization and exercise therapy vs advice
and exercise therapy only. They found no differences in
outcome between the 2 groups and concluded that, in
regard to mobilization (of the shoulder girdle), in this
case meaning GH and AC joints—but not the SC or
spinal joints, “the results of this study demonstrate
conclusively that the addition of this commonly-used
technique to advice and exercise is no more effective
than advice and exercise alone.” Yet Winters et al 51 in a
fully powered RCT^ (n = 172) were able to demonstrate that
mobilization was more effective than injection and
physical therapy, Teys et al 86 in another RCT demon-
strated that mobilization of the GHJ was superior in
reducing algometry measured pain and increasing ROM
as compared with a control/sham treatment group. In this
category of SCDP, the studies by Chen et al, 24 Winters et
al, 51 and Teys et al 86 are the only ones that specifically
applied MMT to the GHJ (also to the cervical and
thoracic spines and upper ribs in Winters et al). Chen et
al however were the only ones that limited mobilizations
to a grade II and III, whereas Winters et al specified
mobilization technique up to a grade IV and V
manipulation, and Teys et al performed Mulligan
mobilizations with movement or MWM, but appears to
have used the force required of a grade IV level
delivering A-P and S-I pressure against the head of the
humerus while the subjects flexed their arm. 24,51,86

Of additional interest, in the SCDP category, there were
5 studies that found grades IV, IV+, and V MMT of the
cervical spine, thoracic spine, and ribs only (no GH, AC, or
SC joint MMT) to be efficacious in treatment of shoulder
pain. 27,42,85,96,103 Whether the addition of GH (or AC or
SC) joint MMT to these studies would have improved
treatment is speculative.

Also reviewed in this category was a case report of 2
patients describing treatment of glenoid hypoplasia. 104
After MMT, both cases had a decrease in pain levels, one
tended toward a change or increase in ROM and
other exercises (as described or similar to the above)
patients describing treatment of glenoid hypoplasia. 104
After MMT, both cases had a decrease in pain levels, one
tended toward a change or increase in ROM and
other exercises (as described or similar to the above)

FS or Adhesive Capsulitis

There is a fair (B) level of evidence for MMT with
exercise which included proprioceptive retraining, as
helpful for FS or adhesive capsulitis (Tables 3 and
5). 27,42,83,87-89,95,105 Studies of FS included a variety of
MMT, exercise, and/or rehabilitation treatments: HVLA
manipulation, end-range mobilization (ERM), midrange
mobilization (MRM), and mobilization with movement
(MWM) of the shoulder only and/or of the shoulder girdle.
A short-term significant difference in favor of using HVLA
manipulation, ERM, or MWM MMT primarily increasing
ROM, with a smaller effect for decreasing pain, was found
as opposed to exercise alone. The studies included 4
RCT^s, 2 CTs, and 1 SGPPD.

Bulgen et al 42 looked at the difference between 4 groups:
one received cortisone injections, another manipulation,
the third ice and PNF, and a fourth was a control or “wait and
see” group with no treatment. Initially, the injection group
had the largest change in ROM; but by the end of the study
(a 6-month trial), there were no significant differences in the
increase in ROM between groups. This study used the
Maitland mobilization (which commonly uses grades I-IV,
although this was unspecified). Although MMT did not
significantly produce changes, neither did the cortisone
injections; however, repeated use of steroid injections
(especially ≥3 or poorly placed injections) may carry
significant risk. 106,107

Although Bulgen et al did not find that MMT was of
benefit, Nicholson, 27 Vermuelen et al, 87 Yang et al, 89 and
Rainbow et al 105 all found significant benefit using MMT.
Of these studies, only Nicholson 27 prescribed exercise
beyond the common base exercise used for FS (below)
described as “active and resisted exercises.” Vermuelen
et al 87 included the pendulum exercise only in the low-grade
manipulation group, whereas Rainbow et al 105 included
pendulum and wall walking exercises in both groups (one
receiving mobilization, the other HVLA manipulation).

In a prospective case series, Vermuelen et al 105 followed 7 patients. Treatments included massage therapy,
mobilization, active exercises, and physical modalities
(ultrasound, short-wave diathermy, and electrotherapy);
absence of pain posttreatment was observed in 5 of the 7
patients, and an increase in ROM was observed. As this
was a case series, only descriptive and not inferential
statistics were performed. 95

Generally, the greatest change noted with MMT
tended toward a change or increase in ROM and
function rather than pain. The most common MMT was
mobilization of the shoulder. The most common
exercise prescribed appeared to be the pendulum, but
other exercises (as described or similar to the above)
were prescribed but often not well or specifically
described. 42,87 Other differences between studies includ-
ed inclusion of patients with diabetes mellitus in the
Vermuelen et al 87 study. Three studies specifically
excluded diabetes, 89,95,105 whereas another 3 did not
mention diabetes at all. 27,42,88 Diabetes did not affect
outcomes in the Vermuelen et al study. 87 but there are
too few studies to state the effect of MMT for diabetic
patients with FS; and how this disorder will affect
MMT outcomes is not known (co-management is therefore recommended).

**Soft Tissue Disorders**

There was a fair level of evidence (B) for MMT using soft tissue or myofascial treatments for soft tissue disorders of the shoulder (Tables 2, 3, 7). Three articles were reviewed: one was an RCT, and 2 were RCTs with blind assessors. Treatment of these groups included the following techniques: soft tissue massage, cryotherapy or heat application followed by passive stretching, and ischemic compression. Although 3 studies yielded a rating of fair for the level of evidence in the short-term treatment of ST disorders and pain of the shoulder, longer-term follow-up is needed; efficacy remains unresolved. Further long-term studies are needed to determine if these soft tissue procedures are associated with sustainable long-term efficacious change and relief of ST shoulder pain and disorders.

One study did track the experimental group (trigger point or ischemic compression of specific shoulder muscles) over a 6-month period and the application of experimental treatment in a crossover study applied to the placebo control repeating the 6-month period protocol; consequently, both groups were followed for 6 months. The control group was treated with sham or placebo therapy 15 times (trigger point or ischemic pressure to muscles near the cervical and thoracic spines) and then later crossed over, offered, and given 15 experimental treatments.

**NSP or Minor NSP**

There is a limited level of evidence (C) for cervical lateral glide mobilization (CLGM) and/or HVLA manipulation with soft tissue release and exercise in the treatment of minor NSP (Tables 2, 3 and 7). Two RCT’s, an SGPPD, and a case study were reviewed for minor NSP. Both RCT’s studies compared to cervical lateral glide mobilization (CLGM) ultrasound and found that CLGM lowered pain scales and increased ROM, as well as normalizing force curves during shoulder elevation. Although both studies received PEDro ratings of 7, because of the small sample sizes, they were not fully powered. Both RCTs involved one visit with assessment pre- and posttreatment.

A single case report that described treatment of entrapment due to the pectoralis minor muscle was also included in this review of NSPs. Rimpey’s case report with a diagnosis of pectoralis minor entrapment with underlying cervical disk herniation, with neck, shoulder, arm, and digit pain and paresthesia on movement, was rated a 7 using WSR analysis. Treatment included soft tissue release, exercises, and HVLA manipulation to the cervical spine and upper ribs. This patient’s complaints resolved with treatment. A decrease in pain perception (including changes in paresthesia), normalization of previous positive orthopedic test results, and an increase in ROM were the markers for improvement. One SGPPD study looked at 13 patients with cervical and/or referred shoulder and/or arm pain. Patients had to have either weak external rotation or abduction strength due to a “facilitated segment” in the cervical spine. After a single CLGM treatment, the majority increased their shoulder external rotation strength immediately after (only) the first treatment, becoming stronger after treatment. Treatment consisted of a grade III mobilization of the C5-6 level only. The authors hypothesized that cervical segmental sympathetic stimulation and central sensitization were causing an inhibitory effect on the muscles that caused muscle weakening. Wang and Meadows posited that mobilization reversed the central phenomenon decreasing central sensitization and that the sympathetic stimulation allowed for an increase in the strength of the external rotators. The effect was diminished though within 20 minutes.

**Shoulder OA**

There is an insufficient level of evidence (I) for MMT with or without exercise or multimodal therapy in the treatment of OA of the shoulder (Tables 3 and 7). Although a separate category was not created for OA, 1 case report and 2 RCT’s reviewed MMT with exercise for an isolated or restricted number of patients (within these trials) with shoulder OA. However, there were no trials devoted solely to the treatment of shoulder OA; and this minimal evidence, combined, remains insufficient (I).41,44,109

**DISCUSSION**

This systematic review of MMT for shoulder pain and disorders, in keeping with the intent of EBC, has presented a broader and more complete review of evidence. This intent is to cautiously provide practitioners, particularly in the context of clinical expertise and patient preference, with a more comprehensive picture of the existing evidence supporting a variety of MMT therapies (with and without rehabilitation or multimodal treatment) that may be useful. It is our position that the best approach to patient care is not informed by restricting one solely to the most stringently controlled randomized trials. Evidenced-based care was never meant to exclude all other study designs along the research hierarchy.

Multimodal treatment appears at this time to be the most efficacious approach for shoulder conditions (Tables 2-7). This review has shown that MMT, whether grade V HVLA thrust or grades III and IV mobilizations, should be considered for inclusion in the treatment of shoulder pain and disorders, applied appropriately for the benefit, effectiveness, and safety of the patient. Regarding MMT,
evaluation of the GH, AC, SC, spinal, upper ribs, and FKC (such as the elbow) joint should be assessed for ROM, accessory glide, and end-range play, feel, or accessory motions. High-velocity, low-amplitude or mobilization grades I to IV (or up to IV++) should then be applied, after an adequate diagnosis has been made and contraindications have been ruled out, in the direction of the restriction when appropriate.

From the results of this review, the clinician should be guided to additionally evaluate the cervicothoracic spine and ribs when treating the shoulder. A number of trials treated the cervicothoracic spine only and reported good outcomes without including GH (or AC or SC) joint manipulation. The segmental fixation of the cervicothoracic spine may refer pain to the shoulder area (from the neck to the arm) or may be partially responsible for inhibition of the lower scapular stabilizers that cause altered biomechanics of the shoulder eventually ending in shoulder pain.108,110

Rarely in clinical practice is there one diagnosis for a given shoulder condition. Often, myofascial soft tissue involvement will be accompanied with joint restrictions and neuromuscular movement dysfunction, which over time may cause tissue injury or failure resulting in a primary joint disorder. Travell and Simons111 have revealed pain referral patterns into the shoulder area as a result of myofascial trigger points. One aspect this review did not address is the impact of myofascial adhesions and restrictions on shoulder function. This is a topic that needs more research, as there is some evidence that fascial disorders may have far-reaching effects on function and pain.92,112 Treatment that addresses all of these dysfunctions as well as joint restrictions/fixations may be more efficacious in improving function and decreasing pain. For example, the work of Kibler and McMullen110 suggests that scapular dyskinesis (an alteration in the normal position or motion of the scapula during coupled scapulohumeral movements) is very often present in the most painful shoulder conditions; rotator cuff injuries have scapular dyskinesis present in 68% of cases and labral tears in 94%, and there is scapular dyskinesis in GH instability in 100% of cases. Scapular stabilization exercise or rehabilitation may often then be the foundation of a shoulder rehabilitation program (requiring scapular MMT and/or shoulder girdle MMT) for success. This review found that scapular stabilization was one of the most common exercises prescribed in the studies reviewed. Please see Table 8 for a description of the most common exercises prescribed in the studies reviewed.

Limitations

One limitation is confusion surrounding and lack of standardization of the term shoulder girdle. Shoulder girdle has been defined variously by different authors at different times and in the past has been the combination of the GH, AC (including scapular glide), and SC joints and/or including the axial spine (cervical and thoracic spines). In this review, some authors described the shoulder girdle as the cervical and thoracic spines and upper ribs, whereas others used the (previously) more common definition given above. Some included it all. Others defined the shoulder as restricted to the GHJ. This confusion cannot be resolved in this article and may have led to different interpretations of findings in this review. The reader is directed to the particular article cited and Tables 2-7 for clarification.113 It is also not clear when manipulation is indicated for the spine and not the GHJ, or the GHJ, spine, scapula, and upper ribs; this is explicated in a minor way in the Tables 3 to 7; and again, the reader is directed to the individual articles cited.

Another limitation is use of the WSR. The WSR is not yet demonstrated to be valid and reliable, and the number or WSR “score” that is given must be viewed with caution, should not be quoted as would a PEDro score, and is best seen as how this review deemed the importance and/or strength of the non-RCT study. Ultimately, the WSR score is this review’s expert but consensus opinion. Finally, the literature base continues to grow. It is likely that some articles were published after submission and acceptance of this article and therefore were not able to be considered for this review.114

Conclusion

This study found a level of B or fair evidence for MMT of the shoulder, shoulder girdle, and/or FKC combined with multimodal or exercise therapy for RCIDs. There is a fair or B level of evidence for MMT of the shoulder/shoulder girdle and FKC combined with a multimodal treatment approach for SCDP. There is a fair (B) level of evidence for MMT with exercise that included proprioceptive retraining as helpful for FS or adhesive capsulitis. There was a fair level of evidence (B) for MMT using soft tissue or myofascial treatments for ST of the shoulder. There is a limited level of evidence (C) for CLGM and/or HVLA manipulation with soft tissue release and exercise in the treatment of minor NSP. There is an insufficient level of evidence (I) for MMT with or without exercise or multimodal therapy in the treatment of OA of the shoulder. In particular, MMT must be combined, when safe, appropriate, and including no contraindications, with commonly indicated exercise or rehabilitative therapy, as it remains the standard care. For clinicians, however, this study is intended to guide them in the appropriate use of MMT, soft tissue technique, exercise, and/or multimodal therapy for the treatment of a variety of shoulder complaints in the context of the entire hierarchy of available evidence.
Practical Applications

- This review allows a basic comparison of the diversity and commonalities of multiple manual therapy techniques used in the treatment shoulder disorders.
- This review, dating from the mid 1980s to 2010, gives a broad overview of the type and quality of previous manual therapy randomized controlled trials and other studies for the treatment of shoulder pain, allowing practitioners to have an increased choice of therapy.
- This review helps to elicit the best evidence along with lesser levels of evidence (which may still be useful in, or for, particular settings or patients) and to bring out the gaps in our understanding or literature.

Acknowledgment

The authors thank Thera-Band for their use of the online Thera-Band Academy search engine.

Funding Sources and Potential Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

References

18. Sege RD, De Vos E. Evidence-based health care for children: what are we missing? Boston Medical Center and Boston University School of Medicine, Boston, MA: The Commonwealth Fund; 2010.
Results of physical examination outcomes in a randomized controlled trial. J Manipulative Physiol Ther 2010;33:96-101.


