


# Noninvasive management of soft tissue disorders of the shoulder: A clinical practice guideline from the Ontario Protocol for Traffic Injury Management (OPTIMa) collaboration

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## Funding information

The development of this clinical practice guideline was funded by the Ministry of Finance and the Financial Services Commission of Ontario (OSS\_00267175). The Ministry of Finance and Financial Services Commission of Ontario were not involved in the design, conduct, or interpretation of the research that informed the development of the care pathways included in this report. The development of the guideline by the Guideline Expert Panel was not influenced by the Ministry of Finance or Financial Services Commission of Ontario; the views and interests of the funding body did not influence the final recommendations. All individuals involved in the project declared any competing interests. This research was undertaken, in part, thanks to funding from the Canada Research Chairs Program to Dr. Pierre Côté, Canada Research Chair in Disability Prevention and Rehabilitation at Ontario Tech University, funding from Alberta Innovates – Health Solutions to Dr. Linda Carroll, Health Senior Scholar, and funding from the Canadian Chiropractic Research Foundation to Dr. Carol Cancelliere.

## Abstract

**Objectives:** Objective of this study is to develop an evidence-based guideline for the noninvasive management of soft tissue disorders of the shoulder (shoulder pain), excluding major pathology.

**Methods:** This guideline is based on high-quality evidence from seven systematic reviews. Multidisciplinary experts considered the evidence of effectiveness, safety, cost-effectiveness, societal and ethical values, and patient experiences when formulating recommendations. Target audience is clinicians; target population is adults with shoulder pain.

**Results:** When managing patients with shoulder pain, clinicians should (a) rule out major structural or other pathologies as the cause of shoulder pain and reassure patients about the benign and self-limited nature of most soft tissue shoulder pain; (b) develop a care plan in partnership with the patient; (c) for shoulder pain of any duration, consider low-level laser therapy; multimodal care (heat/cold, joint mobilization, and range of motion exercise); cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine; or thoracic spine manipulation; (d) for shoulder pain >3-month duration, consider stretching and/or strengthening exercises; laser acupuncture; or general physician care (information, advice, and pharmacological pain management if necessary); (e) for shoulder pain with calcific tendinitis on imaging, consider shock-wave therapy; (f) for shoulder pain of any duration, do not offer ultrasound; taping; interferential current therapy; diacutaneous fibrolysis; soft tissue massage; or cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for pain between the neck and the elbow at rest or during movement of the arm; (g) for shoulder pain >3-month duration, do not offer shock-wave therapy; and (h) should reassess the patient's status at each visit for worsening of symptoms or new physical, mental, or psychological symptoms, or satisfactory recovery.

**Conclusions:** Our evidence-based guideline provides recommendations for non-invasive management of shoulder pain. The impact of the guideline in clinical practice requires further evaluation.

**Significance:** Shoulder pain of any duration can be effectively treated with laser therapy, multimodal care (i.e., heat/cold, joint mobilization, range of motion exercise), or cervicothoracic manipulation and mobilization. Shoulder pain (>3 months) can be effectively treated with exercises, laser acupuncture, or general physician care (information, advice, and pharmacological pain management if necessary).

# 1 | INTRODUCTION

## 1.1 | Background

Shoulder pain is a common musculoskeletal condition in the general population. In the United States, the annual prevalence of shoulder pain was approximately 9% in adults in the period of 2002–2009 and shoulder pain ranked fourth behind low back pain, knee pain, and neck pain as the most prevalent

musculoskeletal condition in 2009 (National Center for Health Statistics, 2011). Shoulder pain is a major cause of disability worldwide (Vos et al., 2016). Furthermore, shoulder pain places a significant economic burden on the healthcare system and society. Employed persons with shoulder pain require a median of 23 days off work in the United States and an average of 39 days off work in Canada (Saskatchewan Workers' Compensation Board, 2015; US Department of Labor, 2015). In Australia, the estimated cost is \$56.92 AUD

per day for the management of shoulder pain among employed persons on a waiting list for public hospital orthopaedic care (Marks et al., 2016).

The clinical management of shoulder pain is challenging. For example, three recently developed clinical practice guidelines for the management of shoulder pain varied in their recommendations (American College of Occupational and Environmental Medicine [ACOEM], 2016; Colorado Division of Workers' Compensation, 2015; Industrial Insurance Chiropractic Advisory Committee [IICAC], 2014). All three guidelines recommended exercise and manual therapy, but their recommendations varied with regard to use of other interventions (acupuncture, massage, heat/cold, transcutaneous electrical nerve stimulation, ultrasound, shock-wave therapy, taping, and biofeedback; ACOEM, 2016; Colorado Division of Workers' Compensation, 2015; IICAC, 2014). Furthermore, the quality of these clinical practice guidelines varies. Specifically, their methodological limitations include searching only one electronic database (i.e., PubMed), using cut-off points to assess risk of bias, or recommendations based on studies with high risk of bias, and dated literature searches (search dates up to 2013). An up-to-date, high quality evidence-based clinical practice guideline is needed to inform the clinical management of soft tissue disorders of the shoulder (shoulder pain) and promote uniform high-quality care for individuals with shoulder pain.

## 1.2 | Scope and purpose of the guideline

We developed a clinical practice guideline based on the best available evidence for the non-invasive management of soft tissue disorders of the shoulder (Table 1). The target populations were adults (aged 18 years or older) with recent-onset (0- to 3-month duration) or persistent (>3-month duration) soft tissue disorders of the shoulder. The target audience is clinicians providing care for patients with shoulder pain in primary, secondary, and tertiary health care settings. The recommended interventions in this guideline aim to (a) accelerate recovery; (b) reduce the intensity of symptoms; (c) promote early restoration of function; (d) prevent chronic pain and disability; (e) improve health-related quality of life; (f) reduce recurrences; and (g) promote active participation of patients in their care.

This guideline was developed by the Ontario Protocol for Traffic Injury Management (OPTIMA) Collaboration, which is a multidisciplinary team of clinicians (from medicine, dentistry, physiotherapy, chiropractic, psychology, occupational therapy, and nursing disciplines), academics and scientists (epidemiologists, clinical epidemiologists, library sciences, and health economists), a patient liaison, a consumer advocate, a retired judge, and automobile insurance

**TABLE 1** Conditions included in soft tissue disorders of the shoulder (Bron et al., 2011; Cabana et al., 1999; Cacchio et al., 2006)

Included conditions	Grade I–II sprains/strains, partial thickness rotator cuff tears, tendonitis, tendinopathy, tendinosis, non-specific shoulder pain (excluding major pathology), and other soft tissues injuries of the shoulder as informed by available evidence
Excluded conditions	Grade III sprain/strain injuries, full thickness rotator cuff tears, glenoid labral tears, adhesive capsulitis, osteoarthritis, fractures/dislocations, infection, neoplasm, and inflammatory disorders

industry experts. One mandate of the OPTIMA Collaboration directed by the funding agency was to develop an evidence-based clinical practice guideline for soft tissue disorders of the shoulder.

## 2 | METHODS

### 2.1 | Systematic reviews and updates

We conducted seven systematic reviews examining the effectiveness and safety of noninvasive interventions for the management of soft tissue disorders of the shoulder (Abdulla et al., 2015; Cox et al., 2016; Goldgrub et al., 2016; Piper et al., 2016; Randhawa et al., 2015; Southerst et al., 2015; Yu et al., 2015). The literature searches for all systematic reviews were updated on April 26, 2019.

#### 2.1.1 | Population, interventions, comparisons and outcomes

The systematic reviews included studies examining the effectiveness and safety of noninvasive interventions for the management of soft tissue disorders of the shoulder (Table 1; Appendices I and II). We included grades I to II sprains or strains, partial thickness tears, nonspecific shoulder pain, shoulder tendinitis, impingement syndromes, bursitis, shoulder osteoarthritis, and other soft tissue injuries of the shoulder (Table 1; Chan et al., 2012; Noonan & Garrett, 1999; Woodward & Best, 2000). We excluded studies of shoulder pain due to major pathology (e.g., fractures, dislocations, infections, neoplasms, systemic disease and others), full thickness tears of the rotator cuff and biceps tendon, and frozen shoulder (Table 1). Noninvasive interventions included acupuncture, exercise, manual therapy, multimodal care, passive physical modalities, soft tissue therapies, and structured patient education (Appendix I). Pharmacological interventions as a component of multimodal care were included in

our guideline. We excluded surgical interventions. Eligible comparators included other interventions, placebo/sham interventions, nonintervention effects associated with wait listing, or no intervention. Eligible outcomes included self-rated recovery, functional recovery, disability, pain intensity, health-related quality of life, psychological outcomes, or adverse events. Eligible study designs included randomized controlled trials (RCTs), cohort studies, case-control studies, and economic studies published in English.

We searched MEDLINE, EMBASE, PsycINFO, and the Cochrane Central Register of Controlled Trials through Ovid Technologies, Inc., and CINAHL Plus with Full Text through EBSCOhost (Appendices IIIA and IIIB).

### 2.1.2 | Original searches

Our initial searches included publication dates from January 1990 to February 2014 (search dates varied between reviews) to identify evidence of effectiveness and safety. We also searched EconLit through ProQuest, Health Technology Assessment (Cochrane), and National Health Service Economic Evaluation Database (Cochrane) for available economic evaluations.

### 2.1.3 | Updated searches

We updated literature searches (first update) of six systematic reviews (Abdulla et al., 2015; Cox et al., 2016; Goldgrub et al., 2016; Piper et al., 2016; Randhawa et al., 2015; Southerst et al., 2015) from February 2014 to April 2015 (search dates varied between reviews) before submission for publication, except for the systematic review of passive physical modalities (published online on November 13, 2014; Yu et al., 2015). On April 26, 2019, we conducted second updated literature searches using the same search strategies of all seven systematic reviews to retrieve any new RCTs. We limited our second updated searches to RCTs because we did not identify any relevant cohort studies and case-control studies in our original and first updated searches.

### 2.1.4 | Quality assessment and data synthesis

Random pairs of independent, trained reviewers screened and critically appraised eligible studies using the Scottish Intercollegiate Guidelines Network criteria for randomized trials and economic studies (Harbour & Miller, 2001). Consensus between the reviewers in each pair was reached through discussion, with the involvement of an independent third reviewer where necessary. Studies with low risk of bias were included in our synthesis according to the

best evidence synthesis principle (Slavin, 1995). Studies with low risk of bias were defined as studies with findings that were likely due to the true treatment effect rather than selection bias, information bias, or confounding. Minimal clinically important difference (MCID) thresholds from the literature were considered when determining the clinical importance of the differences in results between groups (Abdulla et al., 2015; Cox et al., 2016; Goldgrub et al., 2016; Piper et al., 2016; Randhawa et al., 2015; Southerst et al., 2015; Yu et al., 2015). These MCIDs included a between group difference of 1.4/10 cm on the Visual Analog Scale (VAS; Tashjian et al., 2009), 18/100 on the Shoulder Pain and Disability Index (SPADI; Breckenridge & McAuley, 2011), 8/100 on the short form of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (Quick DASH; Mintken et al., 2009), 10.5/100 on the DASH (Roy et al., 2009), 1.14/7 for Symptom 1 and 0.91/7 for Symptom 2 on the Measure Yourself Medical Outcome Profile (Paterson, 1996), and 11% or 4/50 unweighted points on the Shoulder Rating Questionnaire (Moser et al., 2008).

## 2.2 | Development of recommendations

The principle of patient-centered care was fundamental to developing this guideline. We developed the evidence-based recommendations according to:

- Key decision determinants (overall clinical benefit [effectiveness and safety], value for money [cost-effectiveness data when available], and consistency with expected societal and ethical values) based on the Ontario Health Technology Advisory Committee framework (Johnson et al., 2009);
- Best evidence obtained from systematic reviews of scientific literature; and
- Findings from qualitative research exploring patients' lived experiences in receiving care for traffic injuries in Ontario (Lindsay et al., 2016). These findings on patient experiences were considered under the key decision determinant 'expected societal and ethical values.'

All recommended interventions are supported by evidence of effectiveness, safety and cost-effectiveness (when cost-effectiveness data were available), and are consistent with societal and ethical values. We did not recommend interventions if evidence of the interventions did not meet the criteria of one or more key decision determinants (i.e., evidence of effectiveness, safety, cost-effectiveness, and/or consistency with societal and ethical values). Our recommendations on assessment, patient education, and re-evaluation and discharge are based on universal principles

of health professions' standards of practice (Hopman et al., 2013; Stiggebout et al., 2012; Washington State Department of Labor and Industries, 2014). Initiating care from assessment to discharging patients reflects current clinical practice.

This guideline adapted the National Institute for Health and Care Excellence methodology to word guideline recommendations (Table 2; Vargas-Schaffer, 2010). Based on this methodology, recommendations start with the word "offer" (for interventions that are of superior effectiveness compared to other interventions, placebo/sham interventions, or no intervention), "consider" (for interventions providing similar effectiveness to other interventions), or "do not offer" (for interventions providing no benefit beyond placebo/sham or

are harmful). An intervention was deemed to have superior effectiveness if evidence of statistically significant and clinically important benefits was identified in at least one study with low risk of bias.

The frequency and duration of use for recommended interventions was included in the recommendations. This was determined according to treatment frequencies and durations for interventions that were effective in studies with low risk of bias. Specifically, for recommended interventions that were supported by one low risk of bias study, we used the frequency and duration of treatment that was tested in that study. For recommended interventions that were based on more than one low risk of bias study, we computed the mean frequency and duration of care across studies with superior outcomes for a specific intervention.

**TABLE 2** Guideline recommendations: Wording of Guideline Recommendations as adapted from the National Institute for Health and Care Excellence Methodology (Chan et al., 2012)

Effectiveness of interventions	Wording of recommendations
Interventions that should be used are interventions demonstrated to be clearly superior to other interventions, placebo/sham interventions, or no intervention (i.e., statistically significant and clinically important between group differences favoring the intervention)	Recommendations start with the word "offer"
Interventions that should not be offered because they provide no benefit beyond placebo/sham (i.e., statistically significant and clinically important between group differences favoring placebo/sham) or because they are harmful (i.e. serious adverse events or high frequency of minor adverse events)	Recommendations start with the words "do not offer"
Recommendations for interventions providing similar effectiveness to other interventions (between group differences of the interventions were not statistically significant and/or clinically important)	Recommendations start with the word "consider"; the choice of interventions should be influenced by patients' values and preferences.
Evidence was deemed inconclusive when the results of multiple low risk of bias studies conflicted	Intervention was categorized under 'inconclusive evidence'; conflicting results prevented the development of a coherent statement of effectiveness

*Note:* The Guideline Expert Panel was confident that the treatment will do better than harm for the 'offer' or 'consider' interventions, and that the treatment will not benefit patients for 'do not offer' interventions.

### 2.2.1 | Development of original recommendations based on evidence from original searches

All systematic reviews based on the original searches and corresponding recommendations were reviewed and approved by a multidisciplinary Guideline Expert Panel that included 22 individuals representing emergency medicine, internal medicine, rehabilitation medicine, orthopedic surgery, dentistry, chiropractic, physical therapy, psychology, nursing, health economics, epidemiology, clinical epidemiology, law, patient liaison, consumer representative, and insurers (non-voting members; Appendices IVA and IVB). We translated scientific evidence into guideline recommendations following five steps (Table 3).

This evidence-based clinical practice guideline was developed for the Government of Ontario, Canada. This guideline (i.e., the original recommendations) was part of a treatment protocol for common traffic injuries delivered to the Government Ontario in December 2014 (OPTIMA Collaboration, 2015). The Government invited stakeholders (i.e., health care providers, insurers and lawyers) to review and comment on the guideline. Moreover, the government held a series of public consultations on this clinical practice guideline from August 17 to August 21, 2015.

### 2.2.2 | Development of final recommendations based on evidence from original searches and updated searches

Final recommendations were developed by updating the original recommendations using new evidence from updated searches. Final recommendations were reviewed and approved by all coauthors. Coauthors consist of 17 individuals from the

**TABLE 3** Guideline recommendations: Translation of Scientific Evidence into Guideline Recommendations by the Ontario Protocol for Traffic Injury Management Collaboration

Step	Description of process
1	Draft recommendations based on the best-evidence synthesis of the literature were developed by the authors of each systematic review
2	The recommendation subcommittee <sup>a</sup> used the key decision determinants of the Ontario Health Technology Advisory Committee framework (21) to modify the draft recommendation, evaluating its consistency with patients' experiences and preferences, expected societal and ethical values and incorporating economic evidence
3	The recommendation subcommittee reviewed the draft recommendation, debated its validity and, if necessary, made modifications based upon the scientific evidence
4	The recommendation subcommittee reached consensus on the draft recommendation
5	Draft recommendations (with supporting decision determinants) were presented to the Guideline Expert Panel at quarterly meetings. The Guideline Expert Panel provided feedback and voted to accept, reject, or modify each recommendation. Recommendations requiring modification were reformulated and a new, separate vote for the revised recommendation occurred. Voting was done through secret ballot. Consensus was reached when 75% of the Guideline Expert Panel accepted a recommendation

<sup>a</sup>The recommendation subcommittee included individuals representing rehabilitation medicine, nursing, chiropractic, epidemiology, health economics, and patient liaison.

## Quick Reference Guide – Management of Shoulder Pain

Symptoms ≤ 3 months	Symptoms > 3 months
<p><b>For persons with shoulder pain:</b>  <b>Rule out</b> risk factors for serious pathologies<sup>a</sup>  <b>Offer</b> information on nature, management, course of shoulder pain as a framework for initiation of a program of care  <b>Conduct</b> ongoing assessment for symptom improvement or progression during intervention and refer accordingly  <b>Discharge</b> as appropriate at any point during intervention and recovery</p>	
<p><b>Based upon shared decision making between the patient and provider, any one of the following therapeutic interventions is recommended:</b></p>	
<p><b>Home and clinic based interventions:<sup>b,c</sup></b></p> <ol style="list-style-type: none"> <li>Cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine</li> <li>Thoracic spine manipulation</li> <li>Low-level laser therapy</li> <li>Multimodal care that includes the combination of:               <ol style="list-style-type: none"> <li>Heat/Cold</li> <li>Joint mobilization</li> <li>Range of motion exercise</li> </ol> </li> </ol>	<p><b>Home and clinic based interventions:<sup>b,c</sup></b></p> <ol style="list-style-type: none"> <li>Strengthening and stretching exercises</li> <li>Cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine</li> <li>Thoracic spine manipulation</li> <li>Low-level laser therapy</li> <li>Laser acupuncture</li> <li>General physician care (information, advice, and pain contingent medical or pharmaceutical therapy)</li> <li>Multimodal care that includes the combination of (if not previously given in 1st 3 months of care):               <ol style="list-style-type: none"> <li>Heat/Cold</li> <li>Joint mobilization</li> <li>Range of motion exercise</li> </ol> </li> </ol>
<p><b>Do Not Offer:<sup>d</sup></b></p> <ol style="list-style-type: none"> <li>Diacutaneous fibrolysis</li> <li>Ultrasound</li> <li>Interferential current therapy</li> <li>Taping</li> <li>Soft tissue massage</li> <li>Cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm)</li> </ol>	<p><b>Do Not Offer:<sup>d</sup></b></p> <ol style="list-style-type: none"> <li>Diacutaneous fibrolysis</li> <li>Shock-wave therapy</li> <li>Soft-tissue massage</li> <li>Ultrasound</li> <li>Interferential current therapy</li> <li>Taping</li> <li>Cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm)</li> </ol>
<p><b>Outcome:</b>  <b>Recovered → Discharge</b>  <b>Unrecovered: Incomplete recovery → Initiate persistent protocol</b>  <b>Major symptom change (new or worsening physical, mental or psychological symptoms) → Refer to appropriate healthcare provider<sup>e</sup></b></p>	<p><b>Outcome:</b>  <b>Recovered → Discharge</b>  <b>Unrecovered: Incomplete recovery → Refer to appropriate healthcare provider<sup>e</sup></b>  <b>Major symptom change (new or worsening physical, mental or psychological symptoms) → Refer to appropriate healthcare provider<sup>e</sup></b></p>
<p><sup>a</sup>Risk factors for serious pathologies (also known as red flags): Unexplained deformity or swelling or erythema of the skin; significant weakness not due to pain; past history of malignancy; suspected malignancy (e.g., weight loss or loss of appetite); fever/chills/malaise; significant unexplained sensory/motor deficits of the upper extremity; pulmonary or vascular compromise; inability to perform any movements of the shoulder; shoulder pain at rest</p> <p><sup>b</sup>This guideline does not include interventions for which there is a lack of evidence of effectiveness</p> <p><sup>c</sup>The ordering of interventions does not reflect superiority of effectiveness</p> <p><sup>d</sup>Based on evidence of no benefit to patients</p> <p><sup>e</sup>Referral to the appropriate healthcare professional who is authorized to take appropriate actions and initiate additional examinations</p>	

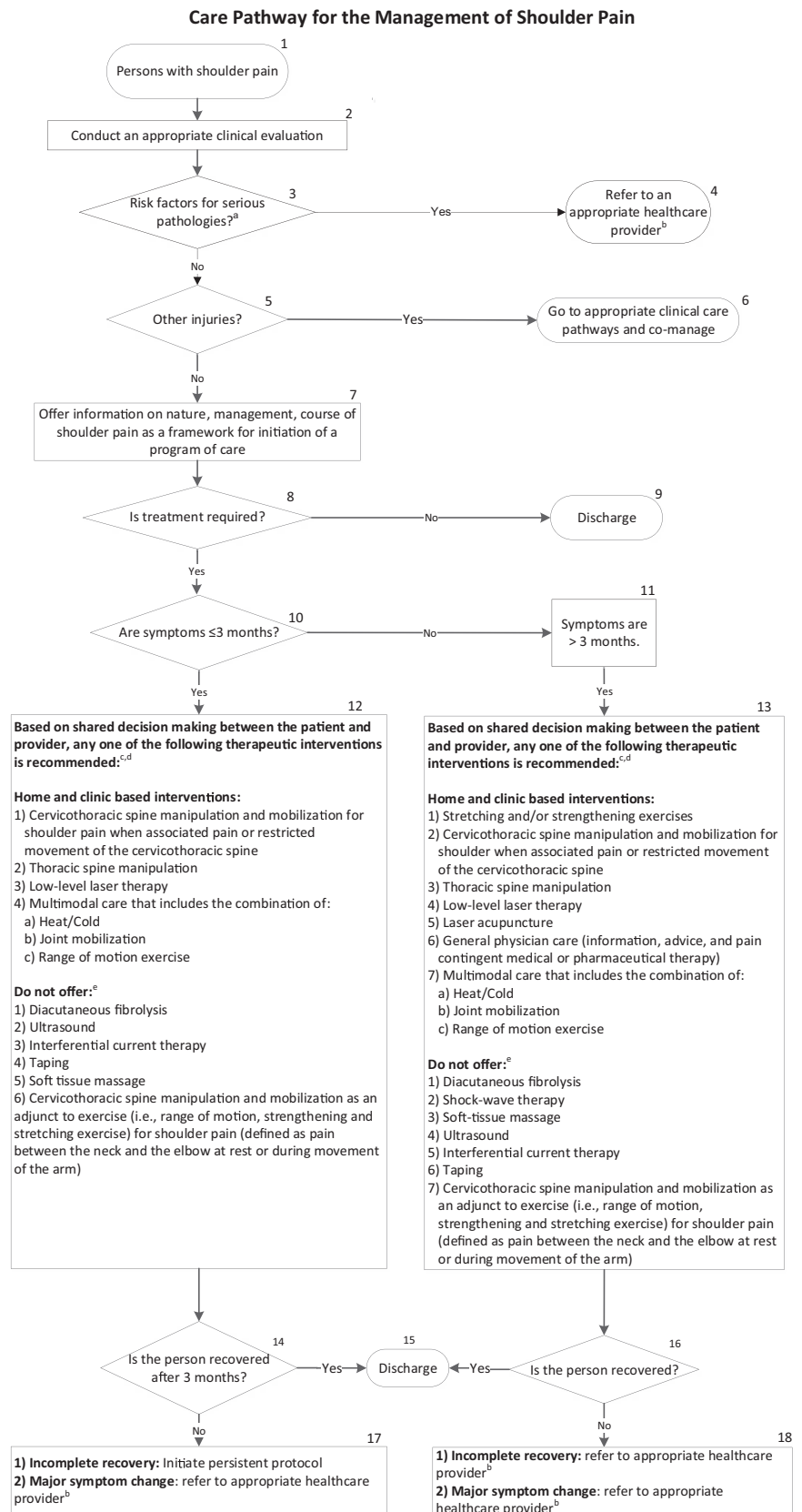
**FIGURE 1** Quick reference guide for the management of shoulder pain

multidisciplinary Guideline Expert Panel representing emergency medicine, internal medicine, rehabilitation medicine, dentistry, chiropractic, physical therapy, psychology, health economics, epidemiology, clinical epidemiology, patient liaison, and consumer representative. Five individuals are not listed as co-authors due to various reasons: (a) health issues

(2 members); (b) retired (1 member); (c) cannot be reached (1 member); (d) do not meet the criteria for authorship (1 member).

Each recommendation was integrated into care pathways and algorithms that were approved by all coauthors (Figures 1–4). Interventions for which there was inconclusive evidence of effectiveness were not included in the care

**FIGURE 2** Care pathway for the management of shoulder pain



<sup>a</sup> Risk factors for serious pathologies (also known as red flags): Unexplained deformity or swelling or erythema of the skin; significant weakness not due to pain; past history of malignancy; suspected malignancy (e.g., weight loss or loss of appetite); fevers/chills/malaise; significant unexplained sensory/motor deficits in the upper extremity; pulmonary or vascular compromise; inability to perform any movements of the shoulder; shoulder pain at rest

<sup>b</sup> Referral to the appropriate healthcare professional who is authorized to take appropriate actions and initiate additional examinations

<sup>c</sup> This guideline does not include interventions for which there is a lack of evidence of effectiveness

<sup>d</sup> The ordering of interventions does not reflect superiority of effectiveness

<sup>e</sup> Based on evidence of no benefit to patients

pathways (Appendix VA). The development of recommendations and care pathways did not consider interventions that are inconsistent with current practice (Appendix VB).

It is recommended that this guideline be updated in 5 years to reflect current best evidence (Kung et al., 2012). The update should use methodology similar to the development of this guideline: (a) form a multidisciplinary guideline expert panel; (b) conduct systematic reviews of scientific literature to identify new best available evidence on effectiveness/safety, cost-effectiveness and qualitative research exploring patients' and providers' lived experiences; (c) use a comprehensive framework for evidence-based recommendations (e.g., key decision determinants based on the Ontario Health Technology Advisory Committee framework).

### 2.3 | Reporting

This clinical practice guideline complies with standard reporting elements suggested by the Guidelines International Network (G-I-N; Qaseem et al., 2012).

### 2.4 | Editorial independence

The development of this clinical practice guideline was funded by the Ministry of Finance and the Financial Services Commission of Ontario (OSS\_00267175). The Ministry of Finance and Financial Services Commission of Ontario were not involved in the design, conduct, or interpretation of the research that informed the development of the care pathways included in this report. The development of the guideline by the Guideline Expert Panel was not influenced by the Ministry of Finance or Financial Services Commission of Ontario; the views and interests of the funding body did not influence the final recommendations. All individuals involved in the project disclosed any conflict of interest (COI) on a standardized form at the onset and end of the project. At each Guideline Expert Panel meeting, we asked members to contact us if their COI forms needed to be updated. Any

individual having a COI at any stage of the guideline development was excused from discussion and voting.

## 3 | RESULTS OF SYSTEMATIC REVIEWS

Plain text without references provided in Appendix VIA.

### 3.1 | Evidence from original searches

The original searches of seven systematic reviews identified 27 RCTs with a low risk of bias (reported in 29 articles; Appendix VIB; Abrisham et al., 2011; Ainsworth et al., 2007; Albert et al., 2007; Barra Lopez et al., 2013; Bennell et al., 2010; Bergman et al., 2004; Bron et al., 2011; Cacchio et al., 2006; Cook et al., 2014; Engebretsen et al., 2009, 2011; Geraets et al., 2005; Gerdsmeyer et al., 2003; Ginn & Cohen, 2005; Guerra de Hoyos et al., 2004; Haahr & Andersen, 2006; Haahr et al., 2005; Hay et al., 2003; Johansson et al., 2011; Lombardi et al., 2008; Ludwig & Borstad, 2003; Molsberger et al., 2010; Santamato et al., 2009; Speed et al., 2002; Szczerko et al., 2009; Van Der Heijden et al., 1999; Vas et al., 2008). Four articles reported outcomes of different follow-ups based on two RCTs conducted by Engebretsen et al. (2009, 2011), Haahr and Andersen (2006), and Haahr et al. (2005). The 29 articles investigated the following interventions: (a) acupuncture (3 articles; Guerra de Hoyos et al., 2004; Molsberger et al., 2010; Vas et al., 2008); (b) exercise (3 articles; Ginn & Cohen, 2005; Lombardi et al., 2008; Ludwig & Borstad, 2003); (c) manual therapy (2 articles; Bergman et al., 2004; Cook et al., 2014); (d) multimodal care (11 articles; Bennell et al., 2010; Bron et al., 2011; Engebretsen et al., 2009, 2011; Geraets et al., 2005; Ginn & Cohen, 2005; Haahr & Andersen, 2006; Haahr et al., 2005; Hay et al., 2003; Johansson et al., 2011; Szczerko et al., 2009); (e) passive physical modalities (12 articles; Abrisham et al., 2011; Ainsworth et al., 2007; Albert et al., 2007; Cacchio et al., 2006; Engebretsen et al., 2009,

### Quick Reference Guide – Management of Shoulder Pain with Calcific Tendinitis

**Management of Calcific Tendinitis**

**For persons with shoulder pain with calcific tendinitis:**  
**Rule out risk factors for serious pathologies<sup>1</sup>**  
**Offer information on nature, management, course of shoulder pain with calcific tendinitis as a framework for initiation of a program of care**  
**Conduct ongoing assessment for symptom improvement or progression during intervention and refer accordingly**  
**Discharge as appropriate at any point during intervention and recovery**

**Based upon shared decision making between the patient and provider, the following therapeutic intervention is recommended:<sup>2</sup>**

- Shock-wave therapy with an amplitude ranging from 0.08mJ/mm<sup>2</sup>-0.06mJ/mm<sup>2</sup>

<b>Outcome:</b>	
<b>Recovered →</b>	<b>Discharge</b>
<b>Unrecovered:</b>	<b>Incomplete recovery → Refer to appropriate healthcare provider<sup>3</sup></b> <b>Major symptom change (new or worsening physical, mental or psychological symptoms) → Refer to appropriate healthcare provider<sup>4</sup></b>

<sup>1</sup>Risk factors for serious pathologies (also known as red flags): Unexplained deformity or swelling or erythema of the skin; significant weakness not due to pain; past history of malignancy; suspected malignancy (e.g., weight loss or loss of appetite); fever/chills/malesia; significant unexplained sensory/motor deficits in the upper extremity; pulmonary or vascular compromise; inability to perform any movements of the shoulder; shoulder pain at rest

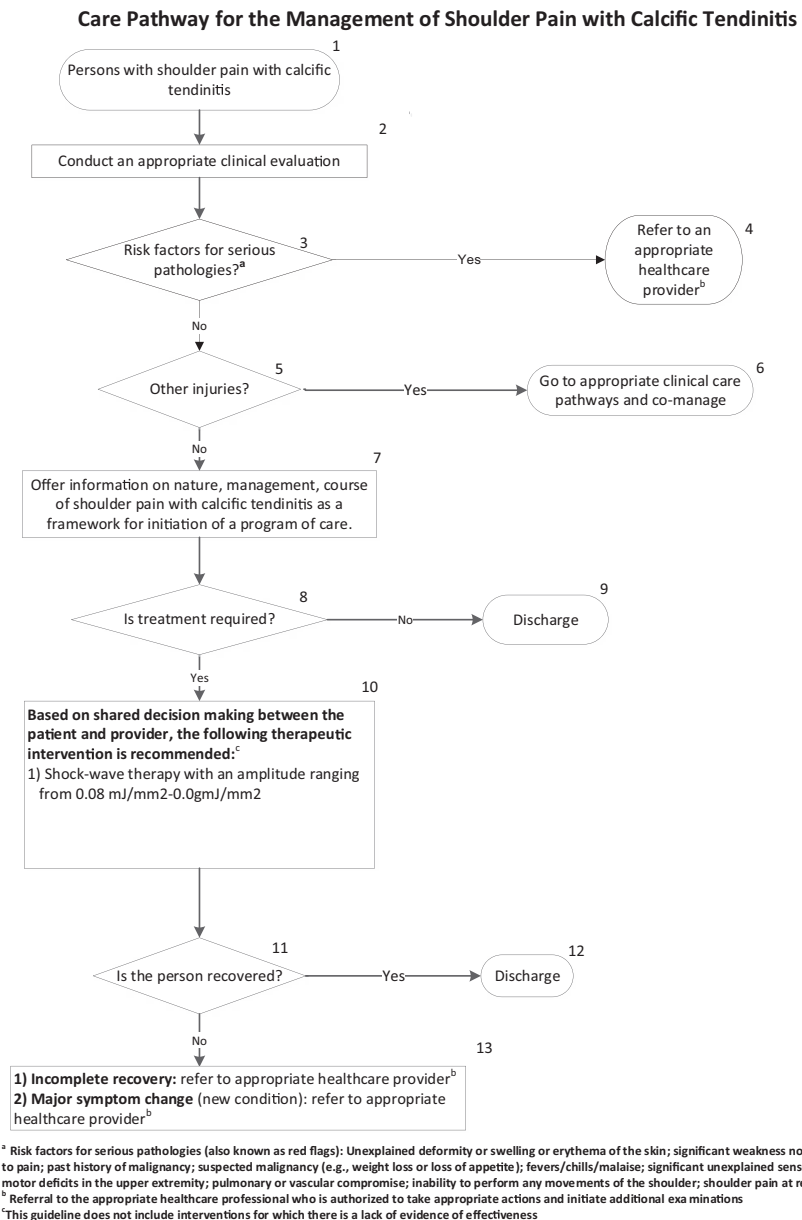
<sup>2</sup>This guideline does not include interventions for which there is a lack of evidence of effectiveness

<sup>3</sup>Referral to an appropriate healthcare professional who is authorized to take appropriate actions and initiate additional examinations

**FIGURE 3** Quick reference guide for the management of shoulder pain with calcific tendinitis



**FIGURE 4** Care pathway for the management of shoulder pain with calcific tendinitis



2011; Gerdesmeyer et al., 2003; Lewis et al., 2005; Rabini et al., 2012; Santamato et al., 2009; Speed et al., 2002; Van Der Heijden et al., 1999); and (f) soft tissue therapies (1 articles; Barra Lopez et al., 2013). One article investigated both exercise and multimodal care (Ginn & Cohen, 2005). Two articles investigated both passive physical modalities and multimodal care (Engebretsen et al., 2009, 2011). We did not identify any articles related to structured patient education. We identified one cost-effectiveness study on multimodal care (Geraets et al., 2006).

Two RCTs evaluating effectiveness of passive physical modalities were not used to inform the development of recommendations (Lewis et al., 2005; Rabini et al., 2012). The interventions are not consistent with current practice (i.e., one application of tape for 20–30 min, three corticosteroid injections over 4 weeks; Lewis et al., 2005; Rabini

et al., 2012). The other 25 RCTs (reported in 27 articles) were used to inform the original recommendations developed by the OPTIMA Collaboration (based on original searches conducted in February 2014; Appendix VII; OPTIMA Collaboration, 2015).

### 3.2 | Evidence from first and second updated searches

Findings from our six systematic reviews were published in 2015 and 2016 (Abdulla et al., 2015; Cox et al., 2016; Goldgrub et al., 2016; Piper et al., 2016; Randhawa et al., 2015; Southerst et al., 2015). We updated the searches (first updated searches) of these six systematic reviews before submission for publication and identified three recent RCTs with a low risk of bias

(reported in four articles): two investigating exercise (Ketola et al., 2009, 2013; Maenhout et al., 2013) and one investigating multimodal care (Rhon et al., 2014; Appendices VIB and VIII). Two of those four articles reported outcomes of different follow-ups based on one RCT (Ketola et al., 2009, 2013). The seventh systematic review was published before the first updated searches (Yu et al., 2015).

The second updated searches of seven systematic reviews (extending from April 15, 2013 to April 26, 2019) for this guideline yielded 842 articles (after duplicates removed), of which 32 were relevant and 19 RCTs (reported in 21 articles) had a low risk of bias (Apeldoorn et al., 2017; Bjornsson Hallgren et al., 2017; Calvo-Lobo et al., 2018; Chary-Valckenaere et al., 2018; Devereaux et al., 2016; Goksu et al., 2016; Haik et al., 2017; Heron et al., 2017; Holmgren et al., 2012; Kibar et al., 2017; Kolk et al., 2013; Kromer et al., 2014; Kvalvaag et al., 2017, 2018; Li et al., 2017; Littlewood et al., 2016; Mintken et al., 2016; Nazligul et al., 2018; Perez-Merino et al., 2016; Perez-Palomares et al., 2017; van der Dolder et al., 2015) and 11 studies had a high risk of bias (Beaudreuil et al., 2015; Del Castillo-Gonzalez et al., 2016; Ketola et al., 2017; Lugo et al., 2016; Moezy et al., 2014; Osteras & Torstensen, 2010; Pan et al., 2016; Rueda et al., 2016; Seven et al., 2017; Subasi et al., 2016; Zhang et al., 2016; Appendices VIB and VIII). Four of those 21 articles reported outcomes of different follow-ups based on two RCTs conducted by Kvalvaag et al. (2017, 2018), Bjornsson Hallgren et al. (2017), and Holmgren et al. (2012). The low risk of bias studies from the second updated searches investigated the following interventions: (a) acupuncture (3 articles; Calvo-Lobo et al., 2018; Kibar et al., 2017; Perez-Palomares et al., 2017); (b) exercise (4 articles; Bjornsson Hallgren et al., 2017; Heron et al., 2017; Holmgren et al., 2012; Littlewood et al., 2016); (c) manual therapy (2 articles; Haik et al., 2017; Mintken et al., 2016); (d) multimodal care (3 articles; Chary-Valckenaere et al., 2018; Kromer et al., 2014; Littlewood et al., 2016); (e) passive physical modalities (9 articles; Apeldoorn et al., 2017; Devereaux et al., 2016; Goksu et al., 2016; Kolk et al., 2013; Kvalvaag et al., 2017, 2018; Li et al., 2017; Nazligul et al., 2018; Perez-Merino et al., 2016); and (f) soft tissue therapies (1 article; van der Dolder et al., 2015).

All 47 RCTs from the original and updated searches were used to inform the final recommendations in this guideline (Appendix VII). The identification and selection of articles in all searches is provided in a summary table and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Appendices VIB and IX).

## 4 | FINAL RECOMMENDATIONS BASED ON ORIGINAL AND UPDATED SEARCHES

Our guideline summarized 15 recommended interventions on managing recent ( $n = 10$ ; offer/consider 4 interventions, do not offer 6 interventions) and persistent ( $n = 14$ ; offer/consider 7

interventions, do not offer 7 interventions) shoulder pain, and shoulder pain with calcific tendinitis ( $n = 1$ ; offer 1 intervention) into the following three recommendations: 3, 4, and 5.

### 4.1 | Recommendation 1: Evaluation of shoulder pain

Clinicians should rule out major structural or other pathologies as the cause of shoulder pain. Once major pathology has been ruled out, clinicians should develop an evidence-based care plan in partnership with the patient. Risks and benefits of the care plan should be discussed with the patient.

Clinicians should conduct a clinical evaluation to rule out major structural or other pathologies (e.g., grade III sprain/strain injuries, adhesive capsulitis, fractures, dislocations, infections, neoplasm, inflammatory disorders) as the cause of the patient's presenting symptoms and signs. The presence of risk factors for serious pathologies (also termed 'red flags') identified during the history/examination warrants further investigation and referral to the appropriate healthcare professional who is authorized to take appropriate actions and initiate additional examinations (Table 4). Once major pathology has been ruled out, clinicians should develop an evidence-based care plan and involve the patient in care planning and decision-making (Figures 1–4; Stiggelbout et al., 2012). Risks and benefits of the care plan should be discussed with the patient. This recommendation is based on universal principles of health professions' standards of practice when evaluating shoulder pain (Hopman et al., 2013; Stiggelbout et al., 2012; Washington State Department of Labor and Industries, 2014).

### 4.2 | Recommendation 2: Management of shoulder pain

Clinicians should educate and reassure patients about the benign and self-limited nature of most soft tissue shoulder pain. Clinicians need to reassure patients if there are no major structural or progressive pathologies (e.g., grade III sprain/strain injuries, dislocations, fractures, or infections) in the shoulder. Patients with worsening of symptoms or new physical, mental, or psychological symptoms should be referred to an appropriate health care provider for further evaluation at any time during their care.

Clinicians should provide information about the nature, management, and course of shoulder pain as a framework for initiating a program of care. The patient should be educated that shoulder pain is most commonly benign and self-limited, frequently with a natural history of spontaneous recovery. If an intervention is indicated, it must be effective and time-limited. This recommendation is based on universal principles of health professions' standards of practice wherein

**TABLE 4** Risk factors of serious pathology (red flags) for shoulder pain (Saskatchewan Workers' Compensation Board, 2015; Seven et al., 2017)

**Risk factors of serious pathology identified during history or physical examination**

- Unexplained deformity or swelling or erythema of the skin
- Significant weakness not due to pain
- Past history of malignancy
- Suspected malignancy (e.g., weight loss or loss of appetite)
- Fever/chills/malaise
- Significant unexplained sensory/motor deficits in the upper extremity
- Pulmonary or vascular compromise
- Inability to perform any movements of the shoulder
- Shoulder pain at rest

patients are informed and educated about their condition, and participate in the decision-making process (Stiggelbout et al., 2012).

### 4.3 | Recommendation 3: Management of recent-onset shoulder pain ( $\leq 3$ months)

For shoulder pain  $\leq 3$  months duration, clinicians may consider low-level laser therapy (LLT); multimodal care including heat/cold, joint mobilization, and range of motion exercise; cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine; or thoracic spine manipulation (Tables 5 and 6, Figures 1 and 2). In view of evidence of no effectiveness, clinicians should not offer ultrasound; taping; interferential current therapy; diacutaneous fibrolysis; soft tissue massage; or cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm).

#### 4.3.1 | Passive physical modalities

For subacromial impingement syndrome, clinicians may offer low-LLT for short-term pain reduction (pulsed laser, 10 sessions over 2 weeks). The parameter of low-LLT is (a) peak power = 1 kW, average power = 6 W, maximum energy of single impulse = 150 mJ, duration of single impulse < 150 ms, fluency = 760 mJ/cm<sup>2</sup>, wavelength = 1,064 nm; or (b) wavelength = 890 nm, time = 2 min/point, power 2–4 J/cm<sup>2</sup> in each point. This recommendation is based on two low risk of bias RCTs suggesting low-LLT was more effective in short-term pain reduction than placebo (Abrisham et al., 2011) or continuous ultrasound (Santamato et al., 2009).

Clinicians should not offer ultrasound. This recommendation is based on evidence from three low risk of bias RCTs that found similar outcomes: (a) between ultrasound and placebo (Ainsworth et al., 2007; Van Der Heijden et al., 1999); (b) between ultrasound and phonophoresis (Perez-Merino et al., 2016); and (c) between ultrasound and iontophoresis (Perez-Merino et al., 2016).

Clinicians should not offer interferential current therapy. This recommendation is based on two low risk of bias RCTs suggesting that interferential current therapy provided similar outcomes to placebo (Nazligul et al., 2018; Van Der Heijden et al., 1999).

Clinicians should not offer taping of the shoulder. This recommendation is based on three low risk of bias RCTs suggesting (a) precut kinesiology tape did not provide added benefits to a shoulder exercise program (Devereaux et al., 2016); (b) kinesiology tape led to similar outcomes as a single steroid injection (statistically significant differences favoring injection for pain [VAS], and function [SPADI], Goksu et al., 2016); (c) rigid tape did not provide added benefits to individualized physiotherapy (Apeldoorn et al., 2017).

#### 4.3.2 | Manual therapy

##### *Cervicothoracic spine manipulation and mobilization*

For shoulder pain with associated pain or restricted movement of the cervicothoracic spine, clinicians may consider cervicothoracic spine manipulation and mobilization as an adjunct to usual care (i.e., information and advice, followed by analgesics), provided in 6 sessions over 12 weeks. The recommendation is based on one low risk of bias RCT comparing manipulation and mobilization in addition to usual care with usual care alone. The study found that participants receiving spinal manipulation and mobilization in addition to usual care were more likely to report “completely recovered” or “much improved” (Bergman et al., 2004). Spinal manipulation and mobilization in addition to usual care brings similar benefit to usual care alone in pain and health-related quality of life.

For shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm), clinicians should not offer cervicothoracic manipulation and mobilization as adjunct to exercise (i.e., range of motion exercise, stretching and strengthening exercise). This recommendation is based on one low risk of bias RCT comparing manipulation and mobilization as an adjunct to exercise with exercise alone (Mintken et al., 2016). The study suggested that cervicothoracic manipulation and mobilization did not provide added benefits to exercise.

##### *Thoracic spine manipulation*

For shoulder impingement syndrome, clinicians may consider thoracic spine manipulation (two sessions with

**TABLE 5** Treatment recommendations for shoulder pain

Recommendation	Recent-onset shoulder pain	Persistent shoulder pain	Shoulder pain with calcific tendinitis
Duration	0–3 months	>3 months	Any duration
Provide information about the nature, management, and course of shoulder pain as a framework for the initiation of the program of care	●	●	●
Supervised strengthening and stretching exercises for low-grade shoulder pain (pain intensity < 3/10 cm or 30/100 mm on Visual Analog Scale). This involves home-based strengthening and stretching of the rotator cuff and scapulohumeral muscles, supervised weekly for 5 weeks	○	●	○
Supervised combined strengthening and stretching exercises (8 repetitions of progressive shoulder flexion/extension/medial rotation/lateral rotation strengthening, 2 sets, twice a week for 8 weeks; or home-based 5 repetitions of stretching of pectoralis minor and posterior shoulder per day, 10–20 repetitions of progressive strengthening for rotator cuff and serratus anterior, 3 sets per week for 8 weeks)	○	●	○
Supervised strengthening and stretching exercise focusing on rotator cuff and scapula stabilizers. This involves supervised and home-based: (a) strengthening eccentric exercises for the rotator cuff (supraspinatus, infraspinatus, and teres minor) and concentric/eccentric exercises for the scapula stabilizers (middle and lower trapezius, rhomboideus, and serratus anterior; 15 times/set, 3 sets twice daily for the first 8 weeks and once daily for weeks 9–12); (b) a posterior shoulder stretch (30–60 s, 3 times/set, 2 sets daily for the first 8 weeks and once daily for weeks 9–12)	○	●	○
Supervised progressive shoulder strengthening exercise. This involves shoulder flexion/extension/medial rotation/ lateral rotation strengthening (2 sets, supervised twice a week for 8 weeks)	○	●	○
Supervised and home-based strengthening exercise. This involves progressive supervised exercises in seven visits and home-based exercise program ( $\geq 4$ times/week using 9 different exercises with 30–40 repetitions 3 times)	○	●	○
Home-based rotator cuff strengthening exercise. This involves home-based internal and external rotation resisted with a therapeutic band and increased load once pain decreased (once a day for 3 sets of 10 repetitions at speed of 6 s/repetition (2-s concentric phase, 2-s isometric phase and 2-s eccentric phase) over 12 weeks)	○	●	○
Home-based strengthening shoulder abduction. This involves isometric abduction and progressed to isotonic abduction through increased repetitions and load using a resistive therapeutic band or hand weight (3 sets of 10–15 repetitions, twice per day)	○	●	○
Five sessions per week over three weeks laser acupuncture with parameters: wavelength = 850 nm, power output = 100 mV, spot area = 0.07 cm <sup>2</sup> , 40 s of 4 J/cm <sup>2</sup> dosage for each acupuncture point, with a total of 11 acupuncture points (GB21, LI 4, LI 11, LI 14, LI 15, LI 16, SI 9, SI 10, SI 11, TE 14, and TE 15)	○	●	○
Six sessions over 12 weeks cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine	●	●	○
Two sessions with three to four days interval of thoracic spine manipulation	●	●	○
General physician care (information, advice, and pain contingent medical or pharmaceutical therapy)	○	●	○
Eight to ten sessions over a maximum 5–6 weeks of multimodal care that includes heat, cold, joint mobilization, and range of motion exercise	●	●	○

(Continues)

TABLE 5 (Continued)

Recommendation	Recent-onset shoulder pain	Persistent shoulder pain	Shoulder pain with calcific tendinitis
Ten sessions over 2 weeks pulsed low-level laser therapy with parameters: (a) peak power = 1 kW, average power = 6 W, maximum energy of single impulse = 150 mJ, duration of single impulse <150 ms, fluency = 760 mJ/cm <sup>2</sup> , wavelength = 1,064 nm; or (b) wavelength = 890 nm, time = 2 min/point, power 2–4 J/cm <sup>2</sup> in each point	●	●	○
A maximum of 4 sessions over 4 weeks shock-wave therapy with an amplitude ranging from 0.08 to 0.60 mJ/mm <sup>2</sup>	○	○	●

Note: ● represents recommended interventions to be considered for the specified duration/type of shoulder pain, and ○ represent that there is no recommendation for this intervention with respect to the specified duration/type of shoulder pain.

TABLE 6 Treatment interventions that should not be offered for shoulder pain

Recommendation	Recent-onset shoulder pain	Persistent shoulder pain	Shoulder pain with calcific tendinitis
Do not offer	0–3 months	>3 months	Any duration
Interferential current therapy	●	●	○
Shock-wave therapy	○	●	○
Taping of the shoulder	●	●	○
Ultrasound	●	●	○
Cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm)	●	●	○
Diacutaneous fibrolysis	●	●	○
Soft tissue massage	●	●	○

Note: ● represents interventions that should not be offered for the specified duration/type of shoulder pain, and ○ represents that there is no ‘do not offer’ recommendation for this intervention with respect to the specified duration/type of shoulder pain.

3–4 days interval). This recommendation is based on one low risk of bias RCT that thoracic spine manipulation is more effective than sham in reducing shoulder pain (Haik et al., 2017).

#### 4.3.3 | Multimodal care

For unilateral pain in shoulder region, clinicians may consider 8–10 sessions over a maximum 5–6 weeks of multimodal care that includes heat, cold, joint mobilization, and range of motion exercise. This recommendation is based on two low risk of bias RCTs examining the effectiveness of multimodal care for recent-onset shoulder pain (Ginn & Cohen, 2005; Hay et al., 2003). This body of evidence suggests that the effective multimodal programs

of care included range of motion, mobilization, heat and cold.

#### 4.3.4 | Soft tissue therapy

Clinicians should not offer diacutaneous fibrolysis. This recommendation is based on one low risk of bias RCT with three study groups that found diacutaneous fibrolysis did not provide additional benefit to a multimodal program of care and provided similar outcomes to sham diacutaneous fibrolysis (Barra Lopez et al., 2013).

Clinicians should not offer soft tissue massage. This recommendation is based on one low risk of bias RCT suggesting that soft tissue massage did not provide added benefits to a shoulder exercise program (van der Dolder et al., 2015).

## 4.4 | Recommendation 4: Management of persistent shoulder pain (>3 months)

For shoulder pain >3-month duration, clinicians may consider stretching and/or strengthening exercises; laser acupuncture; low-LLT; multimodal care (heat/cold, joint mobilization, range of motion exercise); general physician (GP) care (information, advice, and pharmacological pain management if necessary); cervicothoracic spine manipulation and mobilization for shoulder pain when associated pain or restricted movement of the cervicothoracic spine; or thoracic spine manipulation (recommendation Tables 5 and 6; Figures 1 and 2). In view of evidence of no effectiveness, clinicians should not offer shock-wave therapy; ultrasound; taping; interferential current therapy; diacutaneous fibrolysis; or soft tissue massage; or cervicothoracic spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm).

### 4.4.1 | Exercise

#### *Home-based combined strengthening and stretching exercise with supervision*

For shoulder impingement symptoms, clinicians may offer home-based combined strengthening and stretching exercises with supervision. This involves home-based stretching and strengthening exercises for 8 weeks with supervision in one to two follow-up visits, including five repetitions per day of stretching of pectoralis minor and posterior shoulder, and 10–20 repetitions of progressive strengthening (using hand-held weights and therapeutic bands) for rotator cuff and serratus anterior of 3 sets per week (Ludewig & Borstad, 2003). This recommendation is based on one low risk of bias RCT suggesting that home-based combined strengthening and stretching exercise with supervision was more effective than no treatment (Ludewig & Borstad, 2003).

For pain at the shoulder joint and/or the proximal arm that is exacerbated by active shoulder movements, clinicians may consider home-based combined strengthening and stretching exercises with weekly supervision for 5 weeks. This involves home-based strengthening and stretching of the rotator cuff and scapulohumeral muscles, with weekly supervision for 5 weeks. This recommendation is specifically for low-grade shoulder pain (pain intensity <3/10 cm or 30/100 mm on VAS). This recommendation is based on one low risk of bias RCT suggesting that home-based combined strengthening and stretching exercises with supervision provided similar short-term benefits to a single corticosteroid injection or a multimodal program of care (Ginn & Cohen, 2005).

For chronic subacromial impingement syndrome, clinicians may consider home-based specific shoulder exercises with supervision focusing on rotator cuff and scapula stabilizers (Bjornsson Hallgren et al., 2017; Holmgren et al., 2012). This involves home-based exercise with supervision in seven visits: (a) strengthening eccentric exercises for the rotator cuff (supraspinatus, infraspinatus, and teres minor) and concentric/eccentric exercises for the scapula stabilizers (middle and lower trapezius, rhomboideus, and serratus anterior; 15 times/set, 3 sets twice daily for the first 8 weeks and once daily for week 9–12); and (b) a posterior shoulder stretch (30–60 s, 3 times/set, 2 sets daily for the first 8 weeks and once daily for week 9–12). This recommendation is based on one low risk of bias RCT suggesting specific shoulder exercise was more effective than non-specific exercise in reducing night pain. Furthermore, participants in the specific exercise group were more likely to report recovery and less likely to choose surgery.

#### *Clinic-based strengthening exercise*

For shoulder impingement symptoms, clinicians may offer supervised strengthening exercise. This involves 2 sets of 8 repetitions of progressive shoulder flexion/extension/medial rotation/lateral rotation strengthening, supervised twice a week for 8 weeks (Lombardi et al., 2008). These strengthening exercises used multi-pulley muscle-building equipment (flexion, extension, medial rotation, lateral rotation). This recommendation is based on one low risk of bias RCT suggesting supervised strengthening exercise was more effective than a wait list (Lombardi et al., 2008).

#### *Home-based strengthening exercise with supervision*

For shoulder impingement syndrome, clinicians may consider home-based strengthening exercise. This involves progressive supervised exercises in seven visits and a home-based exercise program ( $\geq 4$  times/week using 9 different exercises with 30–40 repetitions 3 times; Ketola et al., 2009, 2013). These strengthening exercises used therapeutic bands and light weights; as strength improved, resistance was increased. This recommendation is based on one low risk of bias RCT suggesting home-based strengthening exercise with supervision led to similar outcomes as surgery plus post-surgical rehabilitation at 2 and 5 years (Ketola et al., 2009, 2013).

#### *Home-based strengthening exercise*

For subacromial impingement symptoms, clinicians may consider home-based rotator cuff strengthening exercise. This involves home-based internal and external rotation resisted with a therapeutic band and increased load once pain decreased (once a day for 3 sets of 10 repetitions at a speed of 6 s/repetition [2-s concentric phase, 2-s isometric

phase and 2-s eccentric phase] over 12 weeks; Maenhout et al., 2013). This recommendation is based on one low risk of bias RCT suggesting home-based heavy load eccentric loading training provided similar outcomes when added to home-based rotator cuff strengthening exercise (Maenhout et al., 2013).

For chronic rotator cuff tendinopathy with shoulder pain with or without referral into the upper limb, clinicians may consider home-based strengthening shoulder abduction. This involves isometric abduction, progressing to isotonic abduction through increased repetitions and loading using a resistive therapeutic band or hand weight (3 sets of 10–15 repetitions, twice per day; Littlewood et al., 2016). This recommendation is based on one low risk of bias study suggesting home-based progressive shoulder abduction provided similar outcomes to individualized physiotherapy (Littlewood et al., 2016).

#### 4.4.2 | Laser acupuncture (laser therapy on acupuncture points)

For subacromial impingement syndrome, clinicians may offer laser acupuncture (5 sessions per week over 3 weeks). The parameter of laser acupuncture is: wavelength = 850 nm, power output = 100 mV, spot area = 0.07 cm<sup>2</sup>, 40 s of 4 J/cm<sup>2</sup> dosage for each acupuncture point, with a total of 11 acupuncture points (Kibar et al., 2017). This recommendation is based on one low risk of bias RCT suggesting that laser acupuncture was more effective than sham for subacromial impingement syndrome (Kibar et al., 2017).

#### 4.4.3 | Passive physical modalities

For subacromial impingement syndrome, clinicians may offer low-LLT for short-term pain reduction (pulsed laser, 10 sessions over 2 weeks). The parameter of LLT is (a) peak power = 1 kW, average power = 6 W, maximum energy of single impulse = 150 mJ, duration of single impulse < 150 ms, fluency = 760 mJ/cm<sup>2</sup>, wavelength = 1,064 nm; or (b) wavelength = 890 nm, time = 2 min/point, power 2–4 J/cm<sup>2</sup> in each point. This recommendation is based on two low risk of bias RCTs suggesting LLT was more effective in short-term pain reduction than placebo (Abrisham et al., 2011) or continuous ultrasound (Santamato et al., 2009).

Clinicians should not offer shock-wave therapy for shoulder impingement syndrome. This recommendation is based on four low risk of bias RCTs suggesting that (a) shock-wave therapy provided similar outcomes to placebo (Kolk et al., 2013; Kvalvaag et al., 2017, 2018; Speed et al., 2002); and (b) shock-wave therapy provided similar outcomes to multimodal care (Engebretsen et al., 2009, 2011). Furthermore,

participants receiving multimodal care were more likely to report improvement in shoulder pain and function (measured by the Shoulder Pain and Disability Index) and returned to work earlier than participants receiving shock-wave therapy (Engebretsen et al., 2009, 2011). Although one RCT reported shock-wave therapy was more effective than placebo (Li et al., 2017), the preponderance of evidence suggests shock-wave therapy provided similar outcomes to placebo or was less effective than multimodal care.

Clinicians should not offer ultrasound. This recommendation is based on evidence from three low risk of bias RCTs that found similar outcomes: (a) between ultrasound and placebo for nonspecific shoulder pain (Ainsworth et al., 2007; Van Der Heijden et al., 1999); (b) between ultrasound and phonophoresis for subacromial impingement syndrome (Perez-Merino et al., 2016); and (c) between ultrasound and iontophoresis (Perez-Merino et al., 2016).

Clinicians should not offer interferential current therapy for persistent shoulder pain. This recommendation is based on two low risk of bias RCTs suggesting that interferential current therapy provided similar outcomes to placebo (Van Der Heijden et al., 1999; Nazligul et al., 2018).

Clinicians should not offer taping for impingement syndrome. This recommendation is based on two low risk of bias RCTs suggesting (a) precut kinesiology tape did not provide added benefits to a shoulder exercise program (Devereaux et al., 2016) and (b) rigid tape did not provide added benefits to individualized physiotherapy (Apeldoorn et al., 2017).

#### 4.4.4 | Manual therapy

##### *Cervicothoracic spine manipulation and mobilization*

For shoulder pain with associated pain or restricted movement of the cervicothoracic spine, clinicians may consider 6 sessions over 12 weeks of cervicothoracic spine manipulation and mobilization as an adjunct to usual care (i.e., information and advice, followed by analgesics). The recommendation is based on one low risk of bias RCT comparing manipulation and mobilization in addition to usual care with usual care alone (Bergman et al., 2004). The study found that participants receiving spinal manipulation and mobilization in addition to usual care were more likely to report “completely recovered” or “much improved” (Bergman et al., 2004). However, spinal manipulation and mobilization in addition to usual care showed similar benefit to usual care alone for measures of pain, and health-related quality of life.

For shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm), clinicians should not offer cervicothoracic manipulation and mobilization as an adjunct to exercise (i.e., range of motion exercise, stretching and strengthening exercise). This recommendation is based on one low risk of bias RCT comparing manipulation

and mobilization as an adjunct to exercise with exercise alone (Mintken et al., 2016). The study suggested that cervicotherapeutic manipulation and mobilization did not provide added benefits to exercise in pain and disability.

#### *Thoracic spine manipulation*

For shoulder impingement syndrome, clinicians may consider thoracic spine manipulation (two sessions with 3–4 days interval). This recommendation is based on one low risk of bias RCT that demonstrated thoracic spine manipulation is more effective than sham in reducing shoulder pain (Haik et al., 2017).

#### *Cervical mobilization*

For shoulder impingement syndrome, clinicians should not offer cervical mobilizations as adjunct to multimodal care including manual therapy, stretching, isotonic strengthening, and restoration of normative movement. This recommendation is based on one low risk of bias RCT comparing cervical mobilizations as adjunct to multimodal care with the same multimodal care without cervical mobilizations. The study suggested that cervical mobilization did not provide additional benefit to a multimodal program of care in pain and disability (Cook et al., 2014). Furthermore, similar proportion of participants in the two groups considered their state to be acceptable (i.e., unlikely to seek further treatment).

#### 4.4.5 | Multimodal care

For persistent shoulder pain, clinicians may consider usual GP care (information, advice, and pharmacological pain management if necessary). This recommendation is based on one low risk of bias RCT examining the effectiveness of GP care (Geraets et al., 2005) and one cost-effectiveness study of GP care (Geraets et al., 2006). Usual GP care (information and advice followed by analgesics if necessary, local injection of a corticosteroid if no improvement within 2 weeks) leads to similar outcomes to behavioral and graded exercise therapy but cost less than behavioral and graded exercise therapy from the societal perspective.

For persistent shoulder pain, clinicians may consider 8–10 sessions over a maximum of 5–6 weeks of multimodal care that includes heat, cold, joint mobilization, and range of motion exercises provided in 8–10 sessions over a maximum of 5–6 weeks (Ginn & Cohen, 2005; Hay et al., 2003). The multimodal program of care may only be considered if not previously provided in the first 3 months of care. However, a second course may be indicated if the patient has demonstrated ongoing and significant improvement.

Clinicians should not offer multimodal care that combines exercise, mobilization, taping, psychological interventions, and massage for persistent shoulder pain. This

recommendation is based on the body of evidence from five low risk of bias RCTs examining the effectiveness of multimodal care for persistent shoulder pain (Bennell et al., 2010; Engebretsen et al., 2009, 2011; Haahr & Andersen, 2006; Haahr et al., 2005; Kromer et al., 2014; Rhon et al., 2014). The body of evidence suggests that a multimodal program of care including exercise, mobilization, taping, psychological interventions, and massage is not effective for persistent shoulder pain.

#### 4.4.6 | Soft tissue therapy

Clinicians should not offer diacutaneous fibrolysis for subacromial impingement. This recommendation is based on one low risk of bias RCT with three study groups that found diacutaneous fibrolysis did not provide additional benefit to a multimodal program of care and provided similar outcomes to sham diacutaneous fibrolysis (Barra Lopez et al., 2013).

Clinicians should not offer soft tissue massage for non-specific shoulder pain. This recommendation is based on one low risk of bias RCT suggesting that soft tissue massage did not provide added benefits to a shoulder exercise program (van der Dolder et al., 2015).

### 4.5 | Recommendation 5: Management of shoulder pain with calcific tendinitis

For shoulder pain with calcific tendinitis, clinicians may consider shock-wave therapy (Tables 5 and 6; Figures 3 and 4).

#### 4.5.1 | Passive physical modalities – Shock-wave therapy

Clinicians may offer a maximum of 4 sessions over 4 weeks of shock-wave therapy with an amplitude ranging from 0.08–0.60 mJ/mm<sup>2</sup> for persistent shoulder calcific tendinitis. This recommendation is based on three low risk of bias RCTs: (a) shock-wave therapy was more effective than sham (Cacchio et al., 2006); (b) high-energy shock-wave therapy was more effective than low-energy shock-wave therapy (Albert et al., 2007; Gerdsmeyer et al., 2003); and (c) low energy shock-wave therapy provided similar outcomes to sham (Gerdsmeyer et al., 2003).

### 4.6 | Recommendation 6: Reevaluation and discharge

This recommendation is based on universal principles of health professions' standards of practice and should



be performed as a component of standard clinical care. Clinicians should reassess the patient at every visit to determine if (a) additional care is necessary; (b) the condition is worsening; or (c) the patient has recovered. The decision to end treatment should be made collaboratively by the patient and the clinician, on the basis of findings of satisfactory recovery. Health care professionals can use the self-rated recovery question to measure recovery: “How well do you feel you are recovering from your injuries?” (Carroll et al., 2016; Fischer et al., 1999). The response options include (a) completely better, (b) much improved, (c) slightly improved, (d) no change, (e) slightly worse, (f) much worse, (g) worse than ever. Patients reporting to be ‘completely better’ or ‘much improved’ should be considered recovered. The self-rated recovery question has been demonstrated to be a valid and reliable global measure of recovery in patients with shoulder pain (Carroll et al., 2016; Fischer et al., 1999). Patients who have not recovered should follow the care pathway outlined in the guideline (Figures 1–4).

## 5 | DISCUSSION

Our shoulder guideline provides evidence-based recommendations (i.e., recommendations 3, 4, and 5) to help clinicians deliver effective interventions for the management of soft tissue disorders of the shoulder (excluding major pathology). The recommended interventions aim to promote uniform high-quality care based on systematic reviews of the literature and synthesis of best available evidence. Implementing the evidence-based recommendations for shoulder pain will likely improve patient outcomes, reduce regional variations, and improve the efficiency of the healthcare system (Anis et al., 1995; Nichol et al., 1999; Rutten et al., 2010). Our recommendations on assessment, patient education, and re-evaluation and discharge (i.e., recommendations 1, 2, and 6) are based on universal principles of health professions' standards of practice (Hopman et al., 2013; Stiggelbout et al., 2012; Washington State Department of Labor and Industries, 2014).

Our guideline focuses on the management of soft tissue disorders of the shoulder. We included grade I to II sprains or strains, nonspecific shoulder pain, shoulder tendinitis, impingement syndromes, bursitis, partial thickness tears, shoulder osteoarthritis, and other soft tissue injuries of the shoulder. These soft tissue shoulder disorders represent most common causes of shoulder pain with similar mechanisms and clinical symptoms and signs in a primary care setting (ACOEM, 2016; Colorado Division of Workers' Compensation, 2015; Ostor et al., 2005). Coexisting etiologies were noted in 77% of patients (House & Mooradian, 2010). Impingement syndromes commonly coexist with other shoulder pathologies such as rotator

cuff partial tears and bursitis (Romeyn & Manske, 2018). Furthermore, clinical tests can elicit symptoms of other co-existing shoulder pathology (Romeyn & Manske, 2018). Therefore, our guideline targets soft tissue disorders of the shoulder as an entity.

### 5.1 | Summary of recommendations

Clinicians should rule out major structural or other pathologies as the cause of shoulder pain. In the absence of major structural or other pathologies, clinicians should develop a care plan in partnership with the patient. Risks and benefits of the care plan should be discussed with the patient. Furthermore, clinicians should discuss with the patient the range of effective interventions available for the management of shoulder pain.

Clinicians should educate and reassure patients about the benign and self-limited nature of shoulder pain as a framework for the initiation of the care plan. For recent shoulder pain ( $\leq 3$  months), clinicians should consider low-LLT or multimodal care involving an active component (i.e., heat/cold, joint mobilization, range of motion exercise) as their first choice. For persistent shoulder pain ( $> 3$  months), clinicians should consider: (a) home-based combined strengthening and stretching exercise with supervision; (b) clinical-based strengthening exercise; (c) laser acupuncture; (d) low-LLT; or (e) multimodal care involving an active component (i.e., heat/cold, joint mobilization, range of motion exercise) as their first choice. For persistent shoulder pain, home-based exercise and general physical care (information, advice, and pharmacological pain management if necessary) are alternative options to meet patients' need and treatment goals. With pain or restricted movement of the cervicothoracic spine, cervicothoracic spine manipulation and mobilization, or thoracic spine manipulation can be considered for both recent and persistent shoulder pain. For shoulder pain with calcific tendinitis, clinicians can consider shock-wave therapy.

Our guideline provides parameters on the dosage of interventions that are informed by high quality RCTs. It is important to note that all recommended interventions provide small benefits.

Our guideline identifies clinical interventions that should not be prescribed because their effectiveness is not clearly established. We found inconclusive evidence on needle acupuncture for persistent shoulder pain because the results of three low risk of bias RCTs conflicted with each other (Molsberger et al., 2010; Perez-Palomares et al., 2017; Vas et al., 2008) and one low risk of bias RCT compared acupuncture on different trigger points (Calvo-Lobo et al., 2018). Furthermore, our guideline does not recommend stand-alone structured patient education because its effectiveness has not been evaluated in high-quality

studies (Randhawa et al., 2015). Instead, patient education serves as a framework for initiating the program of care in this guideline.

## 5.2 | Applicability of the guideline

Barriers and facilitators of guideline utilization and adherence have been identified in the literature (Arksey & O'Malley, 2005; Cabana et al., 1999; Levac et al., 2010). The main barriers to guideline utilization in all healthcare practitioners managing musculoskeletal disorders include (a) disagreement between recommendations and patient expectations; (b) guidelines not specific to individual patients; (c) unfamiliarity with the term “non-specific” or with the biopsychosocial model of MSDs; (d) time-consuming; and (e) heterogeneity in guideline methods (Sorondo et al., 2021). The main facilitators include (a) clinician's interest in evidence-based practice; (b) perception from clinicians that the guideline will improve triage, diagnosis and management; (c) time efficiency; and (d) standardized language (Sorondo et al., 2021).

To enhance utilization of our guideline, we (a) recommend developing a care plan in partnership with the patient; (b) clearly defined the target conditions; (c) used a standardized language for the recommendations; (d) created Quick Reference Guides and Algorithms for the point of care; and (e) clearly described methodology and steps of developing the recommendations. Furthermore, we have developed clinicians' and patients' handouts and shoulder exercise videos (Canadian Chiropractic Guideline Initiative, 2021a, 2021b). These resources are available in English and French languages for the use of the public.

## 5.3 | Comparison to previous guidelines

Overall, our recommendations agree with those of previous clinical practice guidelines for soft tissue disorders of the shoulder (ACOEM, 2016; Colorado Division of Workers' Compensation, 2015; IICAC, 2014). Three guidelines recommended exercise and manual therapy (manipulation and mobilization; ACOEM, 2016; Colorado Division of Workers' Compensation, 2015; IICAC, 2014); and two guidelines recommended heat and cold (ACOEM, 2016; Colorado Division of Workers' Compensation, 2015). With new evidence, our guideline provides frequency, duration, dosage of exercise and differentiate first line exercise therapy (i.e., to offer home-based combined strengthening and stretching exercise with supervision or clinical-based strengthening exercise) and second line exercise therapy (i.e., to consider home-based combined strengthening and stretching exercise with supervision for low grade shoulder pain or home-based

strengthening exercise). Our guideline specifies when to apply manual therapy (i.e., for restricted movement of the cervicothoracic spine). Furthermore, we recommend heat and cold as components of multimodal care (heat/cold, joint mobilization, range of motion exercise). All these details should provide clinicians with better direction when planning treat plans.

There are a few important differences between previous guidelines and ours. Specifically, we recommend offering low-level laser as well as considering GP care and multimodal care (heat/cold, joint mobilization, range of motion exercise). We do not recommend nor refute the use of needle acupuncture. Our systematic reviews identified two low risk of bias studies which found that low-LLT is more effective than placebo or ultrasound (Abrisham et al., 2011; Santamato et al., 2009). We identified three studies suggesting that GP care leads to similar outcomes to multimodal care (behavioral treatment and graded exercise; Geraets et al., 2005); and multimodal care (heat/cold, joint mobilization and range of motion exercise) leads to similar outcomes to corticosteroid injection (Ginn & Cohen, 2005; Hay et al., 2003) or exercise (Ginn & Cohen, 2005). Furthermore, GP care is more cost-effective than multimodal care (behavioral treatment and graded exercise therapy; Geraets et al., 2006). Moreover, our recent systematic review found inconclusive evidence on the effectiveness of needle acupuncture (Molsberger et al., 2010; Perez-Palomares et al., 2017; Vas et al., 2008).

## 5.4 | Comparison between our original and final recommendations

Our updated searches (first and second updated searches from 2014 to 2019) identified 25 articles for the management of soft tissue shoulder pain. The evidence from updated searches added new recommendations to the original recommendations: (a) clinician may consider laser acupuncture (Kibar et al., 2017) and thoracic manipulation (Haik et al., 2017) and (b) do not offer soft tissue massage (van der Dolder et al., 2015) and taping (Apeldoorn et al., 2017; Devereaux et al., 2016; Goksu et al., 2016). The evidence from updated searches strengthened the original recommendations: (a) clinicians may consider stretching and/or strengthening exercise (Bjornsson Hallgren et al., 2017; Heron et al., 2017; Holmgren et al., 2012; Ketola et al., 2009, 2013; Littlewood et al., 2016; Maenhout et al., 2013) and (b) do not offer shock-wave therapy (Kolk et al., 2013; Kvalvaag et al., 2017, 2018), interferential current therapy (Nazligul et al., 2018), and ultrasound (Perez-Merino et al., 2016). Furthermore, we updated original recommendations on manipulation and mobilization to recommend “do not offer cervicothoracic

spine manipulation and mobilization as an adjunct to exercise (i.e., range of motion, strengthening and stretching exercise) for shoulder pain (defined as pain between the neck and the elbow at rest or during movement of the arm; Mintken et al., 2016).

Despite recent improvement in the quality of the literature on the management of shoulder pain, there are still important gaps. Specifically, the evidence is still inconclusive on the effectiveness of needle acupuncture (Cox et al., 2016; Perez-Palomares et al., 2017). Therefore, efforts should be dedicated to determine the effectiveness of this intervention. In addition, high-quality studies are needed to identify the most effective dosage to optimize treatment response for all interventions.

This guideline could be adapted for local use in other jurisdictions. We recommend that clinicians, insurers and policy-makers use the ADAPTE framework to adapt this guideline to their needs and environment (ADAPTE Collaboration, 2010).

## 5.5 | Strengths and limitations

This clinical practice guideline was based on comprehensive literature searches and developed from high-quality evidence. When developing clinical recommendations, the Guideline Expert Panel considered effectiveness, safety, cost-effectiveness, consistency with societal and ethical values, and patient preferences and experiences. Moreover, the Guideline Expert Panel considered the magnitude of benefit of interventions on patient outcomes using established MCIDs. Finally, the Guideline Expert Panel exercised editorial independence and disclosed any relevant conflicts of interest.

Our recommendations were limited by the amount, nature, and quality of evidence published in the literature (Abdulla et al., 2015; Cox et al., 2016; Goldgrub et al., 2016; Piper et al., 2016; Randhawa et al., 2015; Southerst et al., 2015; Yu et al., 2015). For example, inconclusive evidence on the effectiveness of needle acupuncture prevents the development of clinical recommendations (Calvo-Lobo et al., 2018; Cox et al., 2016; Molsberger et al., 2010; Perez-Palomares et al., 2017; Vas et al., 2008). Very few studies have investigated the effectiveness of stand-alone structured patient education (Randhawa et al., 2015). We limited our search to studies published in the English language to increase feasibility, which may have excluded some relevant studies. However, this is an unlikely source of bias because most large-scale RCTs are published in English (Jüni et al., 2002). Also, previous reviews showed that the restriction of systematic reviews to English language studies does not lead to bias (Moher et al., 1996, 2003; Morrison et al., 2012; Sutton et al., 2000).

## ACKNOWLEDGMENTS

The authors would like to acknowledge the invaluable contributions to this guideline from: Lynn Anderson, Poonam Cardoso, Gaelan Connell, Brenda Gamble, Willie Handler, Richard Seto, Viivi Riis, Paula Stern, Thepikaa Varatharajan, Angela Verven, and Leslie Verville.

## CONFLICT OF INTEREST

Dr. Pierre Côté has received fees as a medical-legal expert from the Canadian Chiropractic Protective Association and NCMIC. Dr. J David Cassidy has received payment for expert witness testimony from the National Hockey League (NHL) and for epidemiological advice on sports concussion from both the NHL and the National Collegiate Athletic Association. He has also received payment for expert testimony regarding court actions concerning the risk of stroke from various insurance companies in the United States. Dr. Silvano Mior has received grants from the Ontario Chiropractic Association, Canadian Chiropractic Association (paid directly to institution) and consulting/honorarium-Ontario Protocol for Traffic Injury Management Collaboration. All other individuals involved in the project declared no competing interests.

## AUTHOR CONTRIBUTIONS

All authors have made substantial contributions to all of the following: (1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be submitted. All authors discussed the results and commented on the manuscript.

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## REFERENCES

- Abdulla, S. Y., Southerst, D., Côté, P., Shearer, H. M., Sutton, D., Randhawa, K., Varatharajan, S., Wong, J. J., Yu, H., Marchand, A.-A., Chrobak, K., Woitzik, E., Shergill, Y., Ferguson, B., Stupar, M., Nordin, M., Jacobs, C., Mior, S., Carroll, L. J., ... Taylor-Vaisey, A. (2015). Is exercise effective for the management of subacromial impingement syndrome and other soft tissue injuries of the shoulder? A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Manual Therapy, 20*(5), 646–656. <https://doi.org/10.1016/j.math.2015.03.013>
- Abrisham, S. M., Kermani-Alghoraishi, M., Ghahramani, R., Jabbari, L., Jomeh, H., & Zare, M. (2011). Additive effects of low-level laser therapy with exercise on subacromial syndrome: A randomised, double-blind, controlled trial. *Clinical Rheumatology, 30*(10), 1341–1346. <https://doi.org/10.1007/s10067-011-1757-7>
- ADAPTE Collaboration. (2010). *ADAPTE framework* (version current at January 16, 2009). ADAPTE org.
- Ainsworth, R., Dziedzic, K., Hiller, L., Daniels, J., Bruton, A., & Broadfield, J. (2007). A prospective double blind placebo-controlled randomized trial of ultrasound in the physiotherapy treatment

- of shoulder pain. *Rheumatology*, 46(5), 815–820. <https://doi.org/10.1093/rheumatology/kel232>
- Albert, J. D., Meadeb, J., Guggenbuhl, P., Marin, F., Benkalfate, T., Thomazeau, H., & Chales, G. (2007). High-energy extracorporeal shock-wave therapy for calcifying tendinitis of the rotator cuff. *Bone & Joint Journal*, 89(3), 335–341.
- American College of Occupational and Environmental Medicine (ACOEM). (2016). *Shoulder disorders guideline*. Reed Group Ltd.
- Anis, A. H., Stiell, I. G., Stewart, D. G., & Laupacis, A. (1995). Cost-effectiveness analysis of the Ottawa Ankle Rules. *Annals of Emergency Medicine*, 26(4), 422–428. [https://doi.org/10.1016/S0196-0644\(95\)70108-7](https://doi.org/10.1016/S0196-0644(95)70108-7)
- Apeldoorn, A. T. K., Steven, J., Kalter, J., Knol, D. L., van Tulder, M. W., & Ostelo, R. W. (2017). Rigid shoulder taping with physiotherapy in patients with subacromial pain syndrome: A randomized controlled trial. *Journal of Rehabilitation Medicine*, 49(4), 347–353.
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. <https://doi.org/10.1080/1364557032000119616>
- Barra Lopez, M. E., Lopez de Celis, C., Fernandez Jentsch, G., Raya de Cardenas, L., Lucha Lopez, M. O., & Tricas Moreno, J. M. (2013). Effectiveness of diacutaneous fibrolysis for the treatment of subacromial impingement syndrome: A randomised controlled trial. *Manual Therapy*, 18(5), 418–424. <https://doi.org/10.1016/j.math.2013.02.006>
- Beaudreuil, J. L. S., Aout, M., Vicaut, E., Yelnik, A., Bardin, T., & Orcel, P. (2015). Effect of dynamic humeral centring (DHC) treatment on painful active elevation of the arm in subacromial impingement syndrome. Secondary analysis of data from an RCT. *BJSM Online*, 49(5), 343–346.
- Bennell, K., Wee, E., Coburn, S., Green, S., Harris, A., Staples, M., Forbes, A., & Buchbinder, R. (2010). Efficacy of standardised manual therapy and home exercise programme for chronic rotator cuff disease: Randomised placebo controlled trial. *British Medical Journal*, 340, c2756. <https://doi.org/10.1136/bmj.c2756>
- Bergman, G. J. D., Winters, J. C., Groenier, K. H., Pool, J. J. M., Jong, B.-D., Postema, K., & van der Heijden, G. J. M. G. (2004). Manipulative therapy in addition to usual medical care for patients with shoulder dysfunction and pain: A randomized, controlled trial. *Annals of Internal Medicine*, 141(6), 432–439. <https://doi.org/10.7326/0003-4819-141-6-200409210-00008>
- Bjornsson Hallgren, H. C. A., Lars, E., Johansson, K., Oberg, B., Peterson, A., & Holmgren, T. M. (2017). Specific exercises for subacromial pain. *Acta Orthopaedica*, 88(6), 600–605. <https://doi.org/10.1080/17453674.2017.1364069>
- Breckenridge, J. D., & McAuley, J. H. (2011). Shoulder Pain and Disability Index (SPADI). *Journal of Physiotherapy*, 57(3), 197. [https://doi.org/10.1016/S1836-9553\(11\)70045-5](https://doi.org/10.1016/S1836-9553(11)70045-5)
- Bron, C., de Gast, A., Dommerholt, J., Stegenga, B., Wensing, M., & Oostendorp, R. A. (2011). Treatment of myofascial trigger points in patients with chronic shoulder pain: A randomized, controlled trial. *BMC Medicine*, 9, 8. <https://doi.org/10.1186/1741-7015-9-8>
- Cabana, M. D., Rand, C. S., Powe, N. R., Wu, A. W., Wilson, M. H., Abboud, P.-A., & Rubin, H. R. (1999). Why don't physicians follow clinical practice guidelines? A Framework for Improvement. *The Journal of the American Medical Association*, 282(15), 1458–1465. <https://doi.org/10.1001/jama.282.15.1458>
- Cacchio, A., Paoloni, M., Barile, A., Don, R., de Paulis, F., Calvisi, V., Ranavolo, A., Frascarelli, M., Santilli, V., & Spacca, G. (2006). Effectiveness of radial shock-wave therapy for calcific tendinitis of the shoulder: Single-blind, randomized clinical study. *Physical Therapy*, 86(5), 672. <https://doi.org/10.1093/ptj/86.5.672>
- Calvo-Lobo, C., Pacheco-da-Costa, S., Martínez-Martínez, J., Rodríguez-Sanz, D., Cuesta-Álvaro, P., & López-López, D. (2018). Dry needling on the infraspinatus latent and active myofascial trigger points in older adults with nonspecific shoulder pain: A randomized clinical trial. *Journal of Geriatric Physical Therapy*, 41(1), 1–13. <https://doi.org/10.1519/JPT.000000000000079>
- Canadian Chiropractic Guideline Initiative. (2021a). *Exercise videos – shoulder pain – Vidéos d'exercices douleur à l'épaule*. Retrieved from <https://www.ccg-research.com/exercise-shoulder-menu>
- Canadian Chiropractic Guideline Initiative. (2021b). *Guidelines – Shoulder pain*. Retrieved from <https://www.ccg-research.com/guidelines-shoulder>
- Carroll, L. J., Lis, A., Weiser, S., & Torti, J. (2016). How well do you expect to recover, and what does recovery mean, anyway? Qualitative study of expectations after a musculoskeletal injury. *Physical Therapy*, 96(6), 797–807. <https://doi.org/10.2522/ptj.20150229>
- Chan, O., Del Buono, A., Best, T. M., & Maffulli, N. (2012). Acute muscle strain injuries: A proposed new classification system. *Knee Surgery, Sports Traumatology, Arthroscopy*, 20(11), 2356–2362. <https://doi.org/10.1007/s00167-012-2118-z>
- Chary-Valckenaere, I., Loeuille, D., Jay, N., Kohler, F., Tamisier, J.-N., Roques, C.-F., Boulange, M., & Gay, G. (2018). Spa therapy together with supervised self-mobilisation improves pain, function and quality of life in patients with chronic shoulder pain: A single-blind randomised controlled trial. *International Journal of Biometeorology*, 62(6), 1003–1014. <https://doi.org/10.1007/s00484-018-1502-x>
- Colorado Division of Workers' Compensation. (2015). *Shoulder injury medical treatment guidelines*. Colorado Division of Workers' Compensation.
- Cook, C., Learman, K., Houghton, S., Showalter, C., & O'Halloran, B. (2014). The addition of cervical unilateral posterior–anterior mobilisation in the treatment of patients with shoulder impingement syndrome: A randomised clinical trial. *Manual Therapy*, 19(1), 18–24.
- Cox, J., Varatharajan, S., Cote, P., & Optima, C. (2016). Effectiveness of acupuncture therapies to manage musculoskeletal disorders of the extremities: a systematic review. *The Journal of Orthopaedic and Sports Physical Therapy*, 46(6), 409–429. <https://doi.org/10.2519/jospt.2016.6270>
- Del Castillo-Gonzalez, F.-R.-A., Juan, J., Rodriguez-Fabian, G., Gonzalez-Perez, J., Jimenez-Herranz, E., & Varela, E. (2016). Extracorporeal shockwaves versus ultrasound-guided percutaneous lavage for the treatment of rotator cuff calcific tendinopathy: A randomized controlled trial. *European Journal of Physical and Rehabilitation Medicine*, 52(2), 145–151.
- Devereaux, M., Velanoski, K. Q., Pennings, A., & Elmaraghy, A. (2016). Short-term effectiveness of precut kinesiology tape versus an NSAID as adjuvant treatment to exercise for subacromial impingement: A randomized controlled trial. *Clinical Journal of Sport Medicine*, 26(1), 24–32. <https://doi.org/10.1097/JSM.0000000000000187>
- Engelbreetsen, K., Grotle, M., Bautz-Holter, E., Ekeberg, O. M., Juel, N. G., & Brox, J. I. (2011). Supervised exercises compared with radial extracorporeal shock-wave therapy for subacromial shoulder pain: 1-year results of a single-blind randomized controlled trial. *Physical Therapy*, 91(1), 37–47. <https://doi.org/10.2522/ptj.20090338>
- Engelbreetsen, K., Grotle, M., Bautz-Holter, E., Sandvik, L., Juel, N. G., Ekeberg, O. M., & Brox, J. I. (2009). Radial extracorporeal

- shockwave treatment compared with supervised exercises in patients with subacromial pain syndrome: Single blind randomised study. *British Medical Journal*, 339, b3360.
- Fischer, D., Stewart, A. L., Bloch, D. A., Lorig, K., Laurent, D., & Holman, H. (1999). Capturing the patient's view of change as a clinical outcome measure. *The Journal of the American Medical Association*, 282(12), 1157–1162.
- Geraets, J. J. X. R., Goossens, M. E. J. B., de Bruijn, C. P. C., de Groot, I. J. M., Köke, A. J. S., Pelt, R. A. G. B., van der Heijden, G., Dinant, G.-J., & van den Heuvel, W. J. A. (2006). Cost-effectiveness of a graded exercise therapy program for patients with chronic shoulder complaints. *International Journal of Technology Assessment in Health Care*, 22(1), 76–83. <https://doi.org/10.1017/S0266462306050860>
- Geraets, J. J. X. R., Goossens, M. E. J. B., de Groot, I. J. M., de Bruijn, C. P. C., de Bie, R. A., Dinant, G.-J., van der Heijden, G., & van den Heuvel, W. J. A. (2005). Effectiveness of a graded exercise therapy program for patients with chronic shoulder complaints. *The Australian Journal of Physiotherapy*, 51(2), 87–94. [https://doi.org/10.1016/S0004-9514\(05\)70037-4](https://doi.org/10.1016/S0004-9514(05)70037-4)
- Gerdesmeyer, L., Wagenpfeil, S., Haake, M., Maier, M., Loew, M., Wörtler, K., Lampe, R., Seil, R., Handle, G., Gassel, S., & Rompe, J. D. (2003). Extracorporeal shock wave therapy for the treatment of chronic calcifying tendonitis of the rotator cuff: A randomized controlled trial. *The Journal of the American Medical Association*, 290(19), 2573–2580. <https://doi.org/10.1001/jama.290.19.2573>
- Ginn, K. A., & Cohen, M. L. (2005). Exercise therapy for shoulder pain aimed at restoring neuromuscular control: A randomized comparative clinical trial. *Journal of Rehabilitation Medicine*, 37(2), 115–122.
- Göksu, H., Tuncay, F., & Borman, P. (2016). The comparative efficacy of kinesio taping and local injection therapy in patients with subacromial impingement syndrome. *Acta Orthopaedica et Traumatologica Turcica*, 50(5), 483–488. <https://doi.org/10.1016/j.aott.2016.08.015>
- Goldgrub, R., Côté, P., Sutton, D., Wong, J. J., Yu, H., Randhawa, K., Varatharajan, S., Southerst, D., Mior, S., Shearer, H. M., Jacobs, C., Stupar, M., Chung, C. L., Abdulla, S., Balogh, R., Dogra, S., Nordin, M., & Taylor-Vaisey, A. (2016). The effectiveness of multimodal care for the management of soft tissue injuries of the shoulder: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Journal of Manipulative and Physiological Therapeutics*, 39(2), 121–39.e1. <https://doi.org/10.1016/j.jmpt.2016.01.002>
- Guerra de Hoyos, J. A., Martín, M. D. C. A., Leon, E. B. Y. B. D., Lopez, M. V., López, T. M., Morilla, F. A. V., & Moreno, M. J. G. (2004). Randomised trial of long term effect of acupuncture for shoulder pain. *Pain*, 112(3), 289–298. <https://doi.org/10.1016/j.pain.2004.08.030>
- Haahr, J. P., & Andersen, J. H. (2006). Exercises may be as efficient as subacromial decompression in patients with subacromial stage II impingement: 4-8-years' follow-up in a prospective, randomized study. *Scandinavian Journal of Rheumatology*, 35(3), 224–228. <https://doi.org/10.1080/03009740600556167>
- Haahr, J. P., Ostergaard, S., Dalsgaard, J., Norup, K., Frost, P., Lausen, S., Holm, E. A., & Andersen, J. H. (2005). Exercises versus arthroscopic decompression in patients with subacromial impingement: A randomised, controlled study in 90 cases with a one year follow up. *Annals of the Rheumatic Diseases*, 64(5), 760–764.
- Haik, M. N., Alburquerque-Sendín, F., & Camargo, P. R. (2017). Short-term effects of thoracic spine manipulation on shoulder impingement syndrome: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 98(8), 1594–1605.
- Harbour, R., & Miller, J. (2001). A new system for grading recommendations in evidence based guidelines. *British Medical Journal*, 323(7308), 334–336.
- Hay, E. M., Thomas, E., Paterson, S. M., Dziedzic, K., & Croft, P. R. (2003). A pragmatic randomised controlled trial of local corticosteroid injection and physiotherapy for the treatment of new episodes of unilateral shoulder pain in primary care. *Annals of the Rheumatic Diseases*, 62(5), 394–399. <https://doi.org/10.1136/ard.62.5.394>
- Heron, S. R. W., Steve, R., & Thompson, D. P. (2017). Comparison of three types of exercise in the treatment of rotator cuff tendinopathy/shoulder impingement syndrome: A randomized controlled trial. *Physiotherapy*, 103(2), 167–173. <https://doi.org/10.1016/j.physio.2016.09.001>
- Holmgren, T., Björnsson Hallgren, H., Oberg, B., Adolfsson, L., & Johansson, K. (2012). Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: Randomised controlled study. *British Medical Journal*, 344, e787.
- Hopman, K., Krahe, L., Lukersmith, S., McColl, A., & Vine, K. (2013). *Clinical practice guidelines for the management of rotator cuff syndrome in the workplace*. University of New South Wales.
- House, J., & Mooradian, A. (2010). Evaluation and management of shoulder pain in primary care clinics. *Southern Medical Journal*, 103(11), 1129–35; quiz 36–7.
- Industrial Insurance Chiropractic Advisory Committee (IICAC). (2014). *Conservative care options for work-related mechanical shoulder conditions*. Retrieved from <http://www.lni.wa.gov/ClaimsIns/Providers/ProjResearchComm/IICAC/Resources.asp>
- Johansson, K., Bergström, A., Schröder, K., & Foldevi, M. (2011). Subacromial corticosteroid injection or acupuncture with home exercises when treating patients with subacromial impingement in primary care – A randomized clinical trial. *Family Practice*, 28(4), 355–365.
- Johnson, A. P., Sikich, N. J., Evans, G., Evans, W., Giacomini, M., Glendinning, M., Krahn, M., Levin, L., Oh, P., & Perera, C. (2009). Health technology assessment: A comprehensive framework for evidence-based recommendations in Ontario. *International Journal of Technology Assessment in Health Care*, 25(2), 141–150.
- Jüni, P., Holenstein, F., Sterne, J., Bartlett, C., & Egger, M. (2002). Direction and impact of language bias in meta-analyses of controlled trials: Empirical study. *International Journal of Epidemiology*, 31(1), 115–123.
- Ketola, S., Lehtinen, J. T., & Arnala, I. (2017). Arthroscopic decompression not recommended in the treatment of rotator cuff tendinopathy: A final review of a randomised controlled trial at a minimum follow-up of ten years. *The Bone & Joint Journal*, 99(6), 799–805.
- Ketola, S., Lehtinen, J., Arnala, I., Nissinen, M., Westenius, H., Sintonen, H., Aronen, P., Kontinen, Y. T., Malmivaara, A., & Rousi, T. (2009). Does arthroscopic acromioplasty provide any additional value in the treatment of shoulder impingement syndrome?: A two-year randomised controlled trial. *The Journal of Bone and Joint Surgery British*, 91(10), 1326–1334.
- Ketola, S., Lehtinen, J., Rousi, T., Nissinen, M., Huhtala, H., Kontinen, Y. T., & Arnala, I. (2013). No evidence of long-term benefits of arthroscopic acromioplasty in the treatment of shoulder impingement syndrome: Five-year results of a randomised controlled trial. *Bone & Joint Research*, 2(7), 132–139.
- Kibar, S., Konak, H. E., Evcik, D., & Ay, S. (2017). Laser acupuncture treatment improves pain and functional status in patients with

- subacromial impingement syndrome: A randomized, double-blind, sham-controlled study. *Pain Medicine*, 18(5), 980–987.
- Kolk, A., Auw Yang, K. G., Tammenga, R., & van der Hoeven, H. (2013). Radial extracorporeal shock-wave therapy in patients with chronic rotator cuff tendinitis: A prospective randomised double-blind placebo-controlled multicentre trial. *Bone & Joint Journal*, 95(11), 1521–1526. <https://doi.org/10.1302/0301-620X.95B11.31879>
- Kromer, T., Bie, R., & Bastiaenen, C. (2014). Effectiveness of physiotherapy and costs in patients with clinical signs of shoulder impingement syndrome: One-year follow-up of a randomized controlled trial. *Journal of Rehabilitation Medicine*, 46(10), 1029–1036. <https://doi.org/10.2340/16501977-1867>
- Kung, J., Miller, R. R., & Mackowiak, P. A. (2012). Failure of clinical practice guidelines to meet institute of medicine standards: Two more decades of little, if any, progress. *Archives of Internal Medicine*, 172(21), 1628–1633. <https://doi.org/10.1001/2013.jamainternmed.56>
- Kvalvaag, E., Brox, J. I., Engebretsen, K. B., Soberg, H. L., Juel, N. G., Bautz-Holter, E., Sandvik, L., & Roe, C. (2017). Effectiveness of radial extracorporeal shock wave therapy (rESWT) when combined with supervised exercises in patients with subacromial shoulder pain: A double-masked, randomized, sham-controlled trial. *The American Journal of Sports Medicine*, 45(11), 2547–2554. <https://doi.org/10.1177/0363546517707505>
- Kvalvaag, E. R. C., Engebretsen, K. B., Soberg, H. L., Juel, N. G., Bautz-Holter, E., Sandvik, L., & Brox, J. I. (2018). One year results of a randomized controlled trial on radial extracorporeal shock wave treatment, with predictors of pain, disability and return to work in patients with subacromial pain syndrome. *European Journal of Physical and Rehabilitation Medicine*, 54(3), 341–350.
- Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, 5, 69. <https://doi.org/10.1186/1748-5908-5-69>
- Lewis, J. S., Wright, C., & Green, A. (2005). Subacromial impingement syndrome: The effect of changing posture on shoulder range of movement. *The Journal of Orthopaedic and Sports Physical Therapy*, 35(2), 72–87. <https://doi.org/10.2519/jospt.2005.35.2.72>
- Li, W., Zhang, S.-X., Yang, Q. I., Li, B.-L., Meng, Q.-G., & Guo, Z.-G. (2017). Effect of extracorporeal shock-wave therapy for treating patients with chronic rotator cuff tendonitis. *Medicine*, 96(35), e7940. <https://doi.org/10.1097/MD.0000000000007940>
- Lindsay, G., Mior, S., Côté, P., Carroll, L., & Shearer, H. M. (2016). Patients' experiences with vehicle collision to inform the development of clinical practice guidelines: A narrative inquiry. *Journal of Manipulative and Physiological Therapeutics*, 39(3), 218–228.
- Littlewood, C., Bateman, M., Brown, K., Bury, J., Mawson, S., May, S., & Walters, S. J. (2016). A self-managed single exercise programme versus usual physiotherapy treatment for rotator cuff tendonopathy: A randomised controlled trial (the SELF study). *Clinical Rehabilitation*, 30(7), 686–696.
- Lombardi, I., Jr, Magri, A. G., Fleury, A. M., Da Silva, A. C., & Natour, J. (2008). Progressive resistance training in patients with shoulder impingement syndrome: A randomized controlled trial. *Arthritis and Rheumatism*, 59(5), 615–622.
- Ludewig, P. M., & Borstad, J. D. (2003). Effects of a home exercise programme on shoulder pain and functional status in construction workers. *Occupational and Environmental Medicine*, 60(11), 841–849.
- Lugo, L. H., García, H. I., Rogers, H. L., & Plata, J. A. (2016). Treatment of myofascial pain syndrome with lidocaine injection and physical therapy, alone or in combination: A single blind, randomized, controlled clinical trial. *BMC Musculoskeletal Disorders*, 17, 101.
- Maenhout, A. G., Mahieu, N. N., De Muynck, M., De Wilde, L. F., & Cools, A. M. (2013). Does adding heavy load eccentric training to rehabilitation of patients with unilateral subacromial impingement result in better outcome? A randomized, clinical trial. *Knee Surgery, Sports Traumatology, Arthroscopy*, 21(5), 1158–1167.
- Marks, D., Comans, T., Bisset, L., & Scuffham, P. (2016). The economic burden of shoulder pain awaiting public orthopaedic care. *Manual Therapy*, 25, e43. <https://doi.org/10.1016/j.math.2016.05.048>
- Mintken, P. E. M., Amy, W., Cleland, J. A., Boyles, R. E., Beardslee, A. R., Burns, S. A., Haberl, M. D., Hinrichs, L. A., & Michener, L. A. (2016). Cervicothoracic manual therapy plus exercise therapy versus exercise therapy alone in the management of individuals with shoulder pain: A multicenter randomized controlled trial. *The Journal of Orthopaedic and Sports Physical Therapy*, 46(8), 617–628. <https://doi.org/10.2519/jospt.2016.6319>
- Mintken, P. E., Glynn, P., & Cleland, J. A. (2009). Psychometric properties of the shortened disabilities of the Arm, Shoulder, and Hand Questionnaire (QuickDASH) and Numeric Pain Rating Scale in patients with shoulder pain. *Journal of Shoulder and Elbow Surgery*, 18(6), 920–926. <https://doi.org/10.1016/j.jse.2008.12.015>
- Moezy, A., Sepehrifar, S., & Dodaran, M. S. (2014). The effects of scapular stabilization based exercise therapy on pain, posture, flexibility and shoulder mobility in patients with shoulder impingement syndrome: A controlled randomized clinical trial. *Medical Journal of the Islamic Republic of Iran*, 28, 87.
- Moher, D., Fortin, P., Jadad, A. R., Jüni, P., Klassen, T., Le Lorier, J., Liberati, A., Penna, A., & Linde, K. (1996). Completeness of reporting of trials published in languages other than English: Implications for conduct and reporting of systematic reviews. *The Lancet*, 347(8998), 363–366.
- Moher, D., Pham, B., Lawson, M. L., & Klassen, T. P. (2003). The inclusion of reports of randomised trials published in languages other than English in systematic reviews. *Health Technology Assessment*, 7(41), 1–90.
- Molsberger, A. F., Schneider, T., Gotthardt, H., & Drabik, A. (2010). German Randomized Acupuncture Trial for chronic shoulder pain (GRASP)—a pragmatic, controlled, patient-blinded, multi-centre trial in an outpatient care environment. *Pain*, 151(1), 146–154.
- Morrison, A., Polisen, J., Husereau, D., Moulton, K., Clark, M., Fiander, M., Mierzwinski-Urban, M., Clifford, T., Hutton, B., & Rabb, D. (2012). The effect of English-language restriction on systematic review-based meta-analyses: A systematic review of empirical studies. *International Journal of Technology Assessment in Health Care*, 28(2), 138–144.
- Moser, J. S., Barker, K. L., Doll, H. A., & Carr, A. J. (2008). Comparison of two patient-based outcome measures for shoulder instability after nonoperative treatment. *Journal of Shoulder and Elbow Surgery*, 17(6), 886–892.
- National Center for Health Statistics. (2011). *Health, United States, 2010: With special feature on death and dying*. National Center for Health Statistics.
- Nazligil, T. A. P., Aktas, I., Unlu Ozkan, F., & Cagliyan Hartevioglu, H. (2018). The effect of interferential current therapy on patients with subacromial impingement syndrome: A randomized, double-blind, sham-controlled study. *European Journal of Physical and Rehabilitation Medicine*, 54(3), 351–357.
- Nichol, G., Stiell, I. G., Wells, G. A., Juergensen, L. S., & Laupacis, A. (1999). An economic analysis of the Ottawa knee rule. *Annals of*

- Emergency Medicine*, 34(4 Pt. 1), 438–447. [https://doi.org/10.1016/S0196-0644\(99\)80044-4](https://doi.org/10.1016/S0196-0644(99)80044-4)
- Noonan, T. J., & Garrett Jr., W. E. (1999). Muscle strain injury: Diagnosis and treatment. *Journal of the American Academy of Orthopaedic Surgeons*, 7(4), 262–269. <https://doi.org/10.5435/00124635-199907000-00006>
- Ontario Protocol for Traffic Injury Management Collaboration (OPTIMa Collaboration). (2015). *Enabling recovery from common traffic injuries: A focus on the injured person*. UOIT-CMCC Centre for Disability Prevention and Rehabilitation. Retrieved from <https://www.fscso.gov.on.ca/en/auto/Documents/2015-cti.pdf>
- Osteras, H., & Torstensen, T. A. (2010). The dose-response effect of medical exercise therapy on impairment in patients with unilateral longstanding subacromial pain. *The Open Orthopaedics Journal*, 4, 1–6. <https://doi.org/10.2174/1874325001004010001>
- Ostor, A. J., Richards, C. A., Prevost, A. T., Speed, C. A., & Hazleman, B. L. (2005). Diagnosis and relation to general health of shoulder disorders presenting to primary care. *Rheumatology*, 44(6), 800–805. <https://doi.org/10.1093/rheumatology/keh598>
- Pan, R.-Y., Hsu, Y.-C., Wong, C.-S., Lin, S.-L., Li, T.-Y., Cherg, C.-H., Ko, S.-C., & Yeh, C.-C. (2016). Comparing complementary alternative treatment for chronic shoulder pain of myofascial origin: Collateral meridian therapy versus local tender area-related meridians therapy. *Medicine*, 95(35), e4634. <https://doi.org/10.1097/MD.0000000000004634>
- Paterson, C. (1996). Measuring outcomes in primary care: A patient generated measure, MYMOP, compared with the SF-36 health survey. *British Medical Journal*, 312(7037), 1016–1020. <https://doi.org/10.1136/bmj.312.7037.1016>
- Pérez-Merino, L., Casajuana, M. C., Bernal, G., Faba, J., Astilleros, A. E., González, R., Giralt, M., Romeu, M., & Nogués, M. R. (2016). Evaluation of the effectiveness of three physiotherapeutic treatments for subacromial impingement syndrome: A randomised clinical trial. *Physiotherapy*, 102(1), 57–63. <https://doi.org/10.1016/j.physio.2015.01.010>
- Pérez-Palomares, S., Oliván-Blázquez, B., Pérez-Palomares, A., Gaspar-Calvo, E., Pérez-Benito, M., López-Lapeña, E., de la Torre-Beldarrain, M. L., & Magallón-Botaya, R. (2017). Contribution of dry needling to individualized physical therapy treatment of shoulder pain: A randomized clinical trial. *The Journal of Orthopaedic and Sports Physical Therapy*, 47(1), 11–20. <https://doi.org/10.2519/jospt.2017.6698>
- Piper, S., Shearer, H. M., Côté, P., Wong, J. J., Yu, H., Varatharajan, S., Southerst, D., Randhawa, K. A., Sutton, D. A., Stupar, M., & Nordin, M. C. (2016). The effectiveness of soft-tissue therapy for the management of musculoskeletal disorders and injuries of the upper and lower extremities: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) collaboration. *Manual Therapy*, 21, 18–34.
- Qaseem, A., Forland, F., Macbeth, F., Ollenschläger, G., Phillips, S., & van der Wees, P. (2012). Guidelines International Network: Toward international standards for clinical practice guidelines. *Annals of Internal Medicine*, 156(7), 525–531.
- Rabini, A., Piazzini, D. B., Bertolini, C., Deriu, L., Saccomanno, M. F., Santagada, D. A., Sgadari, A., Bernabei, R., Fabbriani, C., Marzetti, E., & Milano, G. (2012). Effects of local microwave diathermy on shoulder pain and function in patients with rotator cuff tendinopathy in comparison to subacromial corticosteroid injections: A single-blind randomized trial. *The Journal of Orthopaedic and Sports Physical Therapy*, 42(4), 363–370.
- Randhawa, K., Côté, P., Gross, D. P., Wong, J. J., Yu, H., Sutton, D., Southerst, D., Varatharajan, S., Mior, S., Stupar, M., & Shearer, H. M. (2015). The effectiveness of structured patient education for the management of musculoskeletal disorders and injuries of the extremities: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *The Journal of the Canadian Chiropractic Association*, 59(4), 349–362.
- Rhon, D. I., Boyles, R. B., & Cleland, J. A. (2014). One-year outcome of subacromial corticosteroid injection compared with manual physical therapy for the management of the unilateral shoulder impingement syndrome: A pragmatic randomized trial. *Annals of Internal Medicine*, 161(3), 161–169.
- Romeyn, R., & Manske, R. C. (2018). 21 – Importance of the history in the diagnosis of shoulder pathology. In C. E. Giangarra & R. C. Manske (Eds.), *Clinical orthopaedic rehabilitation: A team approach* (4th ed., pp. 100–109). Elsevier.
- Roy, J. S., MacDermid, J. C., & Woodhouse, L. J. (2009). Measuring shoulder function: A systematic review of four questionnaires. *Arthritis and Rheumatism*, 61(5), 623–632. <https://doi.org/10.1002/art.24396>
- Rueda Garrido, J. C., Vas, J., & Lopez, D. R. (2016). Acupuncture treatment of shoulder impingement syndrome: A randomized controlled trial. *Complementary Therapies in Medicine*, 25, 92–97. <https://doi.org/10.1016/j.ctim.2016.01.003>
- Rutten, G. M., Degen, S., Hendriks, E. J., Braspenning, J. C., Harting, J., & Oostendorp, R. A. (2010). Adherence to clinical practice guidelines for low back pain in physical therapy: Do patients benefit? *Physical Therapy*, 90(8), 1111. <https://doi.org/10.2522/ptj.20090173>
- Santamato, A., Solfrizzi, V., Panza, F., Tondi, G., Frisardi, V., Leggin, B. G., Ranieri, M., & Fiore, P. (2009). Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of people with subacromial impingement syndrome: A randomized clinical trial. *Physical Therapy*, 89(7), 643–652. <https://doi.org/10.2522/ptj.20080139>
- Saskatchewan Workers' Compensation Board. (2015). *WCB annual report 2015*. Retrieved from [https://www.wcbask.com/wp-content/uploads/2016/04/Annual-Report-2015\\_FINAL-web.pdf](https://www.wcbask.com/wp-content/uploads/2016/04/Annual-Report-2015_FINAL-web.pdf)
- Seven, M. M., Ersen, O., Akpancar, S., Ozkan, H., Turkkkan, S., Yıldız, Y., & Koca, K. (2017). Effectiveness of prolotherapy in the treatment of chronic rotator cuff lesions. *Orthopaedics & Traumatology, Surgery & Research*, 103(3), 427–433. <https://doi.org/10.1016/j.otsr.2017.01.003>
- Slavin, R. E. (1995). Best evidence synthesis: An intelligent alternative to meta-analysis. *Journal of Clinical Epidemiology*, 48(1), 9–18. [https://doi.org/10.1016/0895-4356\(94\)00097-A](https://doi.org/10.1016/0895-4356(94)00097-A)
- Sorondo, D., Delpierre, C., Côté, P., Salmi, L.-R., Cedraschi, C., Taylor-Vaisey, A., & Lemeunier, N. (2021). Determinants of clinical practice guidelines' utilization for the management of musculoskeletal disorders: A scoping review. *Implementation Science*. <https://doi.org/10.21203/rs.3.rs-119647/v1>
- Southerst, D., Yu, H., Randhawa, K., Côté, P., D'Angelo, K., Shearer, H. M., Wong, J. J., Sutton, D., Varatharajan, S., Goldgrub, R., Dion, S., Cox, J., Menta, R., Brown, C. K., Stern, P. J., Stupar, M., Carroll, L. J., & Taylor-Vaisey, A. (2015). The effectiveness of manual therapy for the management of musculoskeletal disorders of the upper and lower extremities: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Chiropractic & Manual Therapies*, 23, 30. <https://doi.org/10.1186/s12998-015-0075-6>
- Speed, C., Richards, C., Nichols, D., Burnet, S., Wies, J., Humphreys, H., & Hazleman, B. L. (2002). Extracorporeal shock-wave therapy

- for tendonitis of the rotator cuff. *Bone & Joint Journal*, 84(4), 509–512.
- Stiggelbout, A. M., Van der Weijden, T., De Wit, M. P., Frosch, D., Legare, F., Montori, V. M., Trevena, L., & Elwyn, G. (2012). Shared decision making: Really putting patients at the centre of healthcare. *British Medical Journal*, 344, e256.
- Subasi, V. C., Çakır, T., Arıca, Z., Sarier, R. N., Filiz, M. B., Doğan, Ş. K., & Toraman, N. F. (2016). Comparison of efficacy of kinesiological taping and subacromial injection therapy in subacromial impingement syndrome. *Clinical Rheumatology*, 35(3), 741–746.
- Sutton, A. J., Duval, S. J., Tweedie, R. L., Abrams, K. R., & Jones, D. R. (2000). Empirical assessment of effect of publication bias on meta-analyses. *British Medical Journal*, 320(7249), 1574–1577.
- Szczurko, O., Cooley, K., Mills, E. J., Zhou, Q., Perri, D., & Seely, D. (2009). Naturopathic treatment of rotator cuff tendinitis among Canadian postal workers: A randomized controlled trial. *Arthritis and Rheumatism*, 61(8), 1037–1045.
- Tashjian, R. Z., Deloach, J., Porucznik, C. A., & Powell, A. P. (2009). Minimal clinically important differences (MCID) and patient acceptable symptomatic state (PASS) for Visual Analog Scales (VAS) measuring pain in patients treated for rotator cuff disease. *Journal of Shoulder and Elbow Surgery*, 18(6), 927–932.
- US Department of Labor. (2015). *Nonfatal occupational injuries and illnesses requiring days away from work*. Retrieved from <https://www.bls.gov/news.release/osh2.t04.htm>
- van den Dolder, P. A. Ferreira, P. H., & Refshauge, K. M. (2015). Effectiveness of soft tissue massage for nonspecific shoulder pain: Randomized controlled trial. *Physical Therapy*, 95(11), 1467–1477. <https://doi.org/10.2522/ptj.20140350>
- Van Der Heijden, G. J. M. G., Leffers, P., Wolters, P. J. M. C., Verheijden, J. J. D., van Mameren, H., Houben, J. P., Bouter, L. M., & Knipschild, P. G. (1999). No effect of bipolar interferential electrotherapy and pulsed ultrasound for soft tissue shoulder disorders: A randomised controlled trial. *Annals of the Rheumatic Diseases*, 58(9), 530–540. <https://doi.org/10.1136/ard.58.9.530>
- Vargas-Schaffer, G. (2010). Is the WHO analgesic ladder still valid? Twenty-four years of experience. *Canadian Family Physician Medecin De Famille Canadien*, 56(6), 514–517; e202–e205.
- Vas, J., Ortega, C., Olmo, V., Perez-Fernandez, F., Hernandez, L., Medina, I., Seminario, J. M., Herrera, A., Luna, F., Perea-Milla, E., Mendez, C., Madrazo, F., Jimenez, C., Ruiz, M. A., & Aguilar, I. (2008). Single-point acupuncture and physiotherapy for the treatment of painful shoulder: A multicentre randomized controlled trial. *Rheumatology*, 47(6), 887–893. <https://doi.org/10.1093/rheumatology/ken040>
- Vos, T., Allen, C., Arora, M., Barber, R. M., Bhutta, Z. A., Brown, A., Carter, A., Casey, D. C., Charlson, F. J., Chen, A. Z., Coggeshall, M., Cornaby, L., Dandona, L., Dicker, D. J., Dilegge, T., Erskine, H. E., Ferrari, A. J., Fitzmaurice, C., Fleming, T., ... Murray, C. J. L. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*, 388(10053), 1545–1602. [https://doi.org/10.1016/S0140-6736\(16\)31678-6](https://doi.org/10.1016/S0140-6736(16)31678-6)
- Washington State Department of Labor and Industries. (2014). *Conservative care options for work-related mechanical shoulder conditions*. Washington State Department of Labor and Industries. Retrieved from <https://www.guidelinecentral.com/summaries/conservative-care-options-for-work-related-mechanical-shoulder-conditions/>
- Woodward, T. W., & Best, T. M. (2000). The painful shoulder: Part II. Acute and chronic disorders. *American Family Physician*, 61(11), 3291–3300.
- Yu, H., Côté, P., Shearer, H. M., Wong, J. J., Sutton, D. A., Randhawa, K. A., Varatharajan, S., Southerst, D., Mior, S. A., Ameis, A., & Stupar, M. (2015). Effectiveness of passive physical modalities for shoulder pain: Systematic review by the Ontario protocol for traffic injury management collaboration. *Physical Therapy*, 95(3), 306–318.
- Zhang, H., Sun, J., Wang, C., Yu, C., Wang, W., Zhang, M., Lao, L., Yi, M., & Wan, Y. (2016). Randomised controlled trial of contralateral manual acupuncture for the relief of chronic shoulder pain. *Acupuncture in Medicine*, 34(3), 164–170. <https://doi.org/10.1136/acupmed-2015-010947>

## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

**How to cite this article:** Yu H, Côté P, Wong JJ, et al. Noninvasive management of soft tissue disorders of the shoulder: A clinical practice guideline from the Ontario Protocol for Traffic Injury Management (OPTiMa) collaboration. *Eur J Pain*. 2021;00:1–24. <https://doi.org/10.1002/ejp.1788>