

WFC 2013 AWARD WINNING PAPER

EVIDENCE-BASED GUIDELINES FOR THE CHIROPRACTIC TREATMENT OF ADULTS WITH NECK PAIN

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ABSTRACT

Objective: The purpose of this study was to develop evidence-based treatment recommendations for the treatment of nonspecific (mechanical) neck pain in adults.

Methods: Systematic literature searches of controlled clinical trials published through December 2011 relevant to chiropractic practice were conducted using the databases MEDLINE, EMBASE, EMCARE, Index to Chiropractic Literature, and the Cochrane Library. The number, quality, and consistency of findings were considered to assign an overall strength of evidence (strong, moderate, weak, or conflicting) and to formulate treatment recommendations.

Results: Forty-one randomized controlled trials meeting the inclusion criteria and scoring a low risk of bias were used to develop 11 treatment recommendations. Strong recommendations were made for the treatment of chronic neck pain with manipulation, manual therapy, and exercise in combination with other modalities. Strong recommendations were also made for the treatment of chronic neck pain with stretching, strengthening, and endurance exercises alone. Moderate recommendations were made for the treatment of acute neck pain with manipulation and mobilization in combination with other modalities. Moderate recommendations were made for the treatment of chronic neck pain with mobilization as well as massage in combination with other therapies. A weak recommendation was made for the treatment of acute neck pain with exercise alone and the treatment of chronic neck pain with manipulation alone. Thoracic manipulation and trigger point therapy could not be recommended for the treatment of acute neck pain. Transcutaneous nerve stimulation, thoracic manipulation, laser, and traction could not be recommended for the treatment of chronic neck pain.

Conclusions: Interventions commonly used in chiropractic care improve outcomes for the treatment of acute and chronic neck pain. Increased benefit has been shown in several instances where a multimodal approach to neck pain has been used. (*J Manipulative Physiol Ther* 2014;37:42-63)

Key Indexing Terms: *Chiropractic; Practice Guideline; Therapy; Therapeutics; Review; Evidence-Based Practice*

The annual prevalence of nonspecific neck pain is estimated to range between 30% and 50%.¹ Persistent or recurrent neck pain continues to be reported by 50% to 85% of patients 1 to 5 years after initial onset.² Its course is usually episodic, and complete recovery is uncommon for most patients.³ Twenty-seven percent of

patients seeking chiropractic treatment report neck or cervical problems.⁴ Thus, treatment of neck pain is an integral part of chiropractic practice.

Treatment modalities typically used by doctors of chiropractic (DCs) to care for patients with neck pain include spinal manipulation, mobilization, device-assisted spinal

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Paper submitted May 4, 2013; in revised form July 25, 2013; accepted August 1, 2013.

0161-4754/\$36.00

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Table 1. *Strength of evidence and recommendations*

Evidence	Strength of recommendation
Consistent findings among ≥ 2 low-risk-of-bias controlled trials with no limiting factors	Strong
Consistent findings among ≥ 2 low-risk-of-bias controlled trials with minor limiting factors	Moderate
or	
1 low-risk-of-bias controlled trial with no limiting factors	
1 low-risk-of-bias controlled trial with limiting factors	Weak
Unresolvable differences between the findings of 2 or more low-risk-of-bias controlled trials	Inconsistent

manipulation, education about modifiable lifestyle factors, physical therapy modalities, heat/ice, massage, soft tissue therapies such as trigger point therapy, and strengthening and stretching exercises. There is a growing expectation for DCs and other health professionals to adopt and use research-based knowledge, taking sufficient account of the quality of available research evidence to inform clinical practice. As a result, the purpose of the Canadian Chiropractic Association and the Federation Clinical Practice Guidelines Project is to develop evidence-based treatment guidelines. The clinical practice guideline (CPG) experience began in Canada with a consensus conference in April of 1993 that culminated with the publication of “Clinical Guidelines for Chiropractic Practice in Canada”⁵ in 1994. Since then, the chiropractic profession in Canada has published 3 additional guidelines⁶⁻⁸ that are intended to provide practitioners with the most current evidence for the treatment for patients in light of the clinician’s experience and the patient’s preferences.

The original Neck Pain Guideline⁶ published in 2005 relied on studies that were drawn from the literature in a search conducted up to October 2004. The treatment recommendations developed at that time were supported largely by the expert opinion of the Guidelines Development Committee (GDC) in the absence of a solid, high-quality research base. Therefore, an update to the earlier neck pain guidelines that reflects evidence extracted from the published scientific literature about effective chiropractic treatment(s) for adult patients with nonspecific neck pain was needed. The purposes of this study were to develop evidence-based treatment recommendations for the treatment of nonspecific (mechanical) neck pain in adults and to present recommendations synthesized from this evidence and strength rating of each recommendation.

METHODS

This study addresses chiropractic treatments for which there is evidence. There may be other treatments for which there is no evidence and for which this study cannot make recommendations. Therefore, this CPG does not provide a

comprehensive overview of all chiropractic treatment that may be rendered to patients, only those for which there is evidence.

The procedures identified the high-quality (low risk of bias) studies that investigated the benefits of commonly used chiropractic modalities for the treatment for adults with nonspecific neck pain as determined by validated clinical outcome measures compared with placebo or other interventions. Neck pain resulting from whiplash or serious pathology was not included. For the purposes of this guideline, chiropractic treatment of neck pain includes any of the techniques or procedures commonly used by DCs, but excludes acupuncture, surgical procedures, invasive analgesic procedures, injections, psychological interventions, or medications (either prescription or over-the-counter).

The methods used in the development of recommendations for this guideline have been described in detail elsewhere.⁹ The GDC has adopted systematic processes for literature searching, screening, review, analysis, and interpretation, which are consistent with the criteria proposed by the “Appraisal of Guidelines Research and Evaluation” collaboration (<http://www.agreecollaboration.org>). This guideline is a supportive tool for practitioners and for their patients and is not intended as a standard of care. The intent of this guideline is to link clinical practice to the best available published evidence and is only one component of an evidence-based approach to patient care, which should include clinical judgment and patient values.

Data Sources and Searches

A systematic search of the literature was conducted. The search strategy was developed by the GDC in conjunction with an experienced medical research librarian in MEDLINE by exploring MeSH terms related to chiropractic and specific interventions (see [Appendix A](#)). The databases searched included the following: MEDLINE, EMBASE, EMCARE, Index to Chiropractic Literature, and the Cochrane Library. Searches included articles published in English or with English abstracts. The search strategy was limited to adults (≥ 18 years). A study population was considered to be adult when drawn from a “workplace.” The search spanned the period January 2004 to December 2011. Reference lists provided in systematic reviews (SRs) were also reviewed to avoid missing relevant articles. Some of the treatment modalities included in this guideline are not exclusive to DCs but include those that may also be delivered by other health care professionals.

Evidence Selection Criteria

Search results were screened electronically, and a multistage screening was conducted (see [Appendix B](#): level 1 (title and abstract), duplicate citations were removed, and remaining articles were retrieved as electronic and/or hard copies for detailed analysis; level 2 (full-text methodology and relevance);

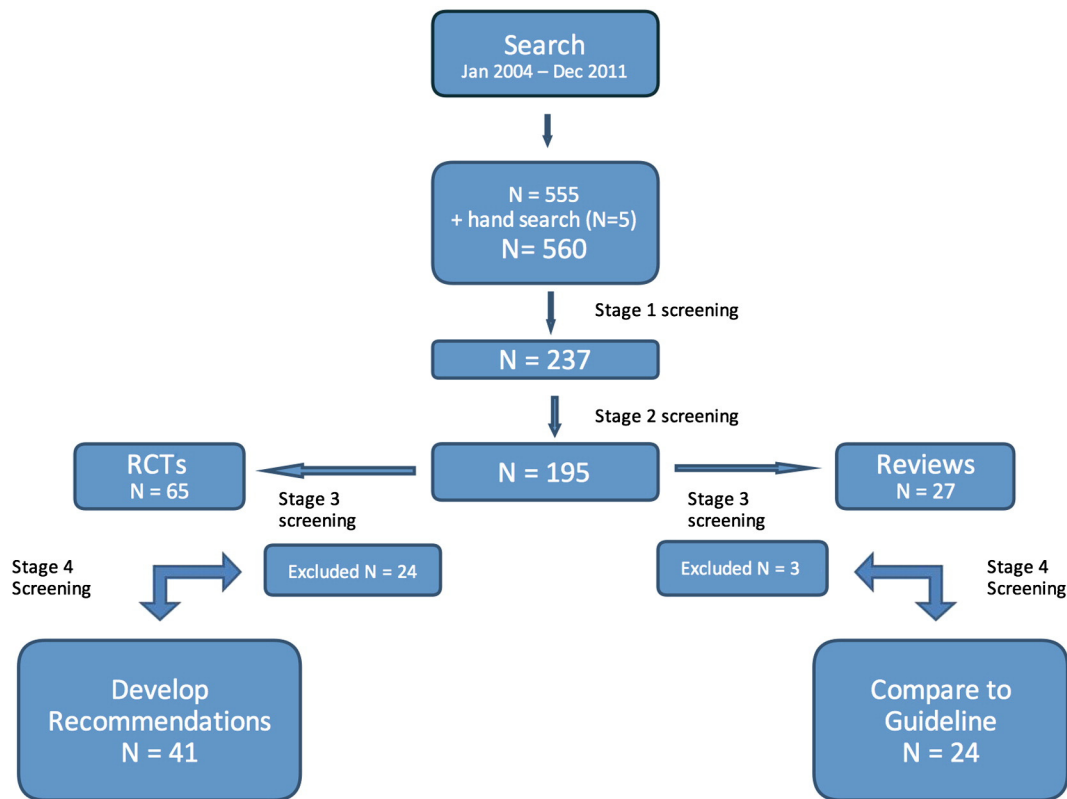


Fig 1. Screening flowchart. RCT, randomized controlled trial. (Color version of figure is available online.)

level 3 (screening randomized controlled trials [RCTs] and systematically conducted reviews); and level 4 (full-text final screening for relevant clinical content and risk of bias assessment and identification of potential methodological flaws).

The primary outcome measures for this guideline were validated measures of “neck pain” or “neck disability.” Secondary outcomes included the following: “cervical range of motion” (cROM), activities of daily living, quality of life (QoL), and time to recovery.

Only RCTs were selected as the evidence base for this guideline consistent with current standards for interpreting clinical findings. The selected literature was next categorized according to intervention type and the articles in each category assessed by the Evidence Rating Team (ERT—R.B., M.D., R.R., and L.S.) for quality, relevance to common chiropractic practice, and the suitability for further analysis and inclusion in this guideline. The inclusion or exclusion of a treatment category was predetermined by consensus among stakeholders in the profession.

The evidence base did not permit the assignment of any RCTs to a separate subacute category. As a result, RCTs were assigned to an acute or chronic category for each of the interventions. In instances where the experimental participants were of a variable duration of symptom(s) (both acute and chronic), the assignment to a category was determined by the predominance (average or mean) of symptom duration. Studies that included participants with subacute symptom

duration were assigned to the acute category. In instances where the mix of participants could not be determined or was relatively equal, the study was excluded.

Developing Recommendations

Two processes were used to assess the RCTs. The first was to assess the risk of bias of the methods, and the second was to assess any factors that may influence the interpretation and subsequent grading of the results.

Risk of Bias Assessment

The rating of the treatment literature was conducted using methods recommended by the Cochrane Back Review Group (CBRG) (<http://back.cochrane.org>). Only RCTs were rated for risk of bias using a template adapted from the CBRG. In this instance, a “low risk of bias” equates to a “high quality” study and “high risk of bias” equates to “low quality.” The CBRG rating instrument for randomized trials identifies 5 inclusion criteria scored “yes” or “no.” Twelve criteria were identified for risks of bias that can be scored as “low risk (score 1)” or “high risk (score 0)/unclear (score 0)” as follows:

1. Was the method of randomization adequate?
2. Was the treatment allocation concealed?
3. Was the patient blinded to the intervention?
4. Was the care provider blinded to the intervention?
5. Was the outcome assessor blinded to the intervention?

Table 2. *Categories of treatment modality*

Category	No.	Rationale for inclusion
1 Acupuncture	10	Previously established GDC exclusion criterion
2 Cervical Pillow	3	Insufficient evidence for recommendations
3 Collar	1	Insufficient evidence for recommendations
4 Diathermy	1	Insufficient evidence for recommendations
5 Patient Education	11	Category combined with Exercise.
6 Exercise	67	Included
7 Flexion-Distraction	1	Included in the traction group
8 Laser	14	Included
9 Magnetic stimulation	1	Not deemed to be a commonly used intervention
10 Manipulation	46	Included
11 Manual therapy	28	Included. Some articles included more appropriately assigned to the manipulation or mobilization groups
12 Massage	5	Included
13 Mobilization	24	Included
14 Neuroemotional technique	1	Not deemed to be a commonly used intervention
15 Physical activity	5	Articles included in exercise
16 Physiotherapy	4	Articles included in exercise, manipulation, or mobilization
17 Postural reeducation	1	Article included in exercise
18 Pulsed electromagnetic energy	6	Evidence excessively heterogeneous
19 Rehabilitation	7	Articles included in exercise
20 Relaxation	1	Article included in exercise
21 Resistance training	3	Articles included in exercise
22 Rolting	1	Article included in massage
23 Sustained natural apophyseal glide	1	Article included in exercise
24 TENS	4	Included
25 Thoracic manipulation	15	Included
26 Traction	8	Included
27 Trigger point therapy	2	Included

GDC, Guidelines Development Committee; TENS, transcutaneous nerve stimulation.

6. Were incomplete outcome data adequately addressed?
7. Are reports of the study free of suggestion of selective outcome reporting?
8. Were the groups similar at baseline regarding the most important prognostic indicators?
9. Were cointerventions avoided or similar in all groups?
10. Was compliance acceptable in all groups?
11. Are all patients reported and analyzed in the group to which they were allocated (intention-to-treat)?
12. Was the timing of outcome assessment similar in all groups?

No weighting factor was applied to individual criteria, and possible bias ratings ranged from 0 (greatest number of risk of bias criteria) to 12 (no risk of bias criteria). Observational

studies, case series, or case reports were excluded because of their uncontrolled nature and inappropriate design to assess treatment effect.

In many instances (particularly when the intervention is a form of manual therapy), it is difficult (if not impossible) to blind either the participant or care provider. Therefore criteria 3 and 4 were scored low risk only when blinding was reported and deemed to be possible by the raters. Whenever an outcome was determined by a participant-directed questionnaire (eg, Neck Disability Index), the outcome assessor was considered to be free of bias (criterion 5). Where the baseline characteristics of study groups have not undergone statistical analysis, the source of bias (criterion 8) was scored high risk, unless all significant prognostic indicators were similar upon inspection by the raters. In studies that tested the “immediate effect” of an intervention, the domains of cointervention (criterion 9) and compliance (criterion 10) for the rating instrument were deemed to be “not applicable” (N/A). In these cases, rather than artificially inflating the scores by rating these domains as low risk, the domain was not scored and the score totalled out of 10 rather than 12. When the identified sources of bias (method of randomization, allocation concealment, blinding, reporting of missing data, cointerventions, compliance, or intention-to-treat) were not reported, a high risk was scored.

Two assessors (R.R. and J.G.) independently rated the literature for risk of bias and were not blinded as to study authors, institutions, and source journals. Two members of the ERT (M.D. and L.S.) corroborated quality rating methods by completing quality assessments on a subset of 8 citations. Consensus of all individual ratings was established by discussion among the ERT.

Studies are rated as having a low risk of bias when at least 50% of CBRG criteria were met (ie, 6/12 or 5/10 for scores of 10). Studies with fewer than 50% of the criteria met were rated as having a high risk of bias. There is empirical evidence from a methodological study conducted with data from the CBRG that a scoring threshold of less than 50% of the criteria is associated with bias.¹⁰ A high level of agreement was confirmed across quality ratings. Complete agreement on all items was achieved for most studies. All discrepancies were easily resolved through discussion.

Grading the Strength of Treatment Recommendations

Recent advances in the development of treatment recommendations have led to a systematic approach to developing and grading the recommendations that aid in interpretation and minimizes bias.¹¹ A comparable approach has been used by the Cochrane Collaboration (<http://back.cochrane.org/>) and has been adapted here. The results of the RCTs in each treatment category were evaluated by the GDC for factors concerning the final interpretation of the results for grading as reported in the Literature Summary. These factors included limitations in study design and/or execution, inconsistency of results, indirectness of evidence, imprecision of results, and clinical

relevance. To assign an overall strength of recommendation (strong, moderate, weak, or inconsistent), the GDC considered the number, quality, and consistency of research results.

A strong recommendation was considered only when 2 or more low-risk-of-bias RCTs had consistent findings and were free of limiting factors. Recommendations were graded “moderate” with the support of 2 or more low-risk-of-bias RCTs with limiting factors, or 1 high-quality RCT free of limiting factors. A “weak” recommendation is supported by only 1 low-risk-of-bias RCT with methodological flaws. In instances where conflicting evidence (inconsistency of results) was found, the GDC reviewed all study findings to determine if these differences could be resolved, for example, a clear prevalence of positive studies over negative studies. Whenever the differences were resolved, the recommendation was graded (strong, moderate or weak) according to the number and ratio of positive to negative studies. Recommendations for practice were developed in collaborative working group meetings. No recommendations were made when consistent findings could not be established or if there was no evidence (Table 1).

Use of SRs

Systematic reviews were identified as a source of comparison for the recommendations developed for this guideline. The SRs were assessed by the ERT for quality using procedures described by Oxman and Guyatt.¹² Quality rating of SRs included 9 criteria answered by yes (score 1) or no (score 0)/do not know (score 0) and a determination of overall scientific quality (no flaws, minor flaws or major flaws), based on the literature raters’ answers to the 9 items. Possible ratings ranged from 0 to 9. Systematic reviews scoring more than half of the total possible rating (ie, ≥ 5) with no or minor flaws were rated as high quality. Systematic reviews scoring 4 or less and/or having major flaws identified were excluded.

RESULTS

Literature Screening and Ratings

The search identified 555 citations that were subsequently augmented by a hand search of the SRs, for a total of 560 publications. Level 1 (title and abstract) reduced this number to 237 (Fig 1). These citations were categorized by treatment modality and the categories, number of selected articles, and reason(s) for inclusion are presented in Table 2. In total, 10 interventions (treatment categories) were identified by the ERT for the evidence to be assessed for risk of bias. Level 2 (full-text methodology and relevance) reduced this number to 195. Level 3 (screening controlled clinical trials, RCTs, and systematically conducted reviews) further reduced the number of citations to 65 controlled trials and 27 SRs. Duplicate citations were removed, and the remaining articles were retrieved as electronic and/or hard copies for detailed analysis. Level 4 (full-text final screening for relevant clinical content

and elimination of high risk of bias studies) produced 41 citations (Tables 3 and 4) that were used to develop the recommendations. In the discussion, findings of 24 SRs are compared with the recommendations of this CPG. Excluded citations (RCTs and SRs) are shown in Table 5.

Treatment Recommendations

Manipulation

Manipulation/Multimodal—Acute Neck Pain. Spinal manipulative therapy is recommended for the treatment of acute neck pain for both short- and long-term benefit (pain and the number of days to recover) when used in combination with other treatment modalities (advice, exercise, and mobilization; grade of recommendation—moderate). This recommendation is based on 3 low-risk-of-bias studies, 2 with limiting factors.^{20,49,56} These 3 studies used several treatment sessions (4 and 5, or an average of 15) for 2 or 12 weeks, respectively.

Manipulation—Chronic Neck Pain. Spinal manipulative therapy is recommended in the treatment of chronic neck pain for short- and long-term benefit (pain, disability; grade of recommendation—weak). This recommendation is based on 1 low-risk-of-bias study with a limiting factor⁵⁴ that used 2 treatments per week for 9 weeks.

Manipulation/Multimodal—Chronic Neck Pain. Spinal manipulative therapy is recommended in the treatment of chronic neck pain as part of a multimodal approach (including advice, upper thoracic high velocity low amplitude thrust, low-level laser therapy, soft tissue therapy, mobilizations, pulsed short wave diathermy, exercise, massage, and stretching) for both short- and long-term benefit (pain, disability, cROMs; grade of recommendation—strong). This recommendation was graded strong owing to 2 low-risk-of-bias studies.^{30,69}

This recommendation is also supported by 5 low-risk-of-bias studies with limiting factors that used a number of treatments over several weeks, in addition to assessing the impact of a single treatment over the short term.^{19,32,52,58,64}

Mobilization

Mobilization/Multimodal—Acute Neck Pain. Mobilization is recommended for the treatment of acute neck pain for short-term (up to 12 weeks) and long-term benefit (days to recovery, pain) in combination with advice and exercise (grade of recommendation—moderate). This recommendation is supported by 2 low-risk-of-bias studies with limiting factors.^{20,49} Leaver et al⁴⁹ used 4 treatment sessions over a 2-week period.

Mobilization—Chronic Neck Pain. Mobilization is recommended for the treatment of chronic neck pain for short-term (immediate) benefit (pain, cROM; grade of recommendation

Table 3. Risk of bias ratings ^a

Citation	Criteria	Risk of bias												Score		
		1	2	3	4	5	6	7	8	9	10	11	12			
Andersen et al ¹³	✓							✓	✓		✓		✓			4/12
Andersen et al ¹⁴	✓	✓					✓	✓	✓				✓			5/12
Andersen et al ¹⁵	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		11/12
Aquino et al ¹⁶	✓	✓	✓		✓	✓	✓	✓	✓		N/A	N/A	✓	✓		9/10
Blikstad and Gemmell ¹⁷	✓	✓	✓	✓	✓			✓	✓	✓	N/A	N/A	✓	✓		7/10
Borman et al ¹⁸	✓							✓	✓					✓		3/12
Boyles et al ¹⁹	✓	✓				✓		✓	✓					✓	✓	6/12
Bronfort et al ²⁰	✓	✓	✓			✓	✓	✓		✓			✓	✓		8/12
Chiu et al ²¹	✓	✓	✓			✓	✓	✓	✓				✓	✓		7/12
Chiu et al ²²	✓	✓	✓			✓	✓	✓	✓				✓	✓		9/12
Chiu et al ²³	✓	✓	✓			✓	✓	✓	✓				✓	✓		7/12
Chow et al ²⁴	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		11/12
Cleland et al ²⁵	✓	✓	✓		✓			✓	✓		N/A	N/A		✓		6/10
Cleland et al ²⁶	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓			8/12
Cunha et al ²⁷	✓	✓						✓							✓	3/12
Dellve et al ²⁸	✓	✓	✓						✓						✓	4/12
Dundar et al ²⁹	✓	✓		✓		✓	✓	✓	✓			✓		✓	✓	9/12
Dunning et al ³⁰	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Dusunceli et al ³¹	✓	✓				✓		✓	✓	✓			✓	✓		6/12
Dziedzic et al ³²	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	8/12
Escortell-Mayor et al ³³	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Gemmell et al ³⁴	✓	✓	✓		✓			✓	✓	✓	N/A	N/A	✓	✓		7/10
González-Iglesias et al ³⁵	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	10/12
González-Iglesias et al ³⁶	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	11/12
Griffiths et al ³⁷	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	9/12
Häkkinen et al ³⁸	✓				✓	✓	✓	✓	✓			✓		✓		7/12
Häkkinen et al ³⁹	✓				✓	✓		✓	✓				✓	✓		6/12
Helewa et al ⁴⁰	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Hoving et al ⁴¹	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Jay et al ⁴²	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11/12
Jellad et al ⁴³	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		6/12
Kanlayanaphotporn et al ⁴⁴	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Klaber Moffett et al ⁴⁵	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	6/12
Krauss et al ⁴⁶	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Lansinger et al ⁴⁷	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	7/12
Lau et al ⁴⁸	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Leaver et al ⁴⁹	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Ma et al ⁵⁰	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	5/12
Martel et al ⁵¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11/12
Martinez-Segura et al ⁵²	✓	✓			✓	✓	✓	✓	✓	✓	N/A	N/A		✓		6/10
McReynolds and Sheridan ⁵³	✓	✓						✓	✓	✓	N/A	N/A		✓		3/10
Muller and Giles ⁵⁴	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	7/12
Pool et al ⁵⁵	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	6/12
Puentedura et al ⁵⁶	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Reid et al ⁵⁷	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/12
Saayman et al ⁵⁸	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Salo et al ⁵⁹	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Schomacher ⁶⁰	✓	✓	✓			✓	✓	✓	✓	✓	N/A	N/A	✓	✓	✓	6/10
Sherman et al ⁶¹	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	7/12
Sillevis et al ⁶²	✓	✓	✓				✓	✓	✓	✓	N/A	N/A	✓	✓	✓	6/10
Sjögren et al ⁶³	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	6/10
Skillgate et al ⁶⁴	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/12
Sutbeyaz et al ⁶⁵	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	8/12
Tuttle et al ⁶⁶	✓							✓							✓	2/12
Vitiello et al ⁶⁷	✓	✓	✓	✓		✓		✓						✓	✓	7/12
Vonk et al ⁶⁸	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	8/12
Walker et al ⁶⁹	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8/12
Ylinen et al ⁷⁰	✓							✓	✓	✓	✓	✓	✓	✓	✓	4/12
Ylinen et al ⁷¹	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	6/12
Ylinen et al ⁷²	✓							✓	✓	✓	✓	✓	✓	✓	✓	4/12

(continued on next page)

Table 3. (continued)

Citation	Criteria	Risk of bias												Score
		1	2	3	4	5	6	7	8	9	10	11	12	
Ylinen et al ⁷³	✓							✓	✓		✓	✓	✓	5/12
Ylinen et al ⁷⁴	✓					✓	✓	✓	✓			✓	✓	6/12
Ylinen et al ⁷⁵	✓	✓				✓		✓	✓			✓	✓	6/12
Zaproudina et al ⁷⁶	✓	✓		✓		✓	✓	✓	✓		✓		✓	8/12

^a In previous guidelines, we have assessed the literature using a quality-measuring tool⁶ that would rate studies as being either high or low quality.

—moderate). This recommendation is based on 3 low-risk-of-bias studies with limiting factors.^{16,44,60}

Manual Therapy

Manual Therapy/Multimodal—Chronic Neck Pain. Manual therapy is recommended in the treatment of chronic neck pain for the short- and long-term benefit (pain, disability, cROM, strength) in combination with advice, stretching, and exercise (grade of recommendation—strong). This recommendation is based on 2 low-risk-of-bias studies.^{38,73} This recommendation is also supported by 2 low-risk-of-bias studies with limiting factors.^{32,55}

Exercise

Exercise—Acute Neck Pain. Home exercise with advice or training is recommended in the treatment of acute neck pain for both long- and short-term benefits (neck pain; grade of recommendation—weak). This recommendation is based on 1 low-risk-of-bias study with a limiting factor.²⁰ This study used a regime of daily home exercise (6-8 repetitions per day) for 12 weeks with two 1-hour advice/training sessions 1 to 2 weeks apart.

Exercise—Chronic Neck Pain. Regular home stretching (3-5 times per week) with advice/training is recommended in the treatment of chronic neck pain for long- and short-term benefits in reducing pain and analgesic intake (grade of recommendation—strong). This recommendation is based on 3 low-risk-of-bias studies.^{38,39,73}

Home strengthening and endurance exercises with advice/training/supervision are recommended for both short- and long-term benefits (neck pain, cROM) in the treatment of chronic neck pain (grade of recommendation—strong). This recommendation is based on 4 low-risk-of-bias studies.^{39,47,69,75} One additional study with a limiting factor⁶³ supported this recommendation. In all 5 studies, regular home exercises were performed daily to 3 times per week. Two additional low-risk citations with limiting factors^{32,40} found exercises of no benefit. Despite the conflicting results, this recommendation was graded strong owing to the 4 low-risk-of-bias studies.

Exercise/Multimodal—Chronic Neck Pain. Exercise (including stretching, isometric, stabilization, and strengthening) is recommended for short- and long-term benefits (pain, disability, muscle strength, QoL, cROM) as part of a multimodal approach to the treatment of chronic neck pain when combined with infrared radiation, massage, or other physical therapies (grade of recommendation—strong). This recommendation is based on 4 low-risk-of-bias studies.^{21,22,31,71} Exercises were typically done 2 to 5 times per week for several weeks.

Laser

Laser—Chronic Neck Pain. Based on inconsistent findings from 3 low-risk-of-bias studies,^{24,29,58} there is insufficient evidence that supports a recommendation for the use of infrared laser (830 nm) in the treatment of chronic neck pain.

Massage

Massage/Multimodal—Chronic Neck Pain. Massage is recommended for the treatment of chronic neck pains for short-term (up to 1 month) benefit (pain, disability, and cROM) when provided in combination with self-care, stretching, and/or exercise (grade of recommendation—moderate). This recommendation is based on 1 low-risk-of-bias study⁷⁶ and 1 low-risk-of-bias study with a limiting factor.⁶¹ In both studies, 5 to 10 upper body/neck massage sessions lasting 1 hour to 75 minutes were provided.

Transcutaneous Nerve Stimulation

Transcutaneous Nerve Stimulation/Multimodal—Chronic Neck Pain. There is insufficient evidence that supports a recommendation for transcutaneous nerve stimulation (TENS) for the treatment of chronic neck pain. This conclusion is based on 1 low-risk-of-bias study with more than 1 limiting factors.²²

Thoracic Manipulation

Thoracic Manipulation—Acute Neck Pain. Based on inconsistent findings from 2 low-risk-of-bias studies,^{35,56} there is insufficient evidence that supports a recommendation for the use of thoracic manipulation in combination with

Table 4. Literature summary

Study	Treatment	Comparators	Outcomes	Score	Comments	Adverse events
Acute neck pain						
Blikstad and Gemmell ¹⁷	Trigger point therapy (N = 15; N = 15)	Sham US	cROM	7/10 ^a	- Higher percentage of participants improved (immediate) - Subacute (4 – 12 wk)	Not recorded
Bronfort et al ^{b 20}	Manipulation (N = 91) with mobs Patient education (N = 91)	Medication, HEA	Pain	8/12	- Small to moderate effect size; participants include subacute participants - Short- and long-term benefit - Home exercise with advice is superior to medication and comparable with spinal manipulative therapy	None reported
Gemmell et al ³⁴	Trigger point therapy (N = 15; N = 15)	Sham US	Pain, cROM	7/10 ^a	- Clinical significance with ischemic compression (immediate) - Acute and subacute pain <3 mo	Not recorded
González-Iglesias et al ^{b 35}	Thoracic manipulation (N = 23)	Electrotherapy	Pain, disability, mobility	11/12	- Relatively small experimental group size (N = 23) - Improvement as part of a multimodal approach in combo with electrotherapy - Pain duration <1 mo	Not recorded
Leaver et al ^{b 49}	Manipulation (N = 91) Mobilization (N = 91)	Mobilization Manipulation	Days to recovery	9/12	- Large confidence interval; small clinical changes - As good as mobilization - May include advice + exercise - Participants with <3-mo duration	Minor events reported
Pool et al ^{b 55}	Manual therapy (N = 75)	Behavioral graded activity	Pain, disability	6/12	- All participants were of subacute symptom duration - No differences found - Exercise + advice	Not recorded
^b Puentedura et al 2011 ⁵⁶	Manipulation (N = 14) Thoracic manipulation (N = 10)	Thoracic manipulation	Pain, disability	8/12	- Small group size (N = 14) - Netter than thoracic manipulation + exercise	None reported
Chronic neck pain						
Aquino et al ¹⁶	Mobilization (N = 24)	Mobilization at random level	Pain	9/10 ^a	- Small experimental group size (N = 24) - Comparable benefit in both groups (immediate)	None reported
Boyles et al ^{b 19}	Manipulation (N = 23)	Nonthrust techniques	Pain, disability	6/12	- Participants pre-dominantly chronic but include acute as well - No better than nonthrust - MPT + exercise	None reported
Chiu et al ^{b 21}	Patient education Exercise or stretching (N = 67)	Control (nonexercise)	Pain, disability, muscle strength	7/12	- Benefit for exercise + IRR	None reported
Chiu et al ^{b 22}	Patient education Exercise or stretching (N = 67) TENS (N = 73)	TENS, IRR	Pain, muscle strength	9/12	- Effects are small and not clinically relevant - Best results with TENS + exercise	None reported

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Table 4. (continued)

Study	Treatment	Comparators	Outcomes	Score	Comments	Adverse events
Chronic neck pain (continued)						
Chiu et al ²³	Traction (N = 39)	Placebo IRR	Pain, disability, cROM	7/12	All groups including IRR - Not superior to placebo	None reported
Chow et al ²⁴	Laser (N = 45)	Placebo	Pain, disability, QoL	11/12	- Improvement with laser treatment - More frequently in control group	Minor events reported
Dundar et al ^{b 29}	Laser (N = 32)	Placebo	Pain, disability, QoL	9/12	- No improvement over placebo - Including exercise and stretching	None reported
Dunning et al ³⁰	Manipulation Thoracic manipulation (N = 56)	Nonthrust techniques	Pain, disability	9/12	- More effective than nonthrust in the short term - Combination of cervical and thoracic thrusting + advice was effective - mean duration >300 d	None reported
Dusunçeli et al ^{b 31}	Patient education (N = 60) Exercise (N = 19; N = 19)	PT, stretching	Medication, disability, cROM	6/12	- Superiority of the neck stabilization exercises +PT - Predominantly chronic (average 40 mo.)	Not recorded
Dziedzic et al ^{b 32}	Patient education (N = 60) Exercise (N = 115; N = 115; N = 121)	MT, pulsed short-wave diathermy	Disability	8/12	- Some participants are of acute symptom duration and small clinical effects - No significant differences - MT + advice + exercise - Most with neck pain >3 mo	None reported
Häkkinen et al ³⁸	Manual therapy (N = 62) Exercise or stretching (N = 125)	Exercise crossover	Pain, neck strength, and mobility	7/12	- Clinically relevant changes not due specifically to manual therapy alone - Short-term benefit for both	None reported
Häkkinen et al ³⁹	Patient education Exercise or stretching (N = 49; N = 52)	Strength training and stretching	Pain, disability, cROM, strength	6/12	- Small but clinically relevant changes - No differences - 1-y follow-up from 2007	Not recorded
Helewa et al ^{b 40}	Exercise (N = 49; N = 33)	Massage, pillow, active exercise	Pain	9/12	- No difference - Including heat or cold pack	None reported
Kanlayanphotporn et al ⁴⁴	Mobilization (N = 30)	Varied mobilization approaches	Pain, cROM	8/12	- Small experimental group size (N = 30) - Comparable benefit for pain - Mean duration > 1500 d	None reported
Lansinger et al ⁴⁷	Patient education Exercise or stretching (N = 62)	Qigong	Pain, disability, cROM	7/12	- Large confidence interval - No difference - Ergonomic advice - 1-5 y in duration	Not recorded
Lau et al ^{b 48}	Thoracic manipulation (N = 60)	IRR and education	Pain, disability, QoL	8/12	- Greater improvement - Both groups received IRR	None reported
Martinez-Segura et al ⁵²	Manipulation (N = 34)	Manual mobilization	Pain, cROM	6/10 ^a	- Some participants of acute symptom duration - More immediate benefit than control mobilization - At least 1 mo.; mean ~4 mo	Not recorded
Muller and Giles ⁵⁴	Manipulation (N = 25)	Medication, acupuncture	Pain, disability	7/12	- Relatively small effect size and experimental group size (N = 25) - Best long-term benefit	Not recorded

Table 4. (continued)

Study	Treatment	Comparators	Outcomes	Score	Comments	Adverse events
Chronic neck pain (continued)						
Saayman et al ^{b 58}	Laser (N = 20; N = 20)	CMT	Pain, disability, cROM	9/12	- Some participants may be of acute symptom duration; small to moderate effect size; small experimental group size (N = 20) - All treatment groups improved; no difference - CMT + LLLT most effective - 1-12 mo in duration	None reported
Schomacher ⁶⁰	Mobilization (N = 59; N = 67)	Mobilization at adjacent segment	Pain	6/10 ^a	- Used several different mobilization techniques; no significant difference - “As good as” - NP duration >70 mo	None reported
Sherman et al ^{b 61}	Massage (N = 32)	Self-care	Disability	7/12	- Small effects size; relatively small experimental group size (N = 32) - Clinical benefit - May include self-care and exercise	None reported
Sillevis et al ⁶²	Thoracic manipulation (N = 50)	Sham manipulation	Pain	6/10 ^a	- No difference shown - Immediate effect	None reported
Sjögren et al ^{b 63}	Patient education Exercise or stretching (N = 53)	Crossover	Intensity of symptoms	6/12	- Pain experienced sometime in the previous 12 mo; small clinical effects and large confidence interval - Significant improvement - Advice on posture and movement	None reported
Skillgate et al ^{b 64}	Manual therapy (N = 206)	Naprapathic care, advice	Pain, disability	8/12	- Participants predominantly chronic but include acute as well - MT effective in short term - Multimodal - Mixed—minimum 2 wk; majority >12 mo	None reported
Sutbeyaz et al ⁶⁵	Electrotherapy (N = 18)	Placebo	Pain, disability	8/12	- Significant improvement immediately after treatment - Unconventional electrotherapy	Not recorded
Vitiello et al ⁶⁷	Electrotherapy (N = 9; N = 7)	TENS, sham	Pain, disability, function, QoL	7/12	- Significant improvement in all outcomes with ENAR - Unconventional electrotherapy	None reported
Walker et al ^{b 69}	Patient education (N = 47) Manual therapy exercise (N = 47)	GP care	Pain, disability	8/12	- MT with stretching more effective - Average duration >500 d	None reported
Ylinen et al ^{b 71}	Patient education Exercise or stretching (N = 60; N = 60)	Control	Pain, disability	6/12	- Effective strength and endurance training - Multimodal (PT, massage, mobs)	Not recorded
Ylinen et al ^{b 73}	Manual therapy (N = 62) Patient education	Stretching exercises crossover	Pain, disability	6/12	- Both were effective - MT + exercise	Not recorded

(continued on next page)

Table 4. (continued)

Study	Treatment	Comparators	Outcomes	Score	Comments	Adverse events
Chronic neck pain (continued)						
Ylinen et al ⁷⁵	Patient education Exercise or stretching (N = 57; N = 59; N = 63)	Strength, endurance and stretching	Pain, disability	6/12	- Large but variable clinical effects - Strength and endurance exercise more effective than stretching	Not recorded
Zaproudina et al ^{b 76}	Massage (N = 33)	PT, TBS	Pain, disability, mobility	8/12	- No difference - PT including massage + exercise + stretching	Not recorded
Variable duration neck pain						
Cleland et al ²⁵	Thoracic manipulation (N = 19)	Placebo	Pain, disability	6/10 ^a	- Immediate pain relief - Mixed (12 wk average duration)	None reported
Cleland et al ²⁶	Thoracic manipulation (N = 17)	Nonthrust	Pain, disability	8/12	- Thrust results in significantly better improvement (immediate) - Mixed average duration ~55 d	Not recorded
Escortell-Mayor et al ^{b 33}	Manual therapy (N = 47) TENS (N = 43)	TENS, MT	Pain, disability, QoL	8/12	- No differences found + advice + home exercise - Mixed; mean ~140 d	None reported
Hoving et al ^{b 41}	Manual therapy (N = 60)	PT, GP care	Pain, disability	9/12	- MT showed early improvement - Including exercise + home exercise - Mixed—minimum 2 wk	None reported
Jellad et al ^{b 43}	Traction (N = 13; N = 13)	Standard rehab	Pain, disability	6/12	- Improvement as part of a multimodal approach (standard rehab) - Mixed—onset previous 3 mo at enrollment	Not recorded

CMT, cervical manipulative therapy; *cROM*, cervical range of motion; *ENAR*, Electro neuro adaptive regulator; *GP*, general practitioner; *HEA*, home exercise with advice; *IRR*, infrared radiation; *LLLT*, low-level laser therapy; *MPT*, manipulative physical therapy; *MT*, manual therapies; *PSWD*, pulsed short wave diathermy; *PT*, physical therapies; *QoL*, quality of life; *TBS*, traditional bone setting; *TENS*, transcutaneous nerve stimulation; *US*, ultrasound. N = number of participants in experimental group. Adverse events: “Not recorded” indicates that there were no notes of participants being asked about any adverse events; “None reported” indicates that participants were asked about adverse events but there were none to report.

^a Studies with immediate outcomes after the intervention were scored out of 10 for risk of bias.

^b Multimodal intervention(s).

electrotherapy or exercise for the treatment of acute neck pain.

Thoracic Manipulation—Chronic Neck Pain. Based on inconsistent findings from 3 low-risk-of-bias studies,^{30,48,62} there is insufficient evidence that supports a recommendation for the use of thoracic manipulation for the treatment of chronic neck pain.

Traction

Traction—Chronic Neck Pain. There is insufficient evidence to support a recommendation for intermittent mechanical traction for the treatment of chronic neck pain. This conclusion is based on 1 low-risk-of-bias study²³ that found no additional improvement in pain or disability after 10 to 12 treatment sessions when combined with nontherapeutic infrared irradiation.

Trigger Point Therapy

Trigger Point Therapy—Acute Neck Pain. There is insufficient evidence that supports a recommendation for activator, ischemic compression, and trigger point pressure release for the treatment of acute neck pain based on 2 low-risk-of-bias studies.^{17,34} Both studies report a clinical improvement, but there was no indication of a significant statistical change.

DISCUSSION

In this guideline, recommendations have been developed that updates the body of evidence supporting chiropractic treatment of neck pain. These recommendations offer a broad range of evidence-based treatment options for practitioners to use in patient-centered care. The development of these

Table 5. Citations excluded after rating and data extraction

Citation	Score	Rationale
RCTs		
Andersen et al ¹³	4/12	- High risk of bias
Andersen et al ¹⁴	5/12	- Study compared different forms of exercise - Participants with neck pain also experiencing pain at other locations - Not the objective of this guideline to address neck pain in participants with co-morbidities
Andersen et al ¹⁵	11/12	- High risk of bias
Borman et al ¹⁸	3/12	- Healthy participants. Study focused on reducing the frequency and intensity of painful episodes in participants prone to neck/shoulder pain.
Cuhna et al ²⁷	3/12	- High risk of bias
Dellve et al ²⁸	4/12	- High risk of bias - Study compared effectiveness of different forms of exercise
González-Iglesias et al ³⁶	11/12	- High risk of bias
Griffiths et al ³⁷	9/12	- Results included in González-Iglesias et al ³⁶ - The study was not designed to provide evidence for the effectiveness of general exercise, for nonspecific neck pain.
Jay et al ⁴²	11/12	- Participants are drawn from a population with a high prevalence of musculoskeletal symptoms. There is no assessment of the duration of neck pain only baseline and subsequent intensity.
Klaber Moffett et al ⁴⁵	6/12	- Not all participants are identified as having chronic pain (51 – 78%). - Approximately 2/3 of the randomized participants were “low back” rather than “neck.” Not possible to separate
Konstantinovic et al ⁷⁷	10/12	- Participants with radiating arm pain - Relatively small experimental group (N = 30)
Krauss et al ⁴⁶	8/12	- Insidious onset of neck pain. No chronicity was identified.
Ma et al ⁵⁰	5/12	- High risk of bias - Study focused on the comparative effect of biofeedback
Martel et al ⁵¹	11/12	- This study focused more on the preventive benefits of manipulation rather than the effect on active cases of acute or chronic neck pain.
McReynolds and Sheridan ⁵³	3/10	- High risk of bias - Group size was exceedingly small (N = 7, 11)
Reid et al ⁵⁷	10/12	- Sustained natural apophyseal glide was not considered a commonly used/known intervention
Salo et al ⁵⁹	8/12	- No measures of pain or cROM although neck pain was assessed at baseline. - Primary outcome was QoL
Sutbeyaz et al ⁶⁵	8/12	- Unconventional form of pulsed electromagnetic frequency
Tuttle et al ⁶⁶	2/12	- High risk of bias - Failed to meet all inclusion criteria
Vitiello et al ⁶⁷	7/12	- Unconventional therapy
Vonk et al ⁶⁸	8/12	- The focus of this study was a comparison of Behavior Graded Activity and conventional exercise, both of which are combined with massage and/or mobilizations. Unfortunately, there’s no description of the actual exercises or how frequently they were done.
Ylinen et al ⁷⁰	4/12	- High risk of bias - Study used pressure pain thresholds in levator and traps rather than traditional measures of neck pain or cROM
Ylinen et al ⁷²	4/12	- High risk of bias
Ylinen et al ⁷⁴	5/12	- High risk of bias
Cochrane/SRs		
Ezzo et al ⁷⁸	7/9	- Duplication of Haraldsson et al ⁹¹
Jensen and Harms-Ringdahl ⁷⁹	4/9	- Low rating score - Major flaws
Ylinen ⁸⁰	2/9	- Low rating score - Major flaws

cROM, cervical range of motion; QoL, quality of life; RCT, randomized controlled trial.

recommendations reflects the most recent evidence (2004 or later), which is limited to low-risk-of-bias studies. Wherever possible, recommendations were made for each of the treatment modalities identified as relevant to common chiropractic practice and for which current evidence was available. Limitations in the current evidence are described

and used in making suggestions for advancing the quality of future research.

During review of the materials, a generalizable weakness of the studies was noted including the heterogeneity of treatment protocols (ie, the use of a primary intervention in combination with other therapeutic treatments). For

example, many of the studies on manipulation were pragmatic and therefore included exercises, advice, and soft tissue work, thus making it difficult or impossible to isolate the therapeutic effect as a “stand-alone” intervention. When therapies are combined, for example, the use of manipulation with electrotherapy or exercise, it was sometimes possible to address making recommendations for the particular intervention “when provided in combination with.” In other instances, interventions are provided in combination with so many other treatment modalities, for example, manipulation with exercise, advice, stretching, and pulsed shortwave diathermy, that a recommendation can only be structured for a “multimodal” form of intervention. In developing treatment recommendations for multimodal interventions, the GDC considered the manner in which practitioners would apply them. We believe that, in many instances, the practitioner uses more than 1 treatment modality in the management of patients with nonspecific neck pain. All studies in which participants received more than 1 intervention or interventions in addition to the primary intervention being investigated are noted, and the recommendation was referenced as multimodal.

Several of the treatment recommendations in this document are diminished by some of the studies that based findings on too few study participants. Specific studies of “low subject numbers” are identified and recorded in The Literature Summary (Table 4). Although this limitation was considered a contributing factor to the imprecision of results and, ultimately, clinical relevance, our recommendations would be fortified by greater participant numbers and clinical relevance.

The inclusion of participants with variable duration of symptoms in a study made it difficult to formulate recommendations. In some cases, it was impossible to determine whether the observed effects (or lack of effect) of an intervention was caused by its impact on participants with acute, subacute, or chronic neck pain. Valuable data may have been missed in excluding studies in which the chronicity of the pain among the participants could not be determined (see above). Despite the positive outcomes reported, no recommendations could be formulated for neck pain of variable duration for the manual therapy,^{33,41} TENS,³³ thoracic manipulation,^{25,26} or traction⁴³ interventions.

Developing treatment recommendations related to the diversity of interventions reported as exercise (stability, mobility, relaxation, rehabilitation, range of motion, strength and endurance exercises, as well as stretching) was challenging. Although few studies are directly comparable in terms of the form of exercise used as the intervention, all demonstrated a degree of benefit for the participant.

Similarly, the breadth, diversity, and understanding of the intervention described as patient education (advice, training, supervision, and instruction of any kind provided

to the patient) were a challenge. Many of the studies reported the inclusion of patient education (either generally or very specifically). In this article, the 11 RCTs identified as patient education were allocated to the exercise category because they specifically dealt with patient education and exercise. All encounters between the patient and practitioner incorporate at least some form of education to the patient. This component of care is essential when directing a patient for the elements of active care (eg, exercise). In addition, patients receiving the described interventions of passive care (eg, manipulation, mobilization, massage, etc) are also educated with regard to diagnostic, investigative, and treatment procedures; anticipated outcomes; potential adverse events; informed consent, and so on. Whenever the author(s) of a study has included an element of patient education as part of the treatment protocol, it has been included as part of the recommendation.

Comparison with SRs

As a result of the search and screening process, 24 current (2005 or later) SRs were identified that assessed the literature with regard to therapeutic benefit for the 10 treatment modalities reviewed in this guideline (Table 6). Although the SRs are considered current, the literature that they assess included studies that are sometimes much older. By contrast, the studies assessed in this guideline were limited to much more recent publications (2005 or later) and generally reflect a higher quality (low risk of bias). A number of SRs (N = 13) assessed the literature for more than 1 treatment modality and, of these, 7 identified interventions that were delivered in combination with other therapies (multimodal).

In general, the individual SR findings within an intervention category remained fairly consistent. For example, within the category of manipulation, 11 of 12 SRs identified by the search suggested some degree of therapeutic benefit from the intervention. Similarly, of the 13 SRs for exercise, all but 1 concluded that therapeutic benefit had been evidenced. Eleven SRs assessed the evidence for only 1 intervention.

In comparing the treatment recommendations of this guideline with the findings of the relevant SRs, there would appear to be a general agreement. However, inconsistency within the SR findings or a paucity of high-quality evidence precludes complete agreement in the cases of massage, traction, and trigger point therapy. In these 3 instances, the SRs predate the studies used in developing the recommendations.

Adverse Events

There were no serious adverse events reported in any of the citations used in developing these treatment recommendations. A summary of the adverse event reporting from the literature summary (Table 4) is shown in Table 7. Of the 43 studies included in this summary, 14 made no

Table 6. Review findings—Cochrane and SRs

Citation	Score	Intervention									
		1. Manipulation	2. Mobilization	3. Manual therapy	4. Exercise (incl Pat Educ)	5. Laser	6. Massage	7. TENS	8. Thoracic manipulation	9. Traction	10. Trigger point therapy
Binder ⁸¹	5	√	√		√			?		?	
Bronfort et al ^{a82}	6	√ ^a	√ ^a		√ ^a				√		
Chow and Barnsley ⁸³	5					√					
Chow et al ⁸⁴	9					√					
Cross et al ⁸⁵	7								√		
D'Sylva et al ^{a86}	9	√	√		√ ^a						
Gemmell and Miller ⁸⁷	7	?	?	?							
Graham et al ⁸⁸	7									?	
Gross et al ⁸⁹	9	√ ^a	√ ^a		√ ^a	√				√	
Gross et al ⁹⁰	9	√	√						√ ^a		
Haraldsson et al ⁹¹	7								?		
Hurwitz et al ^{a92}	7	√	√	√	√	√					
Kay et al ^{a93}	9	√ ^a	√ ^a		√ ^a						
Kay et al ⁹⁴	9				√						
Kroeling et al ⁹⁵	7							?			
Leaver et al ^{a96}	9	√		√	√	√					
Macaulay et al ^{a97}	7			√ ^a	√ ^a						
Miller et al ^{a98}	9	√ ^a	√ ^a	√ ^a	√ ^a						
Sargiovannis and Hollins ⁹⁹	7			?							
Sihawong et al ¹⁰⁰	7				√						
Smidt et al ¹⁰¹	7				?						
Vernon and Humphreys ¹⁰²	9	√	√				–		–	?	
Vernon et al ¹⁰³	7	√						√			
Walser et al ¹⁰⁴	9								√		
Neck pain guideline											
Acute		√ ^a	√ ^a		√				?		?
Chronic		√ ^a	√	√ ^a	√/√ ^a	?	√	?	?	?	

Key: √, demonstration of benefit; ?, inconclusive; –, no demonstration of benefit.

^a Interventions were delivered in combination with other interventions (multimodal).

mention of adverse events. Of the remaining 33, all studies reported either none or only minor adverse events from a total of 1682 study participants and several treatment sessions (on average) per participant.

Considerations for Future Research

Since our original neck pain guideline published in 2005,⁶ the number and quality of clinical trials in chiropractic care have increased significantly. Nonetheless, as a result of our experience in developing these practice guidelines, we would suggest the following be considered to help guide future studies.

We suggest the investigation of treatment interventions on a stand-alone basis that will allow the treatment outcomes to be evaluated without the influence of other forms of care. For example, when manipulative therapy is

provided in combination with exercise, heat, cold, and so on, the benefit of the intervention becomes difficult to interpret, especially when the auxiliary therapies have also been shown to be of benefit.

The use of placebo, control, or sham comparators (whenever ethical) to determine the efficacy of a stand-alone treatment intervention is suggested. When comparing the outcomes of 2 or more interventions, it becomes increasingly difficult to establish if any of the treatment modalities provides anything more than placebo effect or the natural history of recovery, especially in instances of acute neck pain. In several instances, improvements that were identified in patient outcomes were frequently seen as “no better than” or “as good as” 2 or more interventions. Typically, no references are made to the natural history or progression of the condition.

A more thorough reporting of adverse events in the course of conducting a study for the balancing of benefit against risk

Table 7. Adverse events

Intervention	No. of studies	Total no. of participants
Studies not recording adverse events		
Manipulation	2	59
Manual therapy	1	62
Exercise	5	670
Electrotherapy	3	64
Thoracic manipulation	1	17
Trigger point therapy	2	30
Studies having no adverse or serious events reported		
Manipulation	4	147
Mobilization	4	180
Manual therapy	5	465
Exercise	6	408
Laser	3	65
Massage	2	55
TENS	3	95
Thoracic manipulation	4	185
Traction	2	52

TENS, transcutaneous nerve stimulation.

when considering treatment options is needed. Although some studies do report that adverse events were queried and tracked by the researchers/clinicians, they were frequently reported as “none” or “minor,” with no additional information being provided. In other instances, there was simply no mention of adverse events whatsoever.

We suggest that authors clearly define and identify the composition of the participant pool in terms of the duration of symptoms (acute, subacute, and chronic) and that the reporting of results (outcomes) be separated for each “duration of symptoms” group. The results of some studies were reported for groups that included a mix of participants with acute, subacute, and chronic symptoms. Consequently, it was not possible to determine if one group fared better than another or if the response was truly shared. It appears that the focus of neck pain research remains on the chronic condition.

In summary, researchers are encouraged to use suitable controls as experimental comparators. We also suggest a clear separation of participants with acute and chronic symptoms within studies as well as a more thorough reporting of the occurrence or absence of adverse events. The investigation of treatment modalities on a stand-alone basis is needed.

Limitations

The limitations of this study are consistent with those of SRs and clinical guidelines development. Although we made every attempt to include all relevant studies, it is possible that other relevant literature was missed. This study is limited in that literature was searched through December 2011; therefore, more recent literature studies in the publication process were not included in the recommendations. Thus, best judgement should be used to incorporate new high-quality evidence.

Although the focus of the guideline development was on chiropractic treatments, other stakeholders or contributions to what DCs do in practice could have been missed. The literature searched may have included procedures that DCs perform, but the research did not include practicing DCs and thus was omitted from our study. As with any use of the literature, we are limited by what has been published. Thus, publication bias may have an influence in the types of studies or topics included in our searches.

There are inherent limitations in guideline development. Expert opinion and interpretation are necessary procedures for guideline development. Thus, some subjectivity in judgments is present when assessing the strength of the evidence. Also, when evidence is lacking, expert opinion is required.

CONCLUSIONS

The studies included in this guideline indicate that cervical manipulation, mobilization, manual therapy, exercise, and massage can be recommended for the chiropractic treatment of nonspecific, mechanical neck pain. The strongest recommendations are typically made for the primary intervention in combination with another intervention, usually exercise and/or patient education. Owing to conflicting findings in the literature, no recommendation could be made for laser, TENS, or thoracic manipulation in the treatment of chronic neck pain or for the use of thoracic manipulation in the treatment of acute neck pain. There is a lack of evidence to support the

Practical Applications

- Forty-one RCTs were used to develop 11 treatment recommendations.
- Recommendations were made for acute neck pain using exercise and a multimodal approach to manipulation, mobilization.
- Recommendations were also made for chronic neck pain using manipulation, mobilization, and exercise and multimodal approaches to manipulation, manual therapy, exercise and massage.

use of laser, trigger point therapy, or traction for nonspecific, mechanical neck pain in adults.

ACKNOWLEDGMENTS

The authors thank the following for assistance during the preparation of this guideline: members of the Clinical

Practice Guidelines Task Force (Ron Brady, DC; H. James Duncan, BFA, CAE; Wanda Lee MacPhee, DC; Keith Thomson, BSc, DC, ND; Dean Wright, DC) and Jaroslaw Grod, DC, for literature screening and evidence rating.

FUNDING SOURCES AND POTENTIAL CONFLICTS OF INTEREST

Sponsorship and funding were provided by the Canadian Chiropractic Association, Canadian Chiropractic Protective Association, and the Canadian Federation of Chiropractic Regulatory and Educational Accrediting Boards (The "Federation"). No conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): RB, MD, RR, LS.

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Editing of manuscript: RR.

REFERENCES

1. Hogg-Johnson S, van der Velde G, Carroll LJ, et al. The burden and determinants of neck pain in the general population: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)* 2008;33:S39-51.
2. Carroll LJ, Hogg-Johnson S, van der Velde G, et al. Course and prognostic factors for neck pain in the general population: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)* 2008;33:S75-82.
3. Guzman J, Hurwitz EL, Carroll LJ, et al. A new conceptual model of neck pain: linking onset, course, and care: the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)* 2008;33:S14-23.
4. Coulter ID, Shekelle PG. Chiropractic in North America: a descriptive analysis. *J Manipulative Physiol Ther* 2005;28:83-9.
5. Henderson D, Chapman-Smith D, Mior S, Vernon H. Clinical guidelines for chiropractic practice in Canada. Toronto (ON): Canadian Chiropractic Association; 1993. Available from: <http://www.chiro.org/LINKS/FULL/CANADA/index.html>.
6. Anderson-Peacock E, Blouin JS, Bryans R, et al. Chiropractic clinical practice guideline: evidence-based treatment of adult neck pain not due to whiplash. *J Can Chiropr Assoc* 2005;49:158-209.
7. Shaw L, Descarreaux M, Bryans R, et al. A systematic review of chiropractic management of adults with whiplash-associated disorders: recommendations for advancing evidence-based practice and research. *Work* 2010;35:369-94.
8. Bryans R, Descarreaux M, Duranleau M, et al. Evidence-based guidelines for the chiropractic treatment of adults with headache. *J Manipulative Physiol Ther* 2011;34:274-89.
9. CCA/CFCRB-CPG. The Canadian Chiropractic Association and the Canadian Federation of Chiropractic Regulatory Boards Clinical Practice Guidelines Development Initiative (The CCA/CFCRB-CPG) development, dissemination, implementation, evaluation, and revision (DevDIER) plan. *J Can Chiropr Assoc* 2004;48:56-72.
10. van Tulder MW, Suttrop M, Morton S, Bouter LM, Shekelle P. Empirical evidence of an association between internal validity and effect size in randomized controlled trials of low-back pain. *Spine (Phila Pa 1976)* 2009;34:1685-92.
11. Brozek JL, Akl EA, Alonso-Coello P, et al. Grading quality of evidence and strength of recommendations in clinical practice guidelines. Part 1 of 3. An overview of the GRADE approach and grading quality of evidence about interventions. *Allergy* 2009;64:669-77.
12. Oxman AD, Guyatt GH. Validation of an index of the quality of review articles. *J Clin Epidemiol* 1991;44:1271-8.
13. Andersen LL, Kjaer M, Sogaard K, Hansen L, Kryger AI, Sjogaard G. Effect of two contrasting types of physical exercise on chronic neck muscle pain. *Arthritis Rheum* 2008;59:84-91.
14. Andersen LL, Christensen KB, Holtermann A, et al. Effect of physical exercise interventions on musculoskeletal pain in all body regions among office workers: a one-year randomized controlled trial. *Man Ther* 2010;15:100-4.
15. Andersen LL, Saervoll CA, Mortensen OS, Poulsen OM, Hannerz H, Zebis MK. Effectiveness of small daily amounts of progressive resistance training for frequent neck/shoulder pain: randomised controlled trial. *Pain* 2011;152:440-6.
16. Aquino RL, Caires PM, Furtado FC, Loureiro AV, Ferreira PH, Ferreira ML. Applying joint mobilization at different cervical vertebral levels does not influence immediate pain reduction in patients with chronic neck pain: a randomized clinical trial. *J Man Manip Ther* 2009;17:95-100.
17. Blikstad A, Gemmel H. Immediate effect of activator trigger point therapy and myofascial band therapy on non-specific neck pain in patients with upper trapezius trigger points compared to sham ultrasound: a randomised controlled trial. *Clin Chiropr* 2008;11:23-9.
18. Borman P, Keskin D, Ekici B, Bodur H. The efficacy of intermittent cervical traction in patents with chronic neck pain. *Clin Rheumatol* 2008;27:1249-53.
19. Boyles RE, Walker MJ, Young BA, Strunce J, Wainner RS. The addition of cervical thrust manipulations to a manual physical therapy approach in patients treated for mechanical neck pain: a secondary analysis. *J Orthop Sports Phys Ther* 2010;40:133-40.
20. Bronfort G, Evans R, Anderson AV, Svendsen KH, Bracha Y, Grimm RH. Spinal manipulation, medication, or home exercise with advice for acute and subacute neck pain: a randomized trial. *Ann Intern Med* 2012;156:1-10.

21. Chiu TT, Lam TH, Hedley AJ. A randomized controlled trial on the efficacy of exercise for patients with chronic neck pain. *Spine (Phila Pa 1976)* 2005;30:E1-7.
22. Chiu TT, Hui-Chan CW, Chein G. A randomized clinical trial of TENS and exercise for patients with chronic neck pain. *Clin Rehabil* 2005;19:850-60.
23. Chiu TT, Ng JK, Walther-Zhang B, Lin RJ, Ortelli L, Chua SK. A randomized controlled trial on the efficacy of intermittent cervical traction for patients with chronic neck pain. *Clin Rehabil* 2011;25:814-22.
24. Chow RT, Heller GZ, Barnsley L. The effect of 300 mW, 830 nm laser on chronic neck pain: a double-blind, randomized, placebo-controlled study. *Pain* 2006;124:201-10.
25. Cleland JA, Childs JD, McRae M, Palmer JA, Stowell T. Immediate effects of thoracic manipulation in patients with neck pain: a randomized clinical trial. *Man Ther* 2005;10:127-35.
26. Cleland JA, Glynn P, Whitman JM, Eberhart SL, MacDonald C, Childs JD. Short-term effects of thrust versus nonthrust mobilization/manipulation directed at the thoracic spine in patients with neck pain: a randomized clinical trial. *Phys Ther* 2007;87:431-40.
27. Cunha AC, Burke TN, Franca FJ, Marques AP. Effect of global posture reeducation and of static stretching on pain, range of motion, and quality of life in women with chronic neck pain: a randomized clinical trial. *Clinics (Sao Paulo)* 2008;63:763-70.
28. Dellve L, Ahlstrom L, Jonsson A, et al. Myofeedback training and intensive muscular strength training to decrease pain and improve work ability among female workers on long-term sick leave with neck pain: a randomized controlled trial. *Int Arch Occup Environ Health* 2011;84:335-46.
29. Dunder U, Evcik D, Samli F, Pusak H, Kavuncu V. The effect of gallium arsenide aluminum laser therapy in the management of cervical myofascial pain syndrome: a double blind, placebo-controlled study. *Clin Rheumatol* 2007;26:930-4.
30. Dunning JR, Cleland JA, Waldrop MA, et al. Upper cervical and upper thoracic thrust manipulation versus nonthrust mobilization in patients with mechanical neck pain: a multicenter randomized clinical trial. *J Orthop Sports Phys Ther* 2012;42:5-18.
31. Dusunceli Y, Ozturk C, Atamaz F, Hepguler S, Durmaz B. Efficacy of neck stabilization exercises for neck pain: a randomized controlled study. *J Rehabil Med* 2009;41:626-31.
32. Dziedzic K, Hill J, Lewis M, Sim J, Daniels J, Hay EM. Effectiveness of manual therapy or pulsed shortwave diathermy in addition to advice and exercise for neck disorders: a pragmatic randomized controlled trial in physical therapy clinics. *Arthritis Rheum* 2005;53:214-22.
33. Escortell-Mayor E, Riesgo-Fuertes R, Garrido-Elustondo S, et al. Primary care randomized clinical trial: manual therapy effectiveness in comparison with TENS in patients with neck pain. *Man Ther* 2011;16:66-73.
34. Gemmill H, Miller P, Nordstrom H. Immediate effect of ischaemic compression and trigger point pressure release on neck pain and upper trapezius trigger points: a randomised controlled trial. *Clin Chiropr* 2008;11:30-6.
35. González-Iglesias J, Fernandez-de-las-Penas C, Cleland JA, Alburquerque-Sendin F, Palomeque-del-Cerro L, Mendez-Sanchez R. Inclusion of thoracic spine thrust manipulation into an electro-therapy/thermal program for the management of patients with acute mechanical neck pain: a randomized clinical trial. *Man Ther* 2009;14:306-13.
36. González-Iglesias J, Fernandez-de-las-Penas C, Cleland JA, Gutierrez-Vega Mdel R. Thoracic spine manipulation for the management of patients with neck pain: a randomized clinical trial. *J Orthop Sports Phys Ther* 2009;39:20-7.
37. Griffiths C, Dziedzic K, Waterfield J, Sim J. Effectiveness of specific neck stabilization exercises or a general neck exercise program for chronic neck disorders: a randomized controlled trial. *J Rheumatol* 2009;36:390-7.
38. Häkkinen A, Salo P, Tarvainen U, Wiren K, Ylinen J. Effect of manual therapy and stretching on neck muscle strength and mobility in chronic neck pain. *J Rehabil Med* 2007;39:575-9.
39. Häkkinen A, Kautiainen H, Hannonen P, Ylinen J. Strength training and stretching versus stretching only in the treatment of patients with chronic neck pain: a randomized one-year follow-up study. *Clin Rehabil* 2008;22:592-600.
40. Helewa A, Goldsmith CH, Smythe HA, Lee P, Obright K, Stitt L. Effect of therapeutic exercise and sleeping neck support on patients with chronic neck pain: a randomized clinical trial. *J Rheumatol* 2007;34:151-8.
41. Hoving JL, de Vet HC, Koes BW, et al. Manual therapy, physical therapy, or continued care by the general practitioner for patients with neck pain: long-term results from a pragmatic randomized clinical trial. *Clin J Pain* 2006;22:370-7.
42. Jay K, Frisch D, Hansen K, et al. Kettlebell training for musculoskeletal and cardiovascular health: a randomized controlled trial. *Scand J Work Environ Health* 2011;37:196-203.
43. Jellad A, Ben Salah Z, Boudokhane S, Migaou H, Bahri I, Rejeb N. The value of intermittent cervical traction in recent cervical radiculopathy. *Ann Phys Rehabil Med* 2009;52:638-52.
44. Kanlayanaphotporn R, Chiradejnant A, Vachalathiti R. Immediate effects of the central posteroanterior mobilization technique on pain and range of motion in patients with mechanical neck pain. *Disabil Rehabil* 2010;32:622-8.
45. Moffett JK, Jackson DA, Gardiner ED, et al. Randomized trial of two physiotherapy interventions for primary care neck and back pain patients: 'McKenzie' vs brief physiotherapy pain management. *Rheumatology (Oxford)* 2006;45:1514-21.
46. Krauss J, Creighton D, Ely JD, Podlowska-Ely J. The immediate effects of upper thoracic translatoric spinal manipulation on cervical pain and range of motion: a randomized clinical trial. *J Man Manip Ther* 2008;16:93-9.
47. Lansinger B, Larsson E, Persson LC, Carlsson JY. Qigong and exercise therapy in patients with long-term neck pain: a prospective randomized trial. *Spine (Phila Pa 1976)* 2007;32:2415-22.
48. Lau HM, Wing Chiu TT, Lam TH. The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain - a randomized controlled trial. *Man Ther* 2011;16:141-7.
49. Leaver AM, Maher CG, Herbert RD, et al. A randomized controlled trial comparing manipulation with mobilization for recent onset neck pain. *Arch Phys Med Rehabil* 2010;91:1313-8.
50. Ma C, Szeto GP, Yan T, Wu S, Lin C, Li L. Comparing biofeedback with active exercise and passive treatment for the management of work-related neck and shoulder pain: a randomized controlled trial. *Arch Phys Med Rehabil* 2011;92:849-58.
51. Martel J, Dugas C, Dubois JD, Descarreaux M. A randomised controlled trial of preventive spinal manipulation with and without a home exercise program for patients with chronic neck pain. *BMC Musculoskelet Disord* 2011;12:41.
52. Martinez-Segura R, Fernandez-de-las-Penas C, Ruiz-Saez M, Lopez-Jimenez C, Rodriguez-Blanco C. Immediate effects on neck pain and active range of motion after a single cervical high-velocity low-amplitude manipulation in subjects presenting with mechanical neck pain: a randomized controlled trial. *J Manipulative Physiol Ther* 2006;29:511-7.

53. McReynolds TM, Sheridan BJ. Intramuscular ketorolac versus osteopathic manipulative treatment in the management of acute neck pain in the emergency department: a randomized clinical trial. *J Am Osteopath Assoc* 2005;105:57-68.
54. Muller R, Giles LG. Long-term follow-up of a randomized clinical trial assessing the efficacy of medication, acupuncture, and spinal manipulation for chronic mechanical spinal pain syndromes. *J Manipulative Physiol Ther* 2005;28:3-11.
55. Pool JJ, Ostelo RW, Knol DL, Vlaeyen JW, Bouter LM, de Vet HC. Is a behavioral graded activity program more effective than manual therapy in patients with subacute neck pain? Results of a randomized clinical trial. *Spine (Phila Pa 1976)* 2010;35:1017-24.
56. Puentedura EJ, Landers MR, Cleland JA, Mintken PE, Huijbregts P, Fernandez-de-Las-Penas C. Thoracic spine thrust manipulation versus cervical spine thrust manipulation in patients with acute neck pain: a randomized clinical trial. *J Orthop Sports Phys Ther* 2011;41:208-20.
57. Reid SA, Rivett DA, Katekar MG, Callister R. Sustained natural apophyseal glides (SNAGs) are an effective treatment for cervicogenic dizziness. *Man Ther* 2008;13:357-66.
58. Saayman L, Hay C, Abrahamse H. Chiropractic manipulative therapy and low-level laser therapy in the management of cervical facet dysfunction: a randomized controlled study. *J Manipulative Physiol Ther* 2011;34:153-63.
59. Salo PK, Häkkinen AH, Kautiainen H, Ylinen JJ. Effect of neck strength training on health-related quality of life in females with chronic neck pain: a randomized controlled 1-year follow-up study. *Health Qual Life Outcomes* 2010;8:48.
60. Schomacher J. The effect of an analgesic mobilization technique when applied to symptomatic or asymptomatic levels of the cervical spine in subjects with neck pain: a randomized controlled trial. *J Man Manip Ther* 2009;17:101-8.
61. Sherman KJ, Cherkin DC, Hawkes RJ, Miglioretti DL, Deyo RA. Randomized trial of therapeutic massage for chronic neck pain. *Clin J Pain* 2009;25:233-8.
62. Sillevs R, Cleland J, Hellman M, Beekhuizen K. Immediate effects of a thoracic spine thrust manipulation on the autonomic nervous system: a randomized clinical trial. *J Man Manip Ther* 2010;18:181-90.
63. Sjogren T, Nissinen KJ, Jarvenpaa SK, Ojanen MT, Vanharanta H, Malkia EA. Effects of a workplace physical exercise intervention on the intensity of headache and neck and shoulder symptoms and upper extremity muscular strength of office workers: a cluster randomized controlled cross-over trial. *Pain* 2005;116:119-28.
64. Skillgate E, Bohman T, Holm LW, Vingard E, Alfredsson L. The long-term effects of naprapathic manual therapy on back and neck pain—results from a pragmatic randomized controlled trial. *BMC Musculoskelet Disord* 2010;11:26.
65. Sutbeyaz ST, Sezer N, Koseoglu BF. The effect of pulsed electromagnetic fields in the treatment of cervical osteoarthritis: a randomized, double-blind, sham-controlled trial. *Rheumatol Int* 2006;26:320-4.
66. Tuttle N, Barrett R, Laakso L. Relation between changes in posteroanterior stiffness and active range of movement of the cervical spine following manual therapy treatment. *Spine (Phila Pa 1976)* 2008;33:E673-9.
67. Vitiello AL, Bonello R, Pollard H. The effectiveness of ENAR for the treatment of chronic neck pain in Australian adults: a preliminary single-blind, randomised controlled trial. *Chiropr Osteopat* 2007;15:9.
68. Vonk F, Verhagen AP, Twisk JW, Koke AJ, Luiten MW, Koes BW. Effectiveness of a behaviour graded activity program versus conventional exercise for chronic neck pain patients. *Eur J Pain* 2009;13:533-41.
69. Walker MJ, Boyles RE, Young BA, et al. The effectiveness of manual physical therapy and exercise for mechanical neck pain: a randomized clinical trial. *Spine (Phila Pa 1976)* 2008;33:2371-8.
70. Ylinen J, Takala EP, Kautiainen H, et al. Effect of long-term neck muscle training on pressure pain threshold: a randomized controlled trial. *Eur J Pain* 2005;9:673-81.
71. Ylinen JJ, Häkkinen AH, Takala EP, et al. Effects of neck muscle training in women with chronic neck pain: one-year follow-up study. *J Strength Cond Res* 2006;20:6-13.
72. Ylinen JJ, Takala EP, Nykanen MJ, Kautiainen HJ, Häkkinen AH, Airaksinen OV. Effects of twelve-month strength training subsequent to twelve-month stretching exercise in treatment of chronic neck pain. *J Strength Cond Res* 2006;20:304-8.
73. Ylinen J, Kautiainen H, Wiren K, Häkkinen A. Stretching exercises vs manual therapy in treatment of chronic neck pain: a randomized, controlled cross-over trial. *J Rehabil Med* 2007;39:126-32.
74. Ylinen J, Häkkinen A, Nykanen M, Kautiainen H, Takala EP. Neck muscle training in the treatment of chronic neck pain: a three-year follow-up study. *Eura Medicophys* 2007;43:161-9.
75. Ylinen J, Nikander R, Nykanen M, Kautiainen H, Häkkinen A. Effect of neck exercises on cervicogenic headache: a randomized controlled trial. *J Rehabil Med* 2010;42:344-9.
76. Zaproudina N, Hanninen OO, Airaksinen O. Effectiveness of traditional bone setting in chronic neck pain: randomized clinical trial. *J Manipulative Physiol Ther* 2007;30:432-7.
77. Konstantinovic LM, Cutovic MR, Milovanovic AN, et al. Low-level laser therapy for acute neck pain with radiculopathy: a double-blind placebo-controlled randomized study. *Pain Med* 2010;11:1169-78.
78. Ezzo J, Haraldsson BG, Gross AR, et al. Massage for mechanical neck disorders: a systematic review. *Spine (Phila Pa 1976)* 2007;32:353-62.
79. Jensen I, Harms-Ringdahl K. Strategies for prevention and management of musculoskeletal conditions. Neck pain. *Best Pract Res Clin Rheumatol* 2007;21:93-108.
80. Ylinen J. Physical exercises and functional rehabilitation for the management of chronic neck pain. *Eura Medicophys* 2007;43:119-32.
81. Binder A. Neck pain. *Clin Evid* 2006:1654-75.
82. Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report. *Chiropr Osteopat* 2010;18:3.
83. Chow RT, Barnsley L. Systematic review of the literature of low-level laser therapy (LLLT) in the management of neck pain. *Lasers Surg Med* 2005;37:46-52.
84. Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials. *Lancet* 2009;374:1897-908.
85. Cross KM, Kuenze C, Grindstaff TL, Hertel J. Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review. *J Orthop Sports Phys Ther* 2011;41:633-42.
86. D'Sylva J, Miller J, Gross A, et al. Manual therapy with or without physical medicine modalities for neck pain: a systematic review. *Man Ther* 2010;15:415-33.
87. Gemmell H, Miller P. Comparative effectiveness of manipulation, mobilisation and the activator instrument in treatment of non-specific neck pain: a systematic review. *Chiropr Osteopat* 2006;14:7.

88. Graham N, Gross A, Goldsmith CH, et al. Mechanical traction for neck pain with or without radiculopathy. *Cochrane Database Syst Rev* 2008;CD006408.
89. Gross AR, Goldsmith C, Hoving JL, et al. Conservative management of mechanical neck disorders: a systematic review. *J Rheumatol* 2007;34:1083-102.
90. Gross A, Miller J, D'Sylva J, et al. Manipulation or mobilisation for neck pain: a Cochrane review. *Man Ther* 2010;15:315-33.
91. Haraldsson BG, Gross AR, Myers CD, et al. Massage for mechanical neck disorders. *Cochrane Database Syst Rev* 2006;CD004871.
92. Hurwitz EL, Carragee EJ, van der Velde G, et al. Treatment of neck pain: noninvasive interventions: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)* 2008;33:S123-52.
93. Kay TM, Gross A, Goldsmith C, Santaguida PL, Hoving J, Bronfort G. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev* 2005;CD004250.
94. Kay TM, Gross A, Goldsmith CH, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev* 2012;8 CD004250.
95. Kroeling P, Gross A, Goldsmith CH, et al. Electrotherapy for neck pain. *Cochrane Database Syst Rev* 2009;CD004251.
96. Leaver AM, Refshauge KM, Maher CG, McAuley JH. Conservative interventions provide short-term relief for non-specific neck pain: a systematic review. *J Geophys Res* 2010; 56:73-85.
97. Macaulay J, Cameron M, Vaughan B. The effectiveness of manual therapy for neck pain: a systematic review of the literature. *Phys Ther Rev* 2007;12:2161-267.
98. Miller J, Gross A, D'Sylva J, et al. Manual therapy and exercise for neck pain: a systematic review. *Man Ther* 2010;15:334-54.
99. Sarigiannis P, Hollins B. Effectiveness of manual therapy in the treatment of non-specific neck pain: a review. *Phys Ther Rev* 2005;10:35-50.
100. Sihawong R, Janwantanakul P, Sitthipornvorakul E, Pensri P. Exercise therapy for office workers with nonspecific neck pain: a systematic review. *J Manipulative Physiol Ther* 2011;34: 62-71.
101. Smidt N, de Vet HC, Bouter LM, et al. Effectiveness of exercise therapy: a best-evidence summary of systematic reviews. *Aust J Physiother* 2005;51:71-85.
102. Vernon H, Humphreys BK. Chronic mechanical neck pain in adults treated by manual therapy: a systematic review of change scores in randomized controlled trials of a single session. *J Man Manip Ther* 2008;16:E42-52.
103. Vernon HT, Humphreys BK, Hagino CA. A systematic review of conservative treatments for acute neck pain not due to whiplash. *J Manipulative Physiol Ther* 2005; 28:443-8.
104. Walser RF, Meserve BB, Boucher TR. The effectiveness of thoracic spine manipulation for the management of musculoskeletal conditions: a systematic review and meta-analysis of randomized clinical trials. *J Man Manip Ther* 2009;17:237-46.

APPENDIX A. NECK PAIN: 2004-2011 LITERATURE DATABASE SEARCH TERM LOGIC

Search Step No.	PubMed	DIALOG Databases: MEDLINE, AMED, EMCare, EMBASE	Index to Chiropractic Literature
1	Chiropractic[mesh]	(Chiropractic or Electromagnetic Fields or Exercise Therapy! or "Manipulation, Chiropractic" or "Manipulation, Spinal" or Massage or Traction or Transcutaneous Electric Nerve Stimulation or Ultrasonic Therapy)/Maj	Subject: Chiropractic
2	Electromagnetic Phenomena[mesh]	(Manipulative Medicine! or Electromagnetic Field! or Kinesiotherapy or Traction Therapy or Transcutaneous Nerve Stimulation or Ultrasound Therapy)/Maj	Subject:"Electromagnetic Phenomena"
3	Exercise Therapy[mesh]	(Chiropractic? or Adjustment or Ischemic(W)Pressure or Spinal(W)Mobilization? Or Spinal(W)Mobilisation or Ultrasound or Ultrasonic or Low(W)Power(W)Laser or Low(W)Level(W)Laser or Pulsed(W) Electromagnetic(W)Therapy)/TI	Subject:"Exercise Therapy"
4	"Manipulation, Chiropractic"[mesh]	1 OR 2 OR 3	Subject:"Manipulation, Spinal"
5	"Manipulation, Spinal"[mesh]	(Neck Pain or Neck Injuries! or Neck Injury!)/MAJ	Subject: Massage
6	Massage[mesh]	(Neck(W)Pain or Neck(W)Injury OR Neck(W)Injuries)/TI	Subject: Traction
7	Traction[mesh]	5 OR 6	Subject:"Transcutaneous Electric Nerve Stimulation"
8	Transcutaneous Electric Nerve Stimulation[mesh]	4 AND 7	Subject:"Ultrasonic Therapy"
9	Ultrasonic Therapy[mesh]	(Clinical Trial or Meta Analysis or Practice Guideline or Randomized Controlled Trial or Review or Case Report or Classical Article)/DT	Article Title: chiropractic*
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	(Clinical(W)Trial? ? or Controlled(W)Trial? ? or Controlled(W)Trial? ? or Metaanalys? or Meta(W)Analys? ? or Practice(W)Guideline? ? or Randomized(W)Controlled or Randomized(W)Controlled or Randomized(W)Controlled or Randomised(W)Controlled or Randomized(W)Trial? ? or Randomised(W)Trial? ? or Case(W)Report or Clinical(W)Conference or Evaluation(W)Study or Evaluation(W)studies or Multicenter(W)study or Multicenter(W)studies)/TI,AB	Abstract/Notes: chiropractic*
11	chiropractic*[tiab]	(Review or Guideline)/TI	Article Title: adjustment*
12	adjustment*[tiab]	8 AND 9	Abstract/Notes: adjustment*
13	ischemic pressure[tiab]	9 OR 10 OR 11	Article Title: "ischemic pressure"
14	ischaemic pressure[tiab]	8 AND 13	Abstract/Notes: "ischemic pressure"
15	spinal mobilization*[tiab] OR spinal mobilisation*[tiab]	(Letter? ? or Comment? ? OR Editorial?)/TI,DT	Article Title: "ischaemic pressure"
16	ultrasound[tiab]	1 4 NOT 15	Abstract/Notes: "ischaemic pressure"
17	ultrasonic[tiab]	14/2004:2012,Human	Article Title: "spinal mobilization*" or Article Title: "spinal mobilisation*"
18	low power laser[tiab] OR low level laser[tiab]	RD (unique items)	Abstract/Notes: "spinal mobilization*" or Abstract/Notes: "spinal mobilisation*"

APPENDIX A. (continued)

Search Step No.	PubMed	DIALOG Databases: MEDLINE, AMED, EMCare, EMBASE	Index to Chiropractic Literature
19	spinal manipulation*[tiab]		Article Title: "low power laser" or Article Title: "low level laser"
20	11 or 12 or 13 or 14 or 16 or 17 or 18 or 19		Abstract/Notes: "low power laser" or Abstract/Notes: "low level laser"
21	10 or 20		Article Title: "spinal manipulation*"
22	Neck Pain[mesh]		Abstract/Notes: "spinal manipulation*"
23	Neck Injuries[mesh]		Article Title: ultrasound or Article Title: ultrasonic
24	22 or 23		Abstract/Notes: ultrasound or Abstract/Notes: ultrasonic
25	neck pain[tiab] OR neck injury[tiab] OR neck injuries[tiab]		9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
26	24 or 25		Subject: "Neck Pain"
27	21 and 26		Subject: "Neck Injuries"
28	#27 Limits: Clinical Trial, Meta-Analysis, Practice Guideline, Randomized Controlled Trial, Review, Case Reports, Classical Article, Clinical Conference, Clinical Trial, Phase I, Clinical Trial, Phase II, Clinical Trial, Phase III, Clinical Trial, Phase IV, Controlled Clinical Trial, Evaluation Studies, Guideline, Multicenter Study		Article Title: neck
29	#27 Sort by: PublicationDate		Abstract/Notes: neck
30	clinical trial*[tiab] or controlled trial* [tiab] or controled trial*[tiab] or metaanalys* [tiab] or meta analys*[tiab] or practice guideline*[tiab] or guideline[ti] or randomized controlled[tiab] or randomized controled[tiab] or randomised controlled[tiab] or randomised controled[tiab] or randomized trial*[tiab] or randomised trial*[tiab] or review[ti] or case report [tiab] or clinical conference[tiab] or evaluation study[tiab] or evaluation studies[tiab] or multicenter study[tiab] or multicenter studies[tiab]		26 or 27 or 28 or 29
31	27 and 30		25 and 30
32	28 or 31		Article Title: "neck pain" or Article Title: "neck injury" or Article Title: "neck injuries"
33	32 not 28		Abstract/Notes: "neck pain" or Abstract/Notes: "neck injury" or Abstract/Notes: "neck injuries"
34	Whiplash Injuries[mesh] or whiplash[tiab]		26 or 27 or 32 or 33
35	32 not 34		25 and 34
36	32 not 35		All Fields: pubmed or All Fields: medline
37			35 and not 36
38			Limiting 35 to study types

APPENDIX B

Literature screening steps

Level 1 screening criteria (N = 555 + hand searches = 560) Titles and abstracts

Inclusion criteria

Related to neck pain

Related to chiropractic treatment (manual therapies such as manipulation and mobilization; rehabilitation exercises including home exercise; physical therapies such as traction, ischemic pressure, massage, cold packs, pillows, and laser; and electrical modalities (pulsed electromagnetic field therapy, ultrasound, transcutaneous electrical nerve stimulation)

English

Exclusion criteria

Studies with principal aims to assess acupuncture, psychological interventions, and drugs

Not related to adult humans > 18 years

No original data presented

Case reports

Level 2 screening criteria (N = 237) Selection of clinical and controlled trials

Inclusion criteria

Related to neck pain

Related to chiropractic treatment (manual therapy, physical therapy, exercise therapy, and lifestyle interventions)

English

Exclusion criteria

Abstracts not published as full studies

Acupressure

Adverse events

Behavioral interventions

Biofeedback

Cadaver studies

Cognitive interventions

Conference proceedings

Drug interventions or tests

Hypnosis

Imaging/electromyogram (EMG)/electroencephalogram (EEG)/advanced testing

Internet-based interventions

Laboratory tests

Laser acupuncture

Letters to the editor

Nasal or aural or oral interventions

Newspaper articles

No original data presented

Non-SRs

Not related to adult humans > 18 years

Nutritional supplements

Percutaneous interventions

Press releases

Prevalence and epidemiologic studies

Psychological interventions

Reflexology

Relaxation training

Self-care not guided by a practitioner

Single-case reports

Use of intervention surveys

Level 3 screening criteria (N = 195) Screening of clinical and controlled trials

Inclusion criteria

English

RCTs and systematically conducted reviews

Related to chiropractic treatment

Does it meet any exclusion criteria (specified below)

Exclusion criteria

Previously identified exclusion criteria

Level 4 screening criteria (RCTs N = 65); (SRs N = 27)
Full-text screening and risk of bias rating

Inclusion criteria

Met eligibility criteria at all previous levels of screening

Low risk of bias rating

Exclusion criteria

Methodological quality or relevance to chiropractic so low that it precluded extracting any useful credible information

High risk of bias rating

(RCTs N = 42; SRs N = 24)