CLINICAL PRACTICE GUIDELINES

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Neck Pain: Revision 2016
Clinical Practice Guidelines
Linked to the International Classification
of Functioning, Disability, and Health
from the Orthopaedic Section of the
American Physical Therapy Association


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SUMMARY OF RECOMMENDATIONS*

EXAMINATION – OUTCOME MEASURE

A
Clinicians should use validated self-report questionnaires, such as the Neck Disability Index, for patients with neck pain, for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring a change in patient’s status throughout the course of treatment.

EXAMINATION—ACTIVITY LIMITATIONS AND PARTICIPATION MEASURES

F
Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient’s neck pain to assess the changes in the patient’s level of function over the episode of care.

EXAMINATION—PHYSICAL IMPAIRMENT MEASURES

B
When evaluating a patient with neck pain over an episode of care, assessment of impairment of body function should include measures that can assist in classification 1) neck pain with mobility deficits, such cervical active range of motion, cervical and thoracic segmental mobility tests, 2) neck pain with headache, such as the flexion rotation test, and 3) neck pain with radiating pain/cervical radiculopathy, such as the upper limb tension test, Spurling's test, distraction test, and the Valsalva test. Cranial cervical flexion and neck flexor muscle endurance tests may be useful in assessing movement coordination impairments, and algometric assessment of pressure pain threshold may be useful in staging chronicity of neck pain.

DIAGNOSIS/CLASSIFICATION

C
In the absence of symptoms or signs of serious medical or psychological conditions, neck pain associated with (1) motion limitations in the cervical and upper thoracic regions, (2) headaches, and (3) referred or radiating pain into an upper extremity are useful clinical findings for classifying a patient with neck pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: cervicalgia, pain in thoracic spine, headaches, cervicocranial syndrome, sprain and strain of cervical spine, spondylosis with radiculopathy, and cervical disc disorder with radiculopathy; and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of neck pain with the following impairments of body function:

- Neck pain with mobility deficits (b7101 Mobility of several joints)
- Neck pain with headaches (b28010 Pain in head and neck)
- Neck pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Neck pain with radiating pain (b2804 Radiating pain in a segment or region)
The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with mobility deficits** and the associated ICD categories of cervicalgia or pain in thoracic spine:

- Acute neck pain - symptom duration of 6 weeks or less
- Unilateral neck pain – commonly with referred pain to scapula and shoulder
- Limited neck/upper thoracic spine rotation with a side-to-side difference of 10 degrees or more
- Neck or upper limb symptoms reproduced with end-range neck motion
- Restricted neck and/or upper thoracic segmental mobility
- Manual provocation of the involved cervical or upper thoracic segment(s) - using unilateral posterior-to-anterior pressures - reproduces the patient’s reported pain

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with movement coordination impairments** and the associated ICD category of sprain and strain of cervical spine:

- Long-standing and/or recurring neck pain and associated (referred) upper extremity pain
- Symptoms linked to a precipitating trauma/whiplash
- Mid-range neck positions ease symptoms
- Manual provocation of the involved cervical segment reproduces the patient’s neck and neck-related symptoms
- Cervical instability may be present (note that muscle spasm adjacent to the involved cervical segments(s) may prohibit accurate testing)
- Strength and endurance deficits of the deep neck flexor muscles
- Coordination deficits of the deep neck flexor muscles

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with headaches** and the associated ICD categories of headaches or cervicocranial syndrome:

- Noncontinuous unilateral neck pain and associated (referred) headache
- Headache is precipitated or aggravated by neck movements or sustained positions
- Limited upper cervical range of motion
- Restricted upper cervical segmental mobility
- Cervical instability may be present (note that muscle spasm adjacent to the involved cervical segments(s) may prohibit accurate testing)
- Headache reproduced or increased with provocation of the involved upper cervical segments
- Headache reproduced or increased with provocation of the involved trigger points
- Strength and endurance deficits of the deep neck flexor muscles

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with radiating pain** and the associated ICD categories of spondylosis with radiculopathy or cervical disc disorder with radiculopathy:

- Neck pain with associated radiating pain (narrow band of lancinating) pain in the involved upper extremity
• Upper extremity paresthesias, numbness, and weakness may be present
• Cervical sidebending toward the involved side combined with axial loading (Spurling’s test) reproduce the reported symptoms
• Upper limb nerve tension tests reproduce the reported symptoms
• Cervical distraction relieves the reported symptoms
• Upper extremity sensory, strength, or reflex deficits are present if the involved peripheral nerve(s) entrapment(s) is/are significant

INTERVENTIONS: NECK PAIN WITH MOBILITY DEFICITS
For patients with acute neck pain with mobility deficits, clinicians:

B should provide thoracic manipulation, a program of neck range of motion exercises, scapulothoracic and upper extremity strengthening along with counseling strategies to enhance program adherence

C may utilize cervical manipulation and/or mobilization

For patients with subacute neck pain with mobility deficits, clinicians:

B should provide neck and shoulder girdle endurance exercises

C may utilize thoracic manipulation and cervical manipulation and/or mobilization

For patients with chronic neck pain with mobility deficits, clinicians:

B should provide thoracic manipulation and cervical manipulation or mobilization, and cervical deep neck flexor, and scapulothoracic neuromuscular training, stretching, and strengthening exercises, combined with dry needling, laser, or intermittent traction as part of a multimodal approach (consistent with patient preferences)

C may utilize neck, shoulder girdle, and trunk endurance exercise approaches and pain education based counseling strategies that promote and active lifestyle and address cognitive and affective factors

INTERVENTIONS: NECK PAIN WITH MOVEMENT COORDINATION IMPAIRMENTS
For patients with acute neck pain with movement coordination impairments (whiplash associated disorder), clinicians:

C may provide a single-session of early advice, exercise instruction and education; a comprehensive exercise programs (including strength and/or endurance with/without coordination exercises); and/or TENS and pulsed electromagnetic field therapy, for patients whose condition is perceived to be at low risk of progressing toward chronicity.
B should provide education to act as usual, refrain from using a cervical collar, and perform postural and mobilization exercises to decrease pain and increase ROM, and use a multimodal intervention approach including manual mobilization techniques plus exercise (eg, strengthening, endurance, flexibility, postural, coordination, aerobic, and functional exercises) for those few patients expected to experience a moderate to slow recovery with persisting impairments.

B Should (1) educate the patient that early return to normal, non-provocative pre-accident activities is important, and (2) provide reassurance to the patient that good prognosis and full recovery commonly occurs.

For patients with **chronic** neck pain with movement coordination impairments (whiplash associated disorder), clinicians:

B should provide a combination of manipulation or mobilization and exercise; and laser therapy

C may provide an individualized, progressive submaximal exercise and pain education program including, strengthening, endurance, flexibility, coordination, aerobic, and functional exercise using principles of cognitive behavioral therapy; patient education and counseling focusing on prognosis, pain management, encouragement to initiate and maintain active treatments, and assurance.

**INTERVENTIONS: NECK PAIN WITH HEADACHES**

For patients with **acute** neck pain with headache, clinicians:

C may utilize C1-C2 self-sustained natural apophyseal glide (self-SNAG) exercise.

For patients with **subacute** neck pain with headache, clinicians:

B should consider using cervical manipulation and mobilization.

C may consider using C1-C2 self-sustained natural apophyseal glide (self-SNAG) exercise.

For patients with **chronic** neck pain with headache, clinicians:

B should provide cervical or cervico-thoracic manipulation or mobilizations combined with shoulder girdle and neck stretching, strengthening, and endurance exercise.

**INTERVENTIONS: NECK PAIN WITH RADIATING PAIN**

For patients with **acute** neck pain with radiating pain, clinicians:

C may utilize mobilizing and stabilizing exercises, non-provoking nerve mobilization exercises, laser, and short term use of a cervical collar.
For patients with *chronic* neck pain with radiating pain, clinicians:

**B** should provide mechanical intermittent cervical traction, combined with other interventions such as cervical and thoracic mobilization/manipulation and nerve mobility exercises.

**B** should provide education and counseling to encourage participation in occupational and exercise activities.

**C** may use acupuncture.

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to November 2014.

**LIST OF ACRONYMS**

ACR: American College of Radiology

AGREE II: Appraisal of Guidelines for Research and Evaluation II

AMSTAR: assessment of multiple systematic reviews

APTA: American Physical Therapy Association

CCR: Canadian Cervical Spine Rule

CI: confidence interval

CPG: clinical practice guideline

CT: computer tomography

ESWT: extracorporeal shock wave therapy

GRADE: Grading of Recommendations Assessment, Development and Evaluation

ICF: International Classification of Functioning, Disability and Health

ICD: International Classification of Diseases

ICON: International Committee on Neck Pain

ICSI: intra-lesional corticosteroid injection

IFOMPT: International Federation of Orthopaedic Manipulative Physical Therapists
LEFS: Lower Extremity Function Scale
MCID: Minimal clinically important difference
MDT: Mechanical Diagnosis and Therapy
MRI: magnetic resonance imaging
NEXUS: National Emergency X-Radiography Utilization Study
NNT: number needed to treat
NPQ: Neurophysiology of Pain Questionnaire
NSAID: non-steroidal anti-inflammatory drug
ROM: range of motion
SF-36: Medical Outcomes Study Short Form-36
SIGN: Scottish Intercollegiate Guidelines Network
VAS: Visual Analogue Scale
WAD: Whiplash-associated disorder
INTRODUCTION

AIM OF THE GUIDELINES
The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based clinical practice guidelines (CPGs) for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization’s International Classification of Functioning, Disability, and Health (ICF).82

The purposes of these clinical guidelines are to:
- Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization’s terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for patients, payers, and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT
These guidelines are not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made based on clinician experience and expertise in light of the clinical presentation of the patient, the available evidence, available diagnostic and treatment options, and the patient’s values, expectations, and preferences. However, we suggest that significant departures from accepted guidelines should be documented in the patient’s medical records at the time the relevant clinical decision is made.
Methods

Content experts were appointed by the Orthopaedic Section, APTA to conduct a review of the literature and to develop an updated Neck Pain CPG as indicated by the current state of the evidence in the field. The aims of the revision were to provide a concise summary of the evidence since publication of the original guideline and to develop new recommendations or revise previously published recommendations to support evidence-based practice. The authors of this guideline revision worked with research librarians with expertise in systematic reviews to perform a systematic search for concepts associated with neck pain in articles published from 2007 to November 2014 related to classification, examination, and intervention strategies for neck pain consistent with previous guideline development methods related to ICF classification. Primary electronic search methods were performed using a standard structured approach from January 2007 to December 2014 in the following databases PubMed, Cochrane Library, Web of Science, CINAHL, ProQuest Dissertations and Abstracts, PEDro, ProQuest Nursing and Allied Health Sources, and EMBASE by a research librarian. The search strategy guided by PICOT-SD was designed to locate systematic reviews, meta-analyses, or narrative reviews that addressed six clinical areas (classification, examination, intervention, harms, prognosis, and outcome measures), when applicable contrasted with a control or comparison treatments, and used at least one measurement property of an outcome measure in patients with neck pain or musculoskeletal neck conditions in primary to tertiary settings from immediate post treatment to long term follow-up. The study designs included reviews on interventions and cohort/case control trials for prognosis, diagnostic and outcome measurement studies. Secondary reviews were identified through several grey literature sources (references within eligible citations were screened for any additional references; personal files from the investigative team and content experts). [See APPENDIX A for example search strategies and APPENDIX B for example search dates and results, available at www.jospt.org.] In addition, the guideline revision team worked with, and benefited greatly from the efforts of members of the International Committee on Neck pain (ICON), a group currently producing an extensive review of the literature on neck pain. Bridging methods and decision rules were guided by recommendations establish in Whitlock et al 2008 and Robinson et al 2014 & 2015.

The authors declared relationships and developed a conflict management plan that included submitting a Conflict of Interest form to the Orthopaedic Section, APTA, Inc. Articles that were authored by a reviewer were assigned to an alternate reviewer. Partial funding was provided to the CPG development team for travel and expenses for CPG training and development. The CPG development team maintained editorial independence.

In the Impairment/Function-Based Diagnosis and the Examination sections, a narrative review is provided with emphasis placed on systematic reviews and meta-analyses when available. In the Interventions section, only systematic reviews and meta-analyses were considered in the development of recommendations for interventions in this revision. In addition, when there was a systematic review of reviews available, those appraisals were used, and literature was searched for systematic reviews and meta-analyses published since the end date of the published review of reviews. Additionally, if a systematic review or meta-analysis, published after 2014, was identified by the authors during writing, that article was also appraised and included using methods similar to those recommended by Robinson. Articles contributing to
recommendations were reviewed based on specified inclusion and exclusion criteria with the goal of identifying evidence relevant to physical therapist clinical decision-making for adult persons with non-cancer (neuromusculoskeletal) neck pain. The titles and abstracts of each article were reviewed independently by two members of the CPG development team for inclusion. [See APPENDIX C for Inclusion and Exclusion criteria, available at www.jospt.org]. Full text was then similarly appraised to obtain the final set of articles for contribution to recommendations. The team leader (PRB) provided the final decision for discrepancies that were not resolved by the review team. The ratings of the primary sources contained in the systematic reviews or meta-analyses were used by the team in making recommendations. If the systematic reviews or meta-analyses did not provide the necessary information (e.g., study quality, subject characteristics, stage of disorder) or there were discrepancies between the reviews, the reviewers obtained the information directly from the primary source. Quality ratings used in the systematic reviews came from a variety of tools (e.g., Cochrane Risk of Bias, PEDro). Rating of the body of evidence came from other tools (e.g., Grades of Recommendation, Assessment, Development and Evaluation (GRADE), Cochrane Collaboration Back and Neck Review Group), and the CPG team calibrated these ratings into high, moderate, low, and very low quality. Very low quality evidence was not considered in this revision. Ratings of systematic reviews came from two tools (AMSTAR or the closely related SIGN), these ratings were also calibrated into high, acceptable, low and very low categories. Very low quality reviews and findings from very low quality primary sources were not considered in this revision. [See APPENDIX D for flow chart of articles and APPENDIX E for articles included in recommendations, available at www.jospt.org]. Articles on topics that were not immediately relevant to the development of these recommendations, such as shockwave therapy or injection, were not subject to systematic review process and were not included in the flow chart.

This guideline was issued in 2016 based on the published literature up to November 2014. This guideline will be considered for review in 2021, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website: www.orthopt.org

LEVELS OF EVIDENCE
Since the original neck pain clinical practice guideline was published in 2008, publication of the results of a large number of trials has coincided with an increased number of systematic reviews and reviews of reviews. The current update appraises high level systematic reviews using updated criteria for levels of evidence and recommendations consistent with contemporary research methodology. The authors encourage the reader to note these changes in interpreting the guideline recommendations.

Individual systematic reviews, meta-analyses, and review of reviews were graded according to criteria adapted from the Centre for Evidence-Based Medicine, Oxford, United Kingdom for diagnostic, prospective, and therapeutic studies. (Phillips www.cebm.net) In 4 teams of 2, each reviewer independently evaluated the quality of each article using a critical appraisal tool and assigned a level of evidence. [See APPENDIX F and G for evidence level criteria details on procedures used for assigning levels of evidence, available at www.jospt.org]. An abbreviated version of the grading system is provided below. Systematic review AMSTAR scores are available in APPENDIX H at www.jospt.org
The levels of evidence were assigned with alignment to the definitions contained in the Table below:

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Evidence obtained from a high quality systematic review (AMSTAR or SIGN score of 8 or more) that contains consistent findings from multiple high-quality primary sources.</td>
</tr>
</tbody>
</table>
| II    | Evidence obtained from a high or acceptable quality systematic review (AMSTAR or SIGN score of 6 or more) that contains consistent or mostly consistent findings from generally high-quality primary sources  
**-or-**  
Consistent findings from at least 1 high-quality large (n>100 in each arm) randomized controlled trial, or more than 1 small high-quality randomized controlled trials, prospective studies, or diagnostic studies. |
| III   | Evidence obtained from a high or acceptable quality systematic review (AMSTAR or SIGN score of 6 or more) that contains consistent or mostly consistent findings from generally moderate-quality primary sources  
**-or-**  
Mostly consistent findings from 1 high-quality small randomized controlled trial, or more than 1 moderate-quality randomized controlled trial, prospective studies, or diagnostic studies. |
| IV    | Inconsistent findings reported in a high or acceptable systematic review (AMSTAR or SIGN score of 6 or more) where the higher quality primary sources tend to favor a clear direction (even when the lower quality primary source tends to favor a different direction)  
**-or-**  
Inconsistent findings from case controlled studies or retrospective studies, or inconsistent findings from randomized controlled trials where the higher quality randomized controlled trials tend to favor a clear direction (even when lower quality trials favor the opposite)  
**-or-**  
Consensus statement from content experts. |
| V     | Inconsistent evidence drawn from a low rated (score of 5 or below on AMSTAR or SIGN scales) systematic review that may indicate the balance of evidence favoring one direction but with very low confidence, regardless of the quality of the primary sources  
**-or-**  
Case series or individual expert opinion, or direct or indirect evidence from physiology, bench research or theoretical constructs |
When available, a second factor, the magnitude of effect versus harm contributed to the recommendation, and was characterized according to the Table below:

<table>
<thead>
<tr>
<th>GRADE of RECOMMENDATION</th>
<th>Beneficial Effect</th>
<th>Harmful Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Desirable consequences clearly outweigh undesirable consequences. This considers the magnitude of effect (none, small, medium, large), numbers needed to treat, probability of harms, resources and patient burden, etc. A strong grade requires a medium to large effect with low risk of harms and low patient burden.</td>
<td>Consequences equally balanced or uncertain (none or small effect, unclear harms, unclear burden)</td>
</tr>
<tr>
<td>Weak</td>
<td>Desirable consequences probably outweigh undesirable consequences (small to moderate effect, some risk of harms, higher burden)</td>
<td>Undesirably consequences probably outweigh desirable consequences (probability of harms likely outweigh any small-to-moderate effect, burden might be high)</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>Undesirably consequences clearly outweigh desirable consequences (small effect, clear probability of harms or high patient burden)</td>
</tr>
<tr>
<td>Weak</td>
<td>None</td>
<td>Undesirably consequences clearly outweigh undesirable consequences</td>
</tr>
<tr>
<td>Strong</td>
<td>One or more level I systematic reviews support the recommendation, providing evidence for a strong magnitude of effect</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>One or more level II systematic reviews or a preponderance of level III systematic reviews or studies support the recommendation, providing evidence for a mild to moderate magnitude of effect</td>
<td></td>
</tr>
<tr>
<td>Weak</td>
<td>One or more level III systematic reviews or a preponderance of level IV evidence support the recommendation, providing minimal evidence of effect</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>Higher-quality studies conducted on this topic disagree with respect to their conclusions and effect. The recommendation is based on these conflicting studies</td>
<td></td>
</tr>
<tr>
<td>Theoretical/foundational evidence</td>
<td>A preponderance of evidence from animal or cadaver studies, from conceptual models or principles, or from basic science or bench research support the recommendation, providing theoretical/foundational evidence of effect</td>
<td></td>
</tr>
<tr>
<td>Expert opinion</td>
<td>Best practice based on the clinical experience of the guidelines development team</td>
<td></td>
</tr>
</tbody>
</table>
SYMPTOM STAGES AND FOLLOW-UP PERIODS
Results were assigned a stage related to symptom duration: acute (less than 6 weeks), subacute (6-12 weeks), or chronic (greater than 12 weeks). Time periods for follow-up results were characterized according to the Table below.

<table>
<thead>
<tr>
<th>Immediate</th>
<th>Closest to immediately following intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term</td>
<td>Closest to 3 months</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Closest to 6 months</td>
</tr>
<tr>
<td>Long Term</td>
<td>Closest to 12 months or longer</td>
</tr>
</tbody>
</table>

DESCRIPTIOIN OF GUIDELINE VALIDATION
Identified reviewers who are experts in neck pain reviewed this clinical practice guideline content and methods for integrity, accuracy, and that it fully represents the condition. The draft was also reviewed by representatives of Member Organizations of the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT), and any comments, suggestions, or feedback from the expert reviewers and IFOMPT members was delivered to the author and editors to consider and make appropriate revisions. These guidelines were also posted for public comment and review on the orthopt.org web site and a notification of this posting was sent to the members of the Orthopaedic Section, APTA, Inc. Any comments, suggestions, and feedback gathered from public commentary was sent to the author and editors to consider and make appropriate revisions in the guideline. In addition, a panel of consumer/patient representatives and external stakeholders, such as claims reviewers, medical coding experts, academic educators, clinical educators, physician specialists, and researchers also reviewed the guideline and provided feedback and recommendations that were given to the author and editors for further consideration and revisions. Lastly, a panel of consumer/patient representatives and external stakeholders and a panel of experts in physical therapy practice guideline methodology annually review the Orthopaedic Section, APTA’s ICF-based Clinical Practice Guideline Policies and provide feedback and comments to the Clinical Practice Guideline Coordinator and Editors to improve the Association’s guideline development and implementation processes.

DISSEMINATION AND IMPLEMENTATION TOOLS
In addition to publishing these guidelines in the Journal of Orthopaedic and Sports Physical Therapy (JOSPT), these guidelines will be posted on clinical practice guideline areas of both the JOSPT and the Orthopaedic Section, APTA websites, which are free access website areas, and submitted to be available free access on the Agency for Healthcare Quality and Research’s website (guideline.gov). The implementation tools planned to be available for patients, clinicians, educators, payors, policy makers, and researchers, and the associated implementation strategies are:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Patient Perspectives”</td>
<td>Patient-oriented guideline summary in available on jospt.org and orthopt.org</td>
</tr>
<tr>
<td>Mobile app of guideline based exercises for patient/clients and healthcare practitioners</td>
<td>Marketing and distribution of app using orthopt.org and jospt.org</td>
</tr>
</tbody>
</table>
CLASSIFICATION

The primary International Classification of Diseases-10 (ICD-10) code and conditions associated with neck pain include M54.2 Cervicalgia, M54.6 Pain in the thoracic spine, R51 Headache, M53.0 Cervicocranial syndrome, M53.1 Cervicobrachial syndrome, S13.4 Sprain and strain of cervical spine, M47.2 Spondylosis with radiculopathy, M47.8 Spondylosis without myelopathy or radiculopathy, M50 Cervical disc disorders, M62.5 Muscle Wasting and atrophy, M79.1 Myalgia.83

Andelic et al3 linked ICF categories to functional problems reported on the patient specific functional scale by 249 participants with neck pain in Norway. Agreeing with a previous study by Tschiesner174, categories linking to 10% or more functional problems were labeled as "more frequent" and those linking to fewer than 10% were labeled as "less frequent." The more frequent categories of body function linked to were b134 sleep functions (27.2%) and b710 Mobility of joint functions (26.2%). The most frequent categories of activity and participation were d850 remunerative employment (15%), d640 doing housework (14%), d920 recreation and leisure activities, and d430 lifting and carrying objects.3

Additional ICF body function codes associated with neck pain are the sensory functions related to pain and the movement functions related to joint motion and control of voluntary movements. These body function codes include b28010 Pain in neck and head, b2803 Radiating pain in a
dermatome, b2804 Radiating pain in a segment or region, b7101 Mobility of several joints, and b7601 Control of complex voluntary movements.

Additional ICF activities and participation codes associated with neck pain include d4108 Changing a basic body position, d4158 Maintaining a body position, and d4452 Reaching. ICF body structure codes associated with neck pain include s7103 Joints of head and neck, s7104, Muscles of head and neck region, s7105 Ligaments and fascia of head and neck region, s76000 Cervical vertebral column, and s1201 Spinal nerves.

A comprehensive list of codes was published in the previous guideline.22

ORGANIZATION OF THE GUIDELINE
For each topic, the summary recommendation and grade of evidence from the 2008 guideline are presented followed by a synthesis of the recent literature with the corresponding evidence levels. Each topic concludes with the 2016 summary recommendation and its updated grade of evidence.
Pain and impairment of the neck is common. It is estimated that 22 to 70% of the population will have neck pain some time in their lives.\textsuperscript{12, 14, 30, 31, 45, 105, 132} In addition, it has been suggested that the incidence of neck pain is increasing.\textsuperscript{126, 201} At any given time, 10% to 20% of the population reports neck problems,\textsuperscript{12, 32, 73, 178} with 54% of individuals having experienced neck pain within the last 6 months.\textsuperscript{30} Prevalence of neck pain increases with age and is most common in women around the fifth decade of life.\textsuperscript{4, 12, 33, 108, 165}

Although the natural history of neck pain appears to be favorable,\textsuperscript{37, 86} rates of recurrence and chronicity are high.\textsuperscript{8, 75} One study reported that 30% of patients with neck pain will develop chronic symptoms, with neck pain of greater than 6 months duration affecting 14% of all individuals who experience an episode of neck pain.\textsuperscript{12} Additionally, a recent survey demonstrated that 37% of individuals who experience neck pain will report persistent problems for at least 12 months.\textsuperscript{32} Five percent of the adult population with neck pain will be disabled by the pain, representing a serious health concern.\textsuperscript{12, 84} In a survey of workers with injuries to the neck and upper extremity, Pransky et al\textsuperscript{134} reported that 42% missed more than 1 week of work and 26% experienced recurrence within 1 year. The economic burden due to disorders of the neck is high, and includes costs of treatment, lost wages, and compensation expenditures.\textsuperscript{9, 141} Neck pain is second only to low back pain in annual workers’ compensation costs in the United States.\textsuperscript{201} In Sweden, neck and shoulder problems account for 18% of all disability payments.\textsuperscript{126} Jette et al\textsuperscript{85} reported that patients with neck pain make up approximately 25% of patients receiving outpatient physical therapy. Additionally, patients with neck pain frequently are treated without surgery by primary care and physical therapy providers.\textsuperscript{11, 37, 86}

**Evidence Update**

The Global Burden of Disease Injuries and Risk Factors 2010 study measured population health through disability-adjusted life years, and years of life lived in less than ideal health, measured as years lived with disability. Years lived with disability is the number of incident cases, multiplied by the average duration of the condition (average number of years that the condition lasts until remission or death), multiplied by the disability weight. In this large study, neck pain ranked 21st overall in global cause of disability-adjusted life years\textsuperscript{120} and 4th overall in years lived with disability\textsuperscript{191}
In a systematic review by Haldeman, prevalence depended on the definitions used; for neck pain, the one-year prevalence ranged from 30% to 50% in the general population. For neck pain with associated disability the one-year prevalence ranged from 2% to 11% in the general population, and from 11% to 14% of workers who reported being limited in their activities because of neck pain.57

II
In a 2014 systematic review, March’s findings related to neck pain without referral into the upper limbs lasting at least one day. The global point prevalence in 2010 was estimated to be 4.9% (females: 5.8%; males: 4.0%).109

II
Hoy performed a systematic review of epidemiologic studies of activity limiting neck pain, including neck-related upper limb, head and/or trunk pain lasting at least one day. The one-year incidence of neck pain was 10.4% to 21.3%. The one-year remission rate ranged from 33% to 65%. The one year prevalence of neck pain in the general population was on average 25.8% (range 4.80% to 79.5%) with a point prevalence of 14.4% (range 0.4% to 41.5%), and a one-year prevalence of 25.8% (range 4.8% to 79.5%).76

IV
Goode performed a 2006 telephone survey of 141 individuals in North Carolina, and found the estimated prevalence of chronic neck pain among noninstitutionalized individuals for the state of North Carolina was 2.2% (95% confidence interval [95% CI] 1.7–2.6). Individuals with chronic neck pain were largely middle aged (mean age 48.9 years) and the majority of subjects were women (56%) and non-Hispanic white individuals (81%).54

2016 Summary
Significant variation exists in the definition of neck pain and the research methods employed within the epidemiological literature on neck pain. This variation limits the ability to compare or combine data across studies to arrive at consensus; however there is agreement that neck pain is common and increasing worldwide in both the general population and in specific subgroups.

RISK FACTORS
For the purposes of this document, the term ‘risk’ will be reserved specifically for risk factors for new onset of neck pain while ‘prognosis’ (discussed below) will refer to the predicted course of the condition after onset.

Evidence Update
McLean and colleagues (2010) conducted a systematic review of risk factors for the onset of new neck pain across different populations.115 Of 14 independent studies (13 rated high quality), the following risk factors for new onset neck pain were identified: female gender, older age, high job demands, being an ex-smoker, low social or work support, and a previous history of neck or low back disorders. Paksachol and colleagues (2012) conducted a similar review of 7 independent
cohorts (5 rated high quality) with a focus on office workers. Their results indicated that only female gender and prior history of neck pain were strong predictors of new onset neck pain in this population.

**2016 Summary**

Evidence from two recent systematic reviews indicates that female gender and prior history of neck pain are the strongest and most consistent risk factors for new onset neck pain in office workers and the general population. Older age, high job demands, being an ex-smoker, low support, and prior history of low back pain may also be risk factors.

**CLINICAL COURSE AND PROGNOSIS**

**Clinical course**

Risk and prognosis are ideally considered in the context of the "natural course" of a condition as well as the "clinical course" a condition can be expected to take in response to a specific intervention. The natural course is the course a condition can be expected to take if no formal ‘clinical’ intervention is provided. Clinical prognosis is based on two important pieces of information - what is known about the clinical course of the condition, and the presence or absence of factors that may lead to deviation from that course.

**Evidence Update**

Six systematic reviews addressed the clinical course of neck pain. These have most commonly employed observational research designs in which the type of intervention is not controlled, therefore the samples in these reviews can be assumed to have participated in a range of interventions, including medical, surgical, physical therapy, and chiropractic treatments, among others. Results of this research can most logically be interpreted as ‘the average rate of recovery - in this cohort - under this clinical context’. It is also worth noting that the operationalization of recovery is rarely consistent across studies (e.g. pain intensity, self-rated disability scale, work status, medication usage) rendering true mathematical synthesis very difficult.

In general, the reviews in the field have arrived at a similar conclusion: that the clinical course of neck pain is not favorable. Kamper and colleagues (2008) used a meta-analytic approach to synthesize recovery data following acute whiplash-associated disorder. Their results indicate that recovery is slow when the outcome is pain intensity, requiring 6 months or more for average pain intensity to achieve the clinically meaningful change of 20%. When self-rated disability was the outcome, recovery fared no better. Standardized mean scores did not reach 20% improvement over the 12 months for which data were available. This message was subsequently echoed by Hush and colleagues (2011) with a focus on acute idiopathic neck pain, who additionally found that idiopathic neck pain does not resolve further after the first 6.5 weeks. The majority of recovery from acute traumatic or idiopathic neck pain appears to happen within the first 6-12 weeks post-injury, with the rate of recovery slowing considerably after that critical
The 2009 evidence-based guidelines for interventional pain physicians indicated that less than 50% report complete resolution within 1 year and this is consistent with earlier reports by the Neck Pain Task Force.

Chronic or insidious neck pain follows a clinical course that Guzman and colleagues have described best as ‘recurrent’ or ‘episodic,’ suggesting that complete resolution of such symptoms is the exception rather than the rule. An early review by Borghouts and colleagues reported the median frequency of ‘improvement’ in people with non-specific neck pain of varying duration was 30-47% within 6 months.

Rao (2002) reported the results of a knowledge synthesis for cervical myelopathy with or without radiculopathy. While much of the evidence for that synthesis came from very early research of the 1950’s or 60’s, the most recent evidence regarding cervical myelopathy suggested a course of neck pain that could be considered stable (neither decreasing nor increasing). However, both the elderly and those treated conservatively with medication, spinal injections, collar use, bed rest, traction or home exercise were more likely to experience worsening symptoms.

**2016 Summary**

The overall balance of evidence supports a view of the course of neck pain that is not favorable. In acute traumatic conditions, the majority of recovery should occur by 6 and 12 weeks post-injury, after which recovery slows considerably to the point that as many as 50% will continue to describe symptoms after 1 year. Of those with symptoms after 1 year, 15-20% will be classified as moderately or severely disabled. In chronic conditions, the course may be stable or fluctuating, but in most cases can best be classified as recurrent, characterized by periods of relative improvement followed by periods of relative worsening.

**Prognosis**

**Evidence Update**

In the context of neck pain, prognostic factors have been most commonly evaluated in acute trauma-related conditions (e.g. ‘whiplash’). This is likely due to the ability to identify a clear start time (time of whiplash injury) for the onset of the condition and offers the potential to quantify the magnitude of the inciting event (e.g. motor vehicle collision). Insidious onset conditions, such as degenerative disc disease or postural causes, offer a less accurate onset date or magnitude of event leading to more difficult prognostic research.

Since the Quebec Task Force monograph of 1995, several primary research studies and systematic reviews on the topic of prognosis following whiplash-associated disorder (WAD) have been published. A recent overview of systematic reviews sought to identify consistencies in the pool of literature to March 2012 and quantify confidence in the prognostic value of over 130 different factors. The results of that procedure led to high or moderate confidence that each of the following were risk factors for persistent problems when captured in acute or subacute WAD (less than 6 weeks from injury): 1) high pain intensity, 2) high self-reported disability scores, 3) high post-traumatic stress symptoms, 4) strong catastrophic beliefs, and 5) cold hypersensitivity.
In work-related or non-specific neck pain, only older age and a prior history of other musculoskeletal disorders offered the same level of confidence.

Factors that were not supported as useful for establishing a prognosis were: 1) angular deformity of the neck (e.g. scoliosis, flattened lordosis), 2) impact direction, 3) seating position in the vehicle, 4) awareness of the impending collision, 5) having a head rest in place at the time of collision, 6) stationary vs. moving when hit, and 7) older age (note the difference between WAD and non-specific neck pain). For non-specific neck pain, a pre-injury history of regular physical activity was not a useful prognostic factor.\textsuperscript{195}

Walton and colleagues have used meta-analytic techniques to quantify the prognostic utility of many of these factors.\textsuperscript{197} Their results are presented in the Table below, and indicate that high pain intensity and high self-reported disability offer the greatest prognostic value. However, this may simply be a function of research using pain and disability as the predicted outcomes, meaning that the predictive value of these factors may be different when the outcome to be predicted is something else such as work status or health care usage.\textsuperscript{197}

Two more narrowly focused systematic reviews in the area of traumatic neck pain prognosis have been published that were not included in the Walton overviews.\textsuperscript{35, 53} Goldsmith and colleagues reviewed the evidence for cold hyperalgesia as a prognostic variable, and found consistent moderate-grade evidence (4 cohorts) that cold hyperalgesia holds prognostic value.\textsuperscript{53} Daenen and colleagues conducted a systematic review of cervical motor dysfunction as a prognostic variable and found inconclusive results (4 cohorts), preventing endorsement of such tests as being prognostic.\textsuperscript{35}

\textbf{2016 Summary}

Moderate to high-level evidence indicates that female gender and prior history of neck pain are consistent risk factors for new onset neck pain. Low to moderate level evidence suggests older age, high job demands, being an ex-smoker, low support, and prior history of low back pain may also be risk factors.

High-level evidence indicates that the majority of recovery from acute-onset neck pain, whether traumatic or insidious, occurs within the first 6-12 weeks followed by little to no recovery through to 12 months.

Moderate to high-level evidence indicates that clinicians should collect and consider pain intensity, level of self-rated disability, pain-related catastrophizing, post-traumatic stress symptoms (traumatic onset only), and cold hypersensitivity when establishing a prognosis for their clients. The table below offers a list of sample tools that can be used to capture these variables. For non-specific neck pain, age and prior history of musculoskeletal problems may offer prognostic value. There is still relatively little guidance regarding the combination of risk factors and how those should be interpreted and managed. New research focusing on more integrated complex models or prediction rules may shed light on this challenge in the near future.

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<th>Construct</th>
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High pain intensity | Numeric Rating Scale (0-10), consider score of 6 or greater ‘high’
---|---
High self-reported disability | Neck Disability Index, original or shorter adaptations consider greater than 30% as ‘high’
High pain catastrophizing | Pain Catastrophizing Scale, consider score of 20 or greater ‘high’
High acute post-traumatic stress symptoms | Impact of Events Scale - Revised, consider score of 33 or greater 'high'. High post-traumatic distress is not uncommon in acute injuries; here this scale is used to predict symptom chronicity, not to assess for post-traumatic stress disorder.
Cold hyperalgesia | TSA-II Neurosensory Analyzer from Medoc Inc. is largely considered the ‘gold standard’. However the cost of such equipment may render it impractical for clinicians. Alternatives include the cold pressor task as a test of cold endurance (similar but not identical to cold pain threshold), use of an ice cube, or use of cold metal bars. A sample cold sensitivity scale can be found at [http://bit.ly/1ouQbFq](http://bit.ly/1ouQbFq). If using a cold metal rod from a residential freezer or an ice cube, application to the skin over the affected area for 5 seconds should not cause pain >12/20 on that scale. Early testing suggests scores of 13 or greater indicate cold hyperalgesia, but this requires further validation.

### PATHTOANATOMICAL FEATURES / DIFFERENTIAL DIAGNOSIS

#### 2008 Summary

Although the cause of neck pain may be associated with degenerative processes or pathology identified during diagnostic imaging, the tissue that is causing a patient’s neck pain is most often unknown. Thus, clinicians should assess for impaired function of muscle, connective, and nerve tissues associated with the identified pathological tissues when a patient presents with neck pain.

#### Evidence Update

There are a number of anatomical structures in the cervical region that can be sources of nociception including zygaphyseal joints, vertebrae, muscles, ligaments, neural structures, and the intervertebral disc. However, evidence is lacking to support the hypothesis that these pathoanatomical features are a primary source of mechanical neck pain across the age-spectrum in the majority of patients. In a small percentage of patients, the source of neck symptoms may be something more serious, such as cervical myelopathy, cervical instability, fracture, neoplasm, vascular compromise, or systemic disease.

Space-occupying lesions (e.g. osteophytosis or herniated cervical disc) primarily affect the lower cervical segments and are commonly associated with cervical spondylotic myelopathy and central canal stenosis. These may be secondary to acquired degenerative processes and can give rise to signs and symptoms of neck and/or upper quarter complaints as well as neurologic deficits. Congenital narrowing of the spinal canal may also increase the risk for developing
spinal canal stenosis. Magnetic resonance imaging and analysis of cerebrospinal fluid are useful in determining the diagnosis of myelopathy. Clinical tests used in the diagnostic process for cervical myelopathy in general have low sensitivity, and as such should not be used when screening for this condition. While cervical disc herniation and spondylosis are most commonly linked to cervical radiculopathy and myelopathy, the patient’s ultimate presentation may reflect pain mechanisms beyond these discrete pathoanatomical findings.

There exists little consensus on the definition of cervical radiculopathy as it relates to the exact location, intensity, or duration of painful symptoms in patients. Therefore, it is suggested that pain radiating into the arm coupled with motor, reflex, and/or sensory changes in the upper limb such as paraesthesia or numbness are considered in making clinical determination for cervical radiculopathy. Limited evidence suggests that the median nerve test, but not the radial nerve test, is clinically useful in determining the presence of cervical radiculopathy.

The 2012 IFOMPT International Framework for Examination of the Cervical Region for potential of Cervical Arterial Dysfunction prior to Orthopaedic Manual Therapy Intervention provides an excellent decision making pathway for assessment of arterial insufficiency. Since clinicians cannot rely on the results of any one test, the framework provides a tool to guide assessment of both risk factors and clinical presentation, and to make patient-centered, evidence-driven decisions on management.

The Valsalva maneuver was previously described in the Physical Impairment section of the 2008 Neck Pain Guidelines. This test may also be useful as a predictor of serious intracranial pathology in patients presenting with headache and should be used to assist in deciding whether referral for neuroimaging is appropriate (+LR 2.3, 95% CI 1.4-3.8). clinicians should refer to the ACR Appropriateness Criteria Guidelines to decide what type of imaging is warranted.

Clinicians should utilize the Canadian Cervical Spine Rules or the NEXUS Criteria (Appendix I) to rule out the need for radiographic study in clinical conditions of suspected trauma-related fracture.

While no similar tools exists for the assessment of upper cervical ligamentous instability, the authors urge a similar approach that takes into account risk factors, patient history, and examination results to make judicious decisions about patient management. One high quality systematic review by Hutting et al revealed poor diagnostic accuracy for all upper cervical ligament instability tests evaluated. In general, these tests have sufficient specificity and can rule in upper cervical ligamentous instability, but degrees of sensitivity varied.

**2016 Summary**

Direct pathoanatomic cause of mechanical neck pain is rarely identifiable. Clinicians should identify clinical findings (red flags) in patients with neck pain that suggest the presence serious pathology, such as infection, cancer, and cardiac involvement, and the need for medical or surgical consultation. Clinicians should also screen patients with neck pain for serious pathology including suspected arterial insufficiency, upper cervical ligamentous instability, and fracture.
IMAGING STUDIES

As noted in the 2008 CPG, alert and stable adult patients with cervical pain precipitated by trauma should be classified as low risk or high risk based on the Canadian Cervical Spine Rule (CCR)\(^\text{161}\) or the National Emergency X-Radiography Utilization Study (NEXUS) criteria.\(^\text{56}\) (Appendix I) The 2001 American College of Radiology (ACR) for suspected spine trauma and chronic neck pain, Appropriateness Criteria (last reviewed in 2012 and 2013, respectively) should also be used.\(^\text{124}\) According to the CCR, patients are considered high risk if they 1) are greater than 65 years of age; or 2) have had a dangerous mechanism of injury; or 3) have paresthesias in the extremities. Those classified as high risk should undergo computed tomography or cervical radiography. Furthermore, patients are classified as low risk if they 1) are able to sit in the emergency department; or 2) have had a simple rear-end motor vehicle collision; or 3) are ambulatory at any time; or 4) have had a delayed onset of neck pain; or 5) do not have midline cervical spine tenderness; and 6) are able to actively rotate their head 45 degrees in each direction. Imaging in the acute stage is not required for those who are classified as low risk.

The NEXUS low-risk criteria suggest that cervical spine radiography is indicated for patients with trauma unless they meet all of the following: 1) no posterior midline cervical spine tenderness; 2) no evidence of intoxication; 3) a normal level of alertness; 4) no focal neurologic deficit and; 5) no painful distracting injuries. A recent systematic review suggests the CCR rule appears to have better diagnostic accuracy than the NEXUS criteria.\(^\text{117}\)

There is a paucity of available literature regarding the pediatric population to help guide decision-making on the need for imaging. Adult risk classification features should be applied in children greater than age 14. Due to the added radiation exposure of computed tomography the ACR recommends plain radiography (3-views) in those under 14 years of age regardless of mental status.\(^\text{124}\)

Guidelines for the use of diagnostic imaging in patients with acute or chronic (traumatic or non-traumatic) neck pain exist.\(^\text{124}\) However, in view of the frequency of abnormal findings, and the lack of prognostic value,\(^\text{123}\) routine imaging, such as ultrasonography, computer tomography (CT), and magnetic resonance imaging (MRI), in patients without neurologic insult (or deficits) or other disease processes may not be warranted\(^\text{123}\)

Following are issues in imaging specific to the subcategories of neck pain. Neck pain classification categories will be discussed later in these clinical guidelines.

**Neck Pain with Mobility Deficits**

As this is described in terms of acute or chronic neck pain, in the absence of red flag signs, no imaging is indicated.\(^\text{67}\)

**Neck Pain with Radiating Pain**

Magnetic resonance imaging is usually the preferred first test for patients with non-traumatic myelopathy. Gadolinium contrast administration is preferred when oncological, infectious, inflammatory, or vascular causes of myelopathy are suspected.\(^\text{124}\)
In the case of traumatic myelopathy, the priority is to assess mechanical stability of the spine. While radiographs are useful for this purpose, a higher probability of identifying bony injury or ligamentous disruption in the cervical spine is realized with CT. Owing to its superior soft-tissue resolution and multiplanar capability, MRI has replaced CT imaging in patients with painful and symptomatic myelopathy.

**Neck Pain with Movement Coordination Impairment**

Johansson et al investigated imaging changes in individuals with acute whiplash associated disorder (WAD) from a motor vehicle collision. They assessed whether the presence of a cervical spine kyphotic deformity on MRI in the acute stage (approximately 10 days following the motor vehicle collision) was associated with greater severity of baseline symptoms and a worse 1-year prognosis as compared to lordotic or straight postures following a whiplash injury. Findings suggest that kyphotic deformity is not significantly associated with chronic whiplash associated pain.

High-resolution proton density-weighted MRI has demonstrated abnormal signal intensity (indicative of tissue damage) in both the alar and transverse ligaments in some subjects with chronic WAD. Separate studies initially indicated a strong relationship between alar ligament damage, head position (turned) at time of impact, and disability levels (as measured with the Neck Disability Index). However, a 2011 study by Vetti et al demonstrated that alar and transverse ligament signal within one year of injury most likely reflected normal variation. More recent evidence suggests that MRI signal changes of alar and transverse ligaments are not caused by whiplash injury, and MRI examination of alar and transverse ligaments should not be used as the routine workup of patients with whiplash injury.

Previous work in chronic whiplash from a motor vehicle collision demonstrated that female patients (18 to 45 years old) with persistent WAD (grade II per the Quebec Task Force – neck pain, tenderness to palpation, and limited neck range of motion) have increased fat infiltration of the neck extensors and flexors on conventional MRI. These changes in muscle structure were significantly less in subjects with chronic insidious onset neck pain or healthy controls, suggesting that traumatic factors may play a role. The differential development of neck muscle fatty infiltrates was observed in participants with varying levels of functional recovery following whiplash injury. Findings identified longitudinal structural muscle pathology with T1-weighted MRI. These findings were used to differentiate between those with varying levels of functional recovery, establishing a relationship between muscle fat at 6-months post injury and initial pain intensity as well as signs/symptoms of post-traumatic stress disorders. Post-traumatic stress disorder had been identified as a strong factor in the prediction of recovery following whiplash, and these findings were recently replicated in a separate longitudinal study in Australia. The receiver operating characteristic analysis indicated that muscle fat levels of 20.5% or above resulted in a sensitivity of 87.5% and a specificity of 92.9% for predicting outcome at 3 months. These results provide further evidence that muscle degeneration occurs in tandem with known predictive risk factors (older age, pain-related disability, and post-traumatic stress) and that routine imaging protocols should be reconsidered in the vast majority of patients following whiplash.
There remains uncertainty about whether changes in the relative cross-sectional area (mm$^2$) of the cervical paraspinal musculature are related to functional recovery following whiplash injury. Elliott et al. (2008) observed a consistent pattern of larger cross-sectional area with MRI in the multifidus muscles of those with persistent WAD. The larger cross-sectional area was believed to represent larger amounts of fatty infiltrate. However, removal of fat signal from the MRI measures in these patients revealed that the majority of the muscles were not larger; rather, they were atrophied when compared with healthy controls and those with idiopathic neck pain. In contrast, others have shown that atrophy of the neck muscles with MRI are not associated with long term functional outcomes.

Longitudinal observations (10 years or more) of Modic signs (degenerative changes of the vertebral bone marrow adjacent to the endplates) in the cervical intervertebral discs are common in patients with WAD but occur with a similar frequency to healthy controls, suggesting they may be more the result of the physiological ageing process rather than pathological findings related to the whiplash injury.

2016 Summary

In the absence of neurological signs or symptoms, patients with normal radiographic findings or evidence of spondylosis, need no further imaging studies. Clinicians should utilize existing guidelines and appropriateness criteria (CCR, NEXUS, and ACR recommendations) in clinical decision-making regarding imaging studies for traumatic and non-traumatic neck pain in the acute and chronic stages. MRI is the preferred choice of imaging in painful and traumatic myelopathy. Imaging studies often fail to identify any structural pathology related to symptoms in patients with whiplash injury. Although MRI can easily visualize ligamentous structures in the upper cervical spine, there is little evidence that MRI examination of alar and transverse ligaments should be used as the routine workup of patients with whiplash injury. Muscular degeneration in acute and chronic whiplash associated disorders has been demonstrated using MRI studies. These degenerative changes appear unique to those transitioning to chronic whiplash associated disorders and have shown to be related to known prognostic factors for poor functional recovery.

Examination

OUTCOME MEASURES

2008 Recommendation
A
Clinicians should use validated self-report questionnaires, including the Neck Disability Index and the Patient-Specific Functional Scale for patients with neck pain. These tools are useful for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring a change in patient’s status throughout the course of treatment

Evidence Update
II
Many patient reported outcome tools for neck pain are described in the literature. For the most part, these are not validated and the measurement properties of these scales remain uncertain. A notable exception is also the most commonly used patient report outcome tool, the Neck Disability Index (NDI). In a 2012 moderate quality systematic review of patient reported outcome measures, Schellingerhout et al. focused on eight different tools. Of these, the NDI was the most extensively studied over a variety of neck pain conditions and has been translated into many languages. The NDI also has been extensively assessed for its psychometric properties. Schellingerhout et al. found the measurement properties of the NDI to be adequate, except for reliability, and provisionally recommended its use. In an earlier low quality review, Holly et al found the NDI, the Patient Specific Functional Scale (PSFS), and the North American Spine Society scale to be reliable, valid and responsive for assessing radiculopathy for nonoperative therapy. Further, a high quality guideline strongly recommended the use of the NDI, Medical Outcomes Study Short Form-36 (SF-36), Medical Outcomes Study Short Form-12 (SF-12) and Visual Analog Scale for assessing treatment of cervical radiculopathy arising from degenerative disorders. Other scales, including; the PSFS, the Health Status Questionnaire, the Sickness Impact Profile, the McGill Pain Scores, and the Modified Oswestry Disability Index were rated lower but were still recommended outcome measures for assessing treatment of cervical radiculopathy arising from degenerative disorders. Horn and colleagues found the PSFS to have greater reliability than the NDI in patients with cervical dysfunction or cervical radiculopathy. Ferreira et al found that the NDI, along with the Neck Bournemouth Questionnaire and the neck pain and disability scale, demonstrated a balanced distribution of items across the ICF components.

2016 Recommendation
A Clinicians should use validated self-report questionnaires, such as the Neck Disability Index, for patients with neck pain, to identify a patient’s baseline status relative to pain, function, and disability and to monitor a change in patient’s status throughout the course of treatment.

ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES

Evidence Update

III The Spinal Function Sort is a tool used to measure the persons perceived ability to engage in functional activities by rating functional ability on a series of 50 tasks, graphically depicted, and simply described. Each task is rated on a 0-4 point scale yielding a total score of 0 - 200. Although the Spinal Function Sort shows promise in predicting return to work in people with chronic low back pain, it was not useful in predicting return to work in people with sub-acute whiplash associated disorder. Other than the activity-related elements noted in this guideline’s section on Outcome Measures, there are no other activity limitation and participation restriction measures specifically reported in the literature associated with neck pain.
The measures identified in the 2008 Neck Pain CPG continue to be options that a clinician may use to assess changes in a patient’s level of function over an episode of care. In addition, clinicians may ascertain activity limitations or participation restrictions through a physical task analysis approach on activities associated with the individual’s daily living, employment and leisure pursuits.

2008 and 2016 Recommendation

Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient’s neck pain to assess the changes in the patient’s level of function over the episode of care.

PHYSICAL IMPAIRMENT MEASURES

Evidence Update

Two systematic reviews were identified regarding cervical active range of motion (ROM). In a high quality review, Snodgrass et al\textsuperscript{155} studied cervical range of motion as an outcome measure following cervical mobilization / manipulation. In their review of 36 studies, they found the CROM device (Performance Attainment Associates, Lindstrom, MN), the standard goniometer, and the inclinometer to be the most commonly used tools to measure cervical range of motion. It was suggested, based on limited evidence, that cervical range of motion was potentially a valuable tool in the screening/diagnostic process related to cervicogenic headache, cervical radiculopathy, and cervical spinal injury.

In a 2010 acceptable quality review, Williams et al\textsuperscript{198} reviewed 46 articles on reliability and 21 articles on validity of cervical range of motion assessment finding “good” reliability and validity for the CROM device, the single inclinometer method, and the Spin-T goniometer.

In another acceptable quality systematic review, van Trijffel et al\textsuperscript{179} reviewed 7 articles investigating the inter-examiner reliability of determining passive intervertebral motion of the cervical spine. The found overall reliability to be poor to fair, but assessment of C1-C2 and C2-C3 motion segments were found to have fair reliability. Reliability tended to be higher when assessed on symptomatic versus asymptomatic subjects.

One acceptable quality systematic review by Rubinstein et al\textsuperscript{144} evaluated the Spurling’s test, neck distraction test, shoulder abduction test, and the neurodynamic test / upper limb tension test for the median nerve. A positive Spurling's test, traction/neck distraction test, shoulder abduction test, and Valsalva maneuver may suggest cervical radiculopathy while a negative upper limb tension test may rule it out. Caution should be used when considering any of these physical impairment measures independently. Clinicians should look for patterns between patient reported and physical examination findings that rule in or rule out a particular diagnostic classification for a patient.
This revision of the Neck Pain Clinical Practice Guideline adds two additional physical impairment measures to the list presented in the 2008 Guideline, the flexion rotation test, and algometric assessment of the pain pressure threshold.

FLEXION ROTATION TEST

**ICF category:** Measurement of impairment of body function; movement of several joints

**Description:** Measurement of passive rotation range of motion at the C1/2 segment

**Measurement method:**
The patient lies supine while the therapist passively flexes the cervical spine maximally to end range. The therapist then passively rotates the head left and right. The end range of motion in rotation is determined either by patient report of onset of pain or firm resistance felt by the clinician, whichever comes first. The therapist quantifies the range of motion either by visual estimate of the rotation range of motion or use of the Cervical Range of Motion device. A positive test is defined as a restriction of rotation ROM with a cutoff of less than 32°.\(^68\),\(^69\),\(^129\)

**Nature of variable:** Continuous
Units of measurement: Degrees
Diagnostic Accuracy: For identifying restricted movement at C1/2 in patients with cervicogenic headache
Visual estimation
Sensitivity: .90-.95\(^68\),\(^69\),\(^129\) -LR .11-.27\(^68\),\(^129\)
Specificity: .90-97\(^68\),\(^69\),\(^129\) +LR 9-9.4\(^68\),\(^129\)

**Measurement properties:** Mean range of motion is 39-45° in healthy subjects, 20-28° in patients with cervicogenic headache\(^68\),\(^69\),\(^129\). Reliability is excellent as indicated by interrater agreement (Kappa=.81)\(^129\) and test-retest reliability (ICC\(_{(2,1)}\)=.92).\(^69\) SEM is 2-3° with an MDC\(_{90}\)= 4.7-7°.

MDC\(_{95}\): 4.7-7°

**Instrument variations:** Clinicians may use visual estimate or goniometry.

ALGOMETRIC ASSESSMENT OF PAIN PRESSURE THRESHOLD

**ICF Category:** Measurement of impairment of body function; pain in head and neck

**Description:** Measurement of local pain pressure threshold in the upper trapezius

**Measurement Method:** The patient is seated. A digital pressure algometer is applied perpendicular to the muscle at the angle of the upper fibers of the trapezius muscle (approximately 5 to 8 cm superomedial to the superior angle of the scapula) with pressure
increasing at a rate of approximately 4-5 N/s (40-50 kPa/s). Patients are instructed to push a button or tell the examiner the precise moment the sensation changes from pressure to pain. The examiner then repeats the test on the opposite side, and 3 tests of each site are conducted with a minimum 30-second rest between tests.

**Nature of variable:** continuous

**Units of measurement:** Pressure (e.g. Newtons/cm², psi, or kPa)

Diagnostic Accuracy: Sensitivity, specificity, and predictive values are available for a range of change scores.¹⁹⁶

**Measurement properties:** Reference values are established for patients with acute and chronic neck pain. Reliability is excellent as indicated by intrarater agreement (ICC(2,1)=.96 (.91, .98)¹⁹⁴, intrarater agreement (ICC(2,1)=.81-.89,¹⁹⁴,¹⁹⁶ and 2-4 day test-retest reliability (ICC(2,1)=.83 (.69-.91).¹⁹⁶

SEM: Intrarater 20.5 kPa; Interrater 50.3 kPa.¹⁹⁴,¹⁹⁶
MDC₉₀: Intrarater 47.2; Interrater 117-156 kPa.¹⁹⁴,¹⁹⁶

**2016 Recommendation**

B

When evaluating a patient with neck pain over an episode of care, assessment of impairment of body function should include measures that can rule in or rule out 1) neck pain with mobility deficits, including cervical active range of motion, the flexion rotation test, cervical and thoracic segmental mobility tests, and 2) neck pain with radiating pain/cervical radiculopathy, including the upper limb tension test, Spurling’s test, distraction test, and the Valsalva test. Cranial cervical flexion and neck flexor muscle endurance tests may be use in assessing movement coordination impairments, and algometric assessment of pressure pain threshold may be useful in staging chronicity of neck pain.

**DIAGNOSIS/CLASSIFICATION**

The 2008 Neck Pain Clinical Practice Guideline classified neck pain into four categories linked to the model proposed by Fritz and Brennan.⁴⁹

Neck Pain with Mobility Deficits
Neck Pain with Radiating Pain
Neck Pain with Movement Coordination Impairments
Neck Pain with Headache

Classification/diagnostic criteria were described in the 2008 Recommendation.

**Evidence Update**

III

Bergstrom et al⁵ studied the effectiveness of different types of intervention on patients with cervicothoracic or low back pain. They classified patients using the Swedish version of the Multidimensional Pain Inventory into the following categories: adaptive copers (n=52), interpersonally distressed (n=46), and dysfunctional (n=68). The types of intervention were: (1) Behavioral-oriented physiotherapy for approximately 20 hours per week; (2) Cognitive
Behavioral Therapy for approximately 14 hours per week; (3) Behavioral Medicine Rehabilitation which was a combination of the other two interventions for approximately 40 hours per week; and (4) treatment-as-usual, consisting of no treatment offered. The outcome measure was sickness absence measured in days. Overall attendance rates for treatment alternatives was 62%. Results indicated the multidisciplinary Behavioral Medicine Rehabilitation intervention resulted in decreased sickness absence more than treatment as usual in the adaptive coper and interpersonally distressed groups.

IV

In a retrospective analysis, Verhagen and colleagues\textsuperscript{183} failed to find significant differences in outcomes or prognostic factors between non-specific neck pain associated with traumatic (whiplash) and non-traumatic neck pain. Patients with headache were included in both the whiplash (prevalence = 49/63) and non-traumatic (prevalence = 268/395) groups. Patients received an individualized, non-standardized program, which could include medication, advice, education, exercises, modalities and/or manual therapy. Based on non-significant differences in outcomes or prognostic factors, Verhagen and colleagues concluded patients post whiplash should not be considered a separate subgroup from patients with non-traumatic neck pain.\textsuperscript{183}

IV

In a high quality systematic review, Takasaki and May\textsuperscript{166} compared the effectiveness of the Mechanical Diagnosis and Therapy (MDT) approach to other therapeutic approaches, or a "wait and see" approach on a wide variety of types of neck pain. MDT treatments were provided by therapists who were trained in that approach, but who may not have had the highest level of training in MDT. Results on pain intensity and function had wide confidence intervals, and the authors concluded any benefit from MDT approach over other therapeutic approaches or a "wait and see" approach may not be clinically relevant for pain and was not clinically relevant for function.\textsuperscript{166}

Treatment-Based Clinical Prediction Rules for Neck Pain

Clinical prediction rules are helpful in identifying patients who may respond well to a certain treatment. The 2008 Neck Pain Clinical Practice Guideline described clinical prediction rules for manipulation of the cervical spine,\textsuperscript{175} the thoracic spine,\textsuperscript{24} and for the use of traction;\textsuperscript{138} none had been validated. Since 2008, there have been several additional clinical prediction rules developed, and some validation work has been published.

III

Puentedura et al developed a clinical prediction rule to identify patients with neck pain who were likely to respond well to manipulation of the cervical spine.\textsuperscript{135} Thirty-nine percent of 82 patients achieved a successful outcome defined as a +5 ("quite a bit better") or higher on the global rating of change scale after one or two treatment sessions. The analysis identified four items in the clinical prediction rule: symptom duration less than 38 days, pain with posterior-to-anterior manual pressures applied to the spinous processes of the cervical spine, side to side difference in cervical rotation range of motion of 10 degrees or more, and a positive expectation that cervical manipulation will help. They determined a positive likelihood ratio of 13.5 when 3 of the 4 items were present, increasing the probability of a successful outcome from 39\% to 90\%. 
Fernandez-de-la-Penas et al\textsuperscript{46} developed a clinical prediction rule identifying factors that predict success using non-thrust joint mobilization combined with trigger point therapies in women with tension-type headaches. Eight variables were found to predict success, including: age of more than 44.5 years; presence of left sternocleidomastoid trigger points, presence of suboccipital trigger points; presence of left superior oblique trigger points; cervical rotation to the left greater than 69 degrees; total tenderness score of less than 20.5; Neck Disability Index score of less than 18.5; and pain distribution in the referral area of right upper trapezius trigger points of greater than 42.23 units. With five of the eight variables satisfied, the positive likelihood ratio was 7.1 (95% CI 3.1 - 16.3) increasing the probability of success from 47% (pretest) to 86.3 (posttest). If 6 or more of the variables were present, the positive likelihood ratio was infinite, with a posttest probability of success being 100%. This clinical prediction rule has not been validated.

In 2014, Fritz published a randomized clinical trial that investigated the effectiveness of exercise and exercise with traction on NDI scores and neck and arm pain.\textsuperscript{50} A secondary purpose of this study was to investigate whether outcomes were improved if traction was used on individuals identified by the presence of 3 of the 5 factors of the clinical prediction rule published by Raney.\textsuperscript{138} The five factors of this rule are: (1) peripheralization of symptoms with lower cervical mobility testing; (2) positive shoulder abduction sign; (3) positive manual distraction test; (4) positive upper limb tension test; and (5) age of 55 years or older. Results provided "a degree of validation" for the clinical prediction rule, finding the rule assisted in selecting patients most likely to benefit from cervical traction only for the outcome of disability at the 6-month follow-up.\textsuperscript{50}

In a multicenter trial, Cleland and colleagues attempted to validate the clinical prediction rule to identify patients with mechanical neck pain likely to benefit from thoracic manipulation in decreasing neck pain and disability.\textsuperscript{25} The clinical prediction rule was not validated in this study, however patients who received thoracic manipulations and exercise had lower pain and disability scores than those performing exercise alone.

**2016 Recommendation C**

In the absence of symptoms or signs of serious medical or psychological conditions, neck pain associated with (1) motion limitations in the cervical and upper thoracic regions, (2) headaches, and (3) referred or radiating pain into an upper extremity are useful clinical findings for classifying a patient with neck pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: cervicalgia, pain in thoracic spine, headaches, cervicocranial syndrome, sprain and strain of cervical spine, spondylosis with radiculopathy, and cervical disc disorder with radiculopathy; and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of neck pain with the following impairments of body function:

- Neck pain with mobility deficits (b7101 Mobility of several joints)
- Neck pain with headaches (b28010 Pain in head and neck)
- Neck pain with movement coordination impairments (b7601 Control of complex...
voluntary movements)
Neck pain with radiating pain (b2804 Radiating pain in a segment or region)

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with mobility deficits** and the associated ICD categories of cervicalgia or pain in thoracic spine:

- Acute neck pain - symptom duration of 6 weeks or less
- Unilateral neck pain – commonly with referred pain to scapula and shoulder
- Limited neck/upper thoracic spine rotation with a side-to-side difference of 10 degrees or more
- Neck or upper limb symptoms reproduced with end-range neck motion
- Restricted neck and/or upper thoracic segmental mobility
- Manual provocation of the involved cervical or upper thoracic segment(s) - using unilateral posterior-to-anterior pressures - reproduces the patient’s reported pain

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with headaches** and the associated ICD categories of headaches or cervicocranial syndrome:

- Noncontinuous unilateral neck pain and associated (referred) headache
- Headache is precipitated or aggravated by neck movements or sustained positions
- Limited upper cervical range of motion
- Restricted upper cervical segmental mobility
- Cervical instability may be present (note that muscle spasm adjacent to the involved cervical segments(s) may prohibit accurate testing)
- Headache reproduced or increased with provocation of the involved upper cervical segments
- Headache reproduced or increased with provocation of the involved trigger points
- Strength and endurance deficits of the deep neck flexor muscles

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with movement coordination impairments** and the associated ICD category of sprain and strain of cervical spine:

- Long-standing and/or recurring neck pain and associated (referred) upper extremity pain
- Symptoms linked to a precipitating trauma/whiplash
- Mid-range neck positions ease symptoms
- Manual provocation of the involved cervical segment reproduces the patient’s neck and neck-related symptoms
- Cervical instability may be present (note that muscle spasm adjacent to the involved cervical segments(s) may prohibit accurate testing)
- Strength and endurance deficits of the deep neck flexor muscles
- Coordination deficits of the deep neck flexor muscles

The following examination findings are useful in classifying a patient in the ICF impairment-based category of **neck pain with radiating pain** and the associated ICD categories of spondylosis with radiculopathy or cervical disc disorder with radiculopathy:
- Neck pain with associated radiating pain (narrow band of lancinating) pain in the involved upper extremity
- Upper extremity paresthesias, numbness, and weakness may be present
- Cervical sidebending toward the involved side combined with axial loading (Spurling’s test) reproduce the reported symptoms
- Upper limb nerve tension tests reproduce the reported symptoms
- Cervical distraction relieves the reported symptoms
- Upper extremity sensory, strength, or reflex deficits are present if the involved peripheral nerve(s) entrapment(s) is/are significant
Interventions

The literature concerning conservative interventions for neck pain rarely described subject populations with terms synonymous to the four categories of the 2008 Neck Pain Clinical Practice Guideline and carried forward in this revision. As such, the results of the literature can rarely be applied exclusively and exhaustively to these separate categories. Additionally, the evidence base is very weak regarding the differential effectiveness of many interventions for neck pain based on subpopulations (e.g., age, gender, ethnicity). Reporting of intervention dosage in terms of intensity, duration, and frequency is variable and may not allow confident translation into practice. One method of arriving at possible intervention dosage is to combine original trial dosage descriptions with clinical judgment, including principles of exercise, movement, and pain sciences, and patient preferences.

This guideline attempts to differentiate the effects of interventions as they may be applied to the categories of neck pain. When available, information regarding stage (acute - less than 6 weeks, sub-acute - 6 to 12 weeks, or chronic - greater than 12 weeks), comparison group, and follow-up (immediate - within 1 day, short term- closest to 4 weeks, intermediate term - closest to 6 months, and long term- closest to 12 months) are provided. The concepts of immediate, short, intermediate, and long term follow-up are research-based time periods and do not represent duration of care. Similarly, the concepts of acute, subacute and chronic stages represent unequal time periods and it is acknowledged that the characteristics of the condition may be more relevant to the to a patient's progression from one stage to the next stage than the duration of symptoms.

The 2008 intervention recommendations and literature syntheses were not specifically aligned to the ICF-based neck pain categories. The 2016 recommendations encompass all of the prior evidence and recommendations; therefore for clarity, only the 2016 recommendations are presented here. Readers may refer to the 2008 CPG for prior recommendations. The section presenting the evidence update is organized first by intervention type (e.g., manual therapy, exercise, multimodal, education, and physical agents), then by stage (e.g., acute, subacute, and chronic), and finally by comparison group and effect (e.g., benefit compared to control, benefit compared to an alternate treatment, no benefit compared to control, and no benefit compared to an alternate treatment). In general, the interventions described below have a low risk profile. Nonetheless, clinicians should apply a benefit to harm screening protocol, such as the IFOMPT framework for risk assessment prior to performing any intervention.

NECK PAIN WITH MOBILITY DEFICITS

2008 Recommendations
The intervention literature analyses were not specifically aligned to the neck pain categories, but the recommendations were made for cervical mobilization/manipulation, thoracic mobilization/manipulation, stretching exercises, and coordination, strengthening, and endurance exercises.

Evidence Update
Manual Therapy

Acute
For patients with acute and chronic neck pain with mobility deficits, there was a benefit, when compared to control, in using:

- **III** multiple sessions of thoracic manipulation for reducing pain over the immediate and short term.\textsuperscript{17, 34, 51, 59, 77, 78, 150} This finding was consistent over the intermediate term but the magnitude of effect was small for pain, function, and quality of life.\textsuperscript{59}

- **V** one to four sessions of a single cervical manipulation for reducing pain over the immediate but not short term.\textsuperscript{29, 60}

IV
For patients with acute and chronic neck pain with mobility deficits, there is conflicting evidence supporting the use of multiple sessions of cervical manipulation as a stand-alone therapy.\textsuperscript{59}

II
For patients with acute and chronic neck pain with mobility deficits, there was no benefit when compared to cervical mobilization, in using multiple sessions of cervical manipulation for reducing pain and improving function, quality of life, global perceived effect, and patient satisfaction over the immediate, short, and intermediate term.\textsuperscript{23, 51, 59, 78, 190}

IV
For patients with acute to subacute neck pain with mobility deficits, there was a benefit, when compared to control, in using cervical mobilization and ipsilateral, but not contralateral cervical manipulation, for reducing pain over the immediate term.\textsuperscript{51, 187}

III
For patients with acute to subacute neck pain with mobility deficits, there was a benefit compared to varied oral medication combinations (oral analgesic, opioid analgesic, NSAID, muscle relaxant), in using multiple sessions of cervical manipulation for reducing pain and improving function over the long term.\textsuperscript{59, 190}

III
For patients with acute to subacute neck pain with mobility deficits, there was a benefit, compared to only using cervical manipulation or only using cervical mobilization, in using combinations of manual therapies for providing analgesic benefits over the short term.\textsuperscript{102}

Subacute
IV
For patients with subacute neck pain with mobility deficits, there was a benefit when compared to control, in using:

- a single session of thoracic manipulation for reducing pain and improving range of motion over the short term.\textsuperscript{77, 202}
- a single session of thoracic manipulation for reducing disability over the immediate term.\textsuperscript{51}

For patients with subacute to chronic neck pain with mobility deficits, there was no benefit, when compared to a control, in using:
III a single session of thoracic manipulation for reducing pain over the immediate term.\textsuperscript{34}

IV a single session of cervical manipulation for reducing pain over the immediate term where 17\% of individuals reported an exacerbation of symptoms.\textsuperscript{29}

III
For patients with subacute to chronic neck pain with mobility deficits, there was no benefit in using 2 weeks of cervical manipulation compared to 2 weeks of cervical mobilization (low velocity, oscillating passive movements) on improving function or reducing pain, disability, or days to perceived recovery.\textsuperscript{102}

III
For patients with subacute to chronic neck pain with mobility deficits, there was no benefit in using cervical manipulation alone or with advice and home exercises, compared to cervical mobilization and strengthening exercises, or instrumented manipulation, for reducing pain and disability over the short or long term, where thrust manipulation (vs. non-thrust mobilization) was associated with an increased risk of transient minor discomfort in some patients with subacute or chronic neck pain.\textsuperscript{78}

IV
For patients with subacute to chronic neck pain with mobility deficits, there was no benefit in using cervical mobilization, when compared to usual care, for reducing pain over the intermediate term.\textsuperscript{51}

Chronic
For patients with chronic neck pain with mobility deficits, there was a benefit, when compared to a control, in using:

III a single session of thoracic manipulation on pain over the immediate term.\textsuperscript{51, 60, 78}

IV a single session of supine thoracic manipulation on pain over the immediate term.\textsuperscript{34, 51, 60, 77, 78, 102, 150, 192}

For patients with chronic neck pain with mobility deficits, there was a benefit in using:

IV upper thoracic manipulation, when compared to cervical manipulation, for reducing pain over the immediate term.\textsuperscript{202}

IV 12 sessions over four weeks of anterior-posterior unilateral accessory movement procedures, when compared to a rotational or transverse accessory movement procedures, for reducing pain over the immediate term.\textsuperscript{59}

For patients with chronic neck pain with mobility deficits, there was no benefit in using:

III cervical manipulation, when compared to medication (NSAIDs, Celebrex, Vioxx, Paracetamol) for reducing pain or improving function over the short term.\textsuperscript{51, 59}

IV cervical mobilization, when compared to exercise, laser, pulsed ultrasound, acupuncture and massage for reducing pain, improving function and quality of life over the immediate to intermediate term.\textsuperscript{59}

IV mobilization at the most symptomatic segment when compared to mobilization at randomly chosen segment; central posterior to anterior (PA) passive accessory movement mobilization technique when compared to random PA’s at the same segment; ipsilateral
PA’s when compared to a randomly selected PA’s at the same segment; and a mobilization perpendicular to the facet plane at most symptomatic segment when compared to the same mobilization three levels above, for reducing pain over the immediate term.\textsuperscript{59}

**Exercise**

**Acute**

**III**

For patients with acute to subacute neck pain with mobility deficits, there was a benefit in using a home exercise program of daily cervical range of motion exercises, education and advice, when compared to medication, for reducing pain and disability for the intermediate term.\textsuperscript{156} However, this difference may not be clinically important because the home exercise program was not different, when compared to multimodal manual therapy, for reducing pain or disability for the short, intermediate, or long term.\textsuperscript{156}

**III**

For patients with acute to chronic neck pain with mobility deficits, there was a benefit, when compared to a control, in using scapulothoracic and upper extremity strengthening for reducing pain over the short term.\textsuperscript{6, 58, 95}

For patients with acute to chronic neck pain with mobility deficits, there was a benefit, when compared to a control, in using:

  - **III** scapulothoracic and upper extremity endurance training for reducing pain over the immediate term.\textsuperscript{58, 95, 127}
  - **III** stretching exercises plus education for reducing pain and disability and improving quality of life over the short term.\textsuperscript{156}
  - **IV** general fitness training for reducing pain over the immediate and short term.\textsuperscript{6, 58, 95}
  - **IV** deep neck flexor recruitment combined with upper extremity strengthening/ endurance exercises for reducing pain over the immediate term.\textsuperscript{58}

**Subacute**

**III**

For patients with subacute to chronic neck pain with mobility deficits, there was no benefit in using neck and shoulder endurance exercises, when compared to strengthening exercises, for reducing on pain and improving function and global perceived effect over the short and long term.\textsuperscript{78}

**Chronic**

For patients with chronic neck pain with mobility deficits, there was benefit, when compared to a control, in using:

  - **III** neuromuscular exercise (e.g., proprioception, eye-head-neck coordination) for reducing pain and improving function over the short term, but not intermediate or long term, and for improving global perceived effect over the intermediate term.\textsuperscript{95, 102}
  - **III** cervical stretching and strengthening for reducing pain and improving function over the immediate and intermediate term.\textsuperscript{95, 156}
combined cervical and scapulothoracic stretching and strengthening for reducing pain and improving function over the intermediate and long term. \(^{58, 95}\)

deep neck flexor isometric strengthening for reducing pain and disability over the immediate and short term. \(^{6}\)

a combination of stretching, strengthening, endurance training, balance/coordination, and aerobic conditioning, with a cognitive/affective component (Qigong) exercises for reducing pain and improving function over the immediate, short, and intermediate terms. \(^{58, 95, 103, 156}\) Conflicting results reported by Lee et al. \(^{103}\) are due to a combination of different primary authors.

postural and isometric exercise added to the use of a cervical pillow for reducing pain and improving function over the immediate and short term. \(^{58, 95}\)

isometric neck flexion exercise, plus upper extremity strengthening and stretching for reducing pain and improving function over the immediate term. \(^{127}\)

whole body group exercise of cardiovascular training with coordination and extensibility exercise for reducing pain over the immediate term. \(^{95}\)

For patients with chronic neck pain with mobility deficits, there was a benefit in using:

strengthening exercises alone or in combination with manipulation, when compared to manipulation alone, for reducing pain and disability after 1 and 2 years. \(^{78}\)

stretching combined with upper body and neck strengthening on pain, when compared to a program of manipulation, massage and sham micro-current, over the long term. \(^{106, 190}\)

cervical stretching and strengthening, when compared to qigong exercise, for improving function over the intermediate term. \(^{156}\)

neck flexion endurance exercise, plus upper extremity strengthening and stretching, when compared to aerobic exercise, for reducing pain and improving function over the immediate term. \(^{127}\)

supervised exercise programs of neck and upper body strengthening and stretching, when compared to an individualized home exercise program of neck and shoulder mobilization, advice and education, for reducing pain and improving global perceived effect over the short and long term. \(^{127, 156}\)

methods to increase physical activity at work and leisure (eg, bike to work, take stairs, general strengthening and conditioning exercise, and advice), when compared to specific exercise (eg, posture, strengthening for neck and shoulder, body awareness training), for reducing pain over the short-term. \(^{182}\) There was no difference for function, or on pain and function over the long term. \(^{182}\)

deep neck flexor recruitment and strengthening, when compared infrared radiation and advice, for reducing pain over the intermediate term. There was no effect on function over the intermediate term, or on pain or function over the intermediate term. \(^{127}\)

individualized home exercise programs of stabilization, relaxation and postural control, compared to written advice to stay active, for reducing pain and improving function over the intermediate term, but not over the long term. \(^{66, 94, 127}\)

supervised group yoga, when compared to unsupervised home exercise program of posture and neck and shoulder stretching and strengthening, for reducing pain and disability over the short term. \(^{156}\)
For patients with chronic neck pain with mobility deficits, there was no benefit, when compared to a control, in using:

**III** upper extremity and trunk strengthening exercise, and upper extremity stretching and endurance training, and aerobic conditioning, for reducing pain and improving function over the immediate, short and long term.

**IV** adding a strengthening component to a home based stretching program for reducing pain and disability, over the long term.

**IV** breathing exercises for reducing pain and improving function and quality of life, over the immediate term.

**IV** McKenzie stretch/ROM plus dynamic stabilization exercises for reducing pain and disability over the immediate through long term.

**IV** stretching exercise either before or after a manipulation for reducing pain and improving function over the immediate term.

**IV** general endurance, flexibility, coordination and postural awareness training (Feldenkrais) for reducing pain over the short and long term.

**IV** combination of strengthening, stretching, endurance, postural and coordination exercise not specific to the neck, for reducing pain over the short term.

**IV** general strengthening on for reducing pain and improving function or quality of life over the long term.

IV

For patients with chronic neck pain with mobility deficits, there was no benefit in using: active range of motion, stabilization and posture exercises specific to the neck, when compared to generalized exercises to the body, for reducing disability over the short term.

neck and upper extremity endurance training plus stretching, when compared to compared to aerobic conditioning plus stretching, for reducing on pain and improving function over the immediate term, and for improving global perceived effect over the long term.

general endurance, flexibility, coordination and postural awareness training (Feldenkrais), when compared to physiotherapy intervention (lumbopelvic stabilization, whole body strengthening, coordination, endurance and flexibility exercises, advice and HEP), for reducing pain over the long term.

proprioceptive training, compared to stretching and strengthening exercises on pain and function over the short term.

deep neck flexor training with pressure biofeedback, when compared to strength training of the neck flexor muscles with weights, for reducing pain and disability over the immediate term.

**Multimodal Therapy**

**III**

For patients with chronic neck pain with mobility deficits, with or without radiating pain, and with or without headache, there was a benefit in using mobilization / manipulation combined with stretching / strengthening for reducing pain over the short and long term, and function over the long term.
For patients with chronic neck pain with mobility deficits, there was a benefit in using a combination of manipulation or mobilization and exercise, compared to manipulation or mobilization alone, for reducing pain and improving quality of life over the long term.¹¹⁸

III
For patients with chronic neck pain with mobility deficits, there was a benefit in using a multimodal intervention including proprioceptive elements, compared to no intervention, on reducing pain over the immediate term.¹¹³

Physical Agents
For patients with chronic neck pain with mobility deficits, there was a benefit, when compared to a control, in using:

III dry needling for reducing myofascial pain over the immediate term.⁹⁶
III 830nm laser for reducing and improving function, global perceived effect, and quality of life over the immediate, short, and intermediate terms.⁵⁵, ⁶¹, ⁹¹ These results agreed and conflicted with other findings.⁵⁵ Graham et al⁵⁵ reported mild adverse events equal in treatment and placebo groups, including tiredness, nausea, headache, and increased pain following laser treatment.
III pulsed ultrasound for reducing pain, but was inferior to mobilization over the immediate term.⁵⁵
III mechanical traction of the intermittent type, but not the continuous type, for reducing pain over the short term.⁵⁵
III a variety of non-injection inserted needle treatment approaches for reducing pain over the immediate or short term.⁵⁵
IV 780 nm laser for reducing pain over the immediate and short term.⁶¹ This review reported that the super-pulse type of laser drive technology may improve outcomes in patients with chronic myofascial pain syndrome.⁶¹
IV transcutaneous electrical nerve stimulation (TENS) and repetitive magnetic stimulation for reducing pain over the immediate and short term.⁵⁵
IV transcutaneous electrical nerve stimulation (TENS) combined with infrared, hot pack/exercise, and collar/exercise/analgesic interventions for reducing pain and disability, and improving function over the immediate and short term.⁵⁵
IV electric muscle stimulation for reducing pain over the intermediate term.⁵⁵

IV
For patients with chronic neck pain with mobility deficits, there was a benefit in using continuous high power ultrasound, compared to conventional ultrasound, for reducing pain over the immediate term.⁵⁵

IV
For patients with chronic neck pain with mobility deficits, there was no benefit, when compared to a control, in using static magnetic necklace for reducing pain over the immediate term.⁵⁵

IV
For patients with chronic neck pain with mobility deficits associated with osteoarthritis, there was conflicting evidence of benefit, when compared to a control, for using pulsed electromagnetic field for reducing pain over the immediate term.  

For patients with chronic neck pain with mobility deficits, there was no benefit in using:

- **II** dry needling on myofascial trigger points, when compared to lidocaine injections, for reducing pain over the immediate through intermediate terms, and for improving function over the immediate term.  
- **III** dry needling (as long as it elicited a localized twitch response), when compared to lidocaine injection for reducing pain in the immediate term. However, lidocaine injections were more effective than dry needling for reducing pain over the short term.  
- **III** use of a hot pack, when compared to mobilization, manipulation, or electric muscle stimulation, for reducing pain and improving function over the intermediate term.  
- **III** infrared light, when compared to sham TENS, for reducing pain and improving function over the short term.  
- **IV** electric muscle stimulation, when compared to manual therapy, TENS, or heat for reducing pain over the intermediate term.  
- **IV** evaporative cooling spray and stretch, when compared to active control, placebo, or active treatment (heat, education, or exercise), for reducing pain over the immediate term.  
- **IV** transcutaneous electrical nerve stimulation (TENS), when compared to manual therapy or ultrasound, for reducing pain over the immediate and short term.  

**Guidance for Implementation of Recommendations**
- Clinicians should integrate the recommendations below with consideration of the results of the patient evaluation (e.g., physical impairments most related to the patient’s reported activity limitation or concerns, severity and irritability of the condition, patient values and motivating factors)
- In the subacute to chronic stage, the benefit of manual therapy appears to decrease. Manipulation may not offer any benefit over mobilization and may be associated with transient discomfort
- Clinicians should utilize a multimodal approach in managing patients with neck pain with mobility deficits
- Exercise targeting the cervical and scapulothoracic region is a necessary component of managing patients with subacute and chronic neck pain and mobility deficits
- Available adherence strategies (e.g., McLean, et al. 2014) for adoption and maintenance of home exercise should be integrated to maximize clinical benefit over the long term

**2016 Recommendations**
For patients with *acute* neck pain with mobility deficits, clinicians:

- **B** should provide thoracic manipulation, a program of neck range of motion exercises, scapulothoracic and upper extremity strengthening along with counseling strategies to enhance program adherence
- **C** may utilize cervical manipulation and/or mobilization
For patients with **subacute** neck pain with mobility deficits, clinicians:

**B**
should provide neck and shoulder girdle endurance exercises

**C**
may utilize thoracic manipulation and cervical manipulation and/or mobilization

For patients with **chronic** neck pain with mobility deficits, clinicians:

**B**
should provide thoracic manipulation and cervical manipulation or mobilization, and cervical, deep neck flexor, and scapulothoracic neuromuscular training, stretching, and strengthening exercises, combined with dry needling, laser, or intermittent traction as part of a multimodal approach (consistent with patient preferences)

**C**
may utilize neck, shoulder girdle, and trunk endurance exercise approaches and patient education and counseling strategies that promote an active lifestyle and address cognitive and affective factors

**NECK PAIN WITH MOVEMENT COORDINATION IMPAIRMENTS**

**2008 Recommendations**
The 2008 Neck Pain CPG intervention literature analyses were not specifically aligned to the neck pain categories or staging, but the recommendations were made for coordination, strengthening, and endurance exercises, stretching exercises, and patient education and counseling that (1) promotes early return to normal, non-provocative pre-injury activities, and (2) provides reassurance to the patient that good prognosis and full recovery commonly occurs.

**Evidence Update**

**III**
In a 2014 systematic review of clinical practice guidelines, Wong et al\(^{200}\) found all guidelines to recommend education and exercise in the management of acute WAD, with most guidelines recommending education and exercise for the subacute and chronic stages as well. The components of education were: emphasis on remaining active, advice on management and coping, reassurance about the prognosis, and functional improvement goals. Further, this review found recommendations for mobilization or manipulation, a multimodal approach, and recommendations against the use of a cervical collar.\(^{200}\)

**Exercise**

**Acute**
For patients with acute neck pain with movement coordination impairments, there was a benefit in using:

**III** neck posture/stabilization exercise, when compared to use of a cervical collar, for reducing pain over the short through long term.\(^{38}\)

**IV** supervised exercise (endurance, stretch, stabilization, coordination), when compared to unsupervised exercise, for reducing pain and disability, and improving self-efficacy over the short but not intermediate term.\(^{168, 184}\)

**IV**
For patients with acute neck pain with movement coordination impairments, there was no benefit in using neck kinesthetic and coordination exercise, when compared to advice to stay active, for reducing pain over the short and intermediate term.27, 38

Subacute
IV
For patients with subacute neck pain with movement coordination impairments, there was no benefit in using strengthening (progressive loading) for the cervical and shoulder muscles, balance and posture exercise, when compared to a control, for reducing pain and improving the ability to perform work activities, over the short and long term.168, 184

Chronic
IV
For patients with chronic neck pain with movement coordination impairments, when compared to a control, there was a benefit in using:
- an individualized, progressive submaximal exercise program and pain education including strengthening, endurance, flexibility, coordination, aerobic and functional exercise using cognitive behavioral therapy principles, for reducing pain and improving function over the immediate, but not long term.58, 90, 95, 127, 156, 169
- vestibular rehabilitation for improving dizziness handicap inventory scores, but not for reducing pain, over the short term.58, 169
- eye-head-neck coordination exercise for improving head repositioning accuracy over the short term. An improvement in pain was realized but the magnitude of the effect is questionable given the group differences in initial pain scores.58, 169

IV
For patients with chronic neck pain with movement coordination impairments, there was no benefit in using cervical rotation strength training, when compared to endurance training, for reducing pain, improving muscle strength, and improving SF-36 physical function scores, over the short term.169

Multimodal Therapy
Acute
IV
For patients with acute neck pain with movement coordination impairments, there was a benefit in using a home program consisting of cervical active ROM exercise, advice, physical agents and limited collar use, when compared to a control, for reducing pain over the short term.94

For patients with acute neck pain with movement coordination impairments, there was a benefit in using:
- III intensive physical therapy program (including, manual therapy, cervical ROM and isometric strengthening exercise, advice, and physical agents), when compared to one session of physical therapy consisting of home exercise instruction and advice, for reducing pain and work days lost, and improving self-perceived benefit, over the intermediate term. These differences were statistically significant but of small magnitude, and thus, possibly not clinically relevant.164, 203
cervical mobilization and/or manipulation combined with active cervical ROM exercise when compared to rest, use of a collar and/or analgesic medications and/or advice, for reducing pain, but there was no difference in function, over the short term.\textsuperscript{27, 38, 78, 95, 118, 152, 167, 184}

massage, active and resisted exercise of the neck and shoulder and heat, when compared to collar use, for reducing pain and disability over the intermediate term.\textsuperscript{167}

cervical mobilization plus low load active kinesthetic, posture and ROM exercise, when compared to a self-managed exercise and education program, for reducing pain and disability, over the immediate term.\textsuperscript{90, 169}

For patients with acute neck pain with movement coordination impairments, there was no benefit in using massage/mobilization plus AROM exercises, when compared to collar use or advice to stay active, for effecting pain disability, work capacity and quality of life, over the long term.\textsuperscript{66, 78, 167}

A higher percentage of patients with acute neck pain with movement coordination impairments who received intensive multimodal physical therapy reported symptoms after 2 years, compared with those who received a single session of physical therapy consisting of home active cervical ROM exercise and advice.\textsuperscript{94, 184}

For patients with chronic neck pain with movement coordination impairments, there was a benefit in using cervical mobilization combined with low load cervical and scapular activation and kinesthetic training, when compared to a booklet on education and exercise, for reducing pain and improving function over the immediate term.\textsuperscript{90}

For patients with acute neck pain with movement coordination impairments, there was a benefit in using:

- instructions to decrease the use of a cervical collar, improve posture, and perform mobilizing exercises, when compared to only receiving rest and analgesics, increased ROM and decreased pain, over the intermediate term.\textsuperscript{116}
- advice to act as usual, when compared to use of a soft collar, for reducing pain over the intermediate term and long term.\textsuperscript{167}
For patients with acute neck pain with movement coordination impairments, there was no benefit in using:

- **III** verbal education on the mechanism of injury to reduce fear and uncertainty, and advice to remain active, when compared to the use of a semi rigid collar or active mobilization, for reducing neck pain, headache disability, and improving work ability over the long term.\(^{116}\)

- **III** instructions to decrease the use of a cervical collar, improve posture and perform mobilizing exercises, when compared to active physiotherapy, for improving cervical range of motion (ROM) and reducing pain intensity over the intermediate term.\(^{116}\)

- **IV** a pamphlet focusing on activity, when compared to generic information provided in the emergency department, for reducing pain or improving function over the short term.\(^{57}\)

**Chronic**

**IV**

For patients with chronic neck pain with movement coordination impairments, there was a benefit in using oral education focusing on prognosis, encouragement, assurance and activity integrated in with exercise, when compared to a control, for reducing pain and disability over the short term.\(^{116}\)

**Physical Agents**

**Acute**

**IV**

For patients with an unspecified duration of neck pain with movement coordination impairments, there was a benefit, when compared to a control, in using

- TENS or pulsed electromagnetic field for reducing pain over the immediate term.\(^{55}\)
- 2 to 6 sessions of triggerpoint dry needling for improving pain or function over the immediate term.\(^{119}\)

**IV**

For patients with acute neck pain with movement coordination impairments, there was a benefit in using Ultra-Reiz (a form of TENS), when compared to pulsed ultrasound or to multimodal treatment including ice, advice and home exercise, for reducing pain over the short term.\(^{55}\)

**IV**

For patients with acute neck pain with movement coordination impairments, there was no benefit, when compared to a control, in using:

- laser for reducing pain over the immediate or intermediate term.\(^{55}\)
- pulsed ultrasound on function or global perceived effect over the immediate term.\(^{55}\)
- iontophoresis for reducing pain over the immediate term.\(^{55}\)

**IV**

For patients with acute neck pain with movement coordination impairments, there was no benefit in using iontophoresis, when compared to interferential current or multimodal treatment, for reducing pain over the immediate term.\(^{55}\)

**Chronic**
III
For patients with chronic neck pain with movement coordination impairments, there was a benefit, when compared to a control, in using 830nm laser for reducing pain, improving function, improving global perceived effect and quality of life over the immediate and intermediate term.55 Graham et al55 reported of mild adverse events equal in treatment and placebo groups, including tiredness, nausea, headache, and increased pain following laser treatment.

Guidance for Implementation of Recommendations
- Clinicians should integrate the recommendations below with consideration of the results of the patient evaluation (eg, physical impairments most related to the patient's reported activity limitation or concerns, severity and irritability of the condition, patient values and motivating factors)
- Existing evidence indicates that recovery from neck pain with movement coordination impairments is most likely to follow 1 of 3 trajectories: quick and early recovery, moderate to slow recovery with lingering impairments, and poor recovery with severe disability. A patient's course of recovery within and between trajectories may not be fixed as there are many factors that can influence the course of recovery. Appropriate evaluation of the acutely injured patient should focus on identifying risk factors for chronicity and predicting the most likely course of recovery for that patient. This prognostic subgrouping is conspicuously absent from many RCTs evaluated for this guideline, but makes clinical sense. While early intervention may impede recovery in the quick and early recovery group, it is likely more appropriate for the severe and non-recovered group. The available evidence provides little guidance for treatment recommendations based on anticipated trajectories. In light of this gap in knowledge, we endorse early, informed risk-based assessment and prognosis from which treatment recommendations should flow naturally. An aggressive search for the pain generating ‘tissue at fault’ is currently unlikely to be productive in the acute stage of injury.

Low Risk for Chronicity/Quick and Early Recovery Expected
As mentioned in the Clinical Course section in this guideline, a significant portion of clients with acute neck pain with movement coordination impairments should expect to recover significantly within the first 2-3 months. For those clients whose condition is perceived to be at low risk of progressing into chronicity, clinicians should provide early advice, education and counseling that includes reassurance of the expected course of recovery, encouragement to remain active at a level similar to prior to the current episode, and training in home exercises to maintain/improve movement of the neck within a comfortable range. Helpful information can be found at the following Australian government sponsored website: here. A supervised exercise program (minimum one session, one follow-up) is preferable over an unsupervised program (verbal instruction or pamphlet). Intensive exercise or work-hardening programs are not recommended in the early acute or subacute phases.

Unclear Risk for Chronicity/Moderate to Slow Recovery with Lingering Impairments Expected
Management often requires additional assessment and evaluation. Impairment-based treatment should flow naturally from evaluation findings. This group is more suitable for responding to a more intensive conservative program combined with low-level
pharmaceuticals. Clients should be monitored closely. The timing and achievement of defined favorable outcomes are often undetermined and unpredictable.

**High Risk for Chronicity/Poor Recovery with Severe Disability Expected**

In consideration of the factors discussed in "Risk, Prognosis, and Clinical Course" and in "Imaging", some patients may be perceived to be at a higher risk of developing chronic problems and poor functional recovery. For those patients, a more concerted multimodal treatment program that could include medical and psychological consultation would be indicated.

- Available adherence strategies (eg, McLean et al114) for adoption and maintenance of home exercise should be integrated to maximize clinical benefit over the long term.

### 2016 Recommendations

For patients with **acute** neck pain with movement coordination impairments (whiplash associated disorder), clinicians:

**C** may provide for patients whose condition is perceived to be at low risk of progressing toward chronicity:

- a single-session consisting of early advice, exercise instruction and education;
- a comprehensive exercise program (including strength and/or endurance with/without coordination exercises);
- TENS, dry needling, or pulsed electromagnetic field therapy.

**B** should (1) educate the patient to

- return to normal, non-provocative pre-accident activities as soon as possible
- refrain from using a cervical collar
- perform postural and mobilization exercises to decrease pain and increase ROM, and (2) provide reassurance to the patient that good prognosis and full recovery commonly occurs.

**B** should use a multimodal intervention approach including manual mobilization techniques plus exercise (eg, strengthening, endurance, flexibility, postural, coordination, aerobic, and functional exercises) for those few patients expected to experience a moderate to slow recovery with lingering impairments.

For patients with **chronic** neck pain with movement coordination impairments (whiplash associated disorder), clinicians:

**B** should provide a combination of manipulation or mobilization and exercise; and laser therapy

**C** may provide an individualized, progressive submaximal exercise program including, strengthening, endurance, flexibility, coordination, aerobic, and functional exercise using principles of cognitive behavioral therapy; patient education and counseling focusing on
prognosis, pain management, encouragement to initiate and maintain active treatments, and assurance.

NECK PAIN WITH HEADACHE

2008 Recommendations
The intervention literature analyses were not specifically aligned to the neck pain categories or staging, but recommendations were made for coordination, strengthening, and endurance exercises to reduce neck pain and headache.

Evidence Update

Manual Therapy

Subacute

III
For patients with subacute to chronic neck pain with headache, there was a benefit, when compared to a control, in using-cervical manipulation and mobilization for reducing neck pain, headache intensity, and headache frequency over the immediate through long term.²¹, ⁴⁷, ⁷⁸, ¹³⁶

Chronic

III
For patients with chronic neck pain with headache, there was a benefit in using:
- cervical manipulation done 3 or 4 times per week for 12 to 18 sessions, when compared to cervical manipulations done 1 time per week for 3 to 8 sessions, for reducing headache pain and frequency over the short term.²¹, ⁵⁷ This benefit was not maintained over the intermediate term.²¹, ⁵⁹
- multiple sessions of cervical or cervico-thoracic manipulation, when compared to multiple sessions of massage or placebo treatments, for reducing pain and improving function over the short and intermediate term.²¹, ⁴⁷, ¹³⁶
- cervical manipulation, when compared to cervical mobilization, for reducing pain, over the immediate, but not the short term.¹⁶

For patients with chronic neck pain with headache, there was no benefit in using:
- III cervical manipulation and mobilization, when compared to exercise alone or manipulation plus exercise, effecting neck pain and headache intensity, frequency and duration, over the long term.¹⁶, ⁷⁸ However two other reviews reported a small advantage in using manual therapy and exercise, when compared to manipulation alone, for reducing pain and improving function, and a 69% advantage in global perceived effect, over the long term.⁵⁸, ¹⁰⁶
- IV cervical manipulation alone, when compared to laser and massage, for reducing headache intensity or duration, over the immediate term.²¹, ¹³⁶

Exercise

Acute

IV
For patients with acute to subacute neck pain with headache, there was a benefit, when compared to a control, in C1-C2 self-sustained natural apophyseal glide (self-SNAG) for reducing pain and headache intensity\textsuperscript{136} over the short and long term.\textsuperscript{58, 95, 136}

**Chronic**  
**III**  
For patients with chronic neck pain with headache, there was a benefit, when compared to a control, in using cervicoscapular strengthening and endurance exercise with pressure biofeedback for reducing pain, function, and improving global perceived effect, over the long term.\textsuperscript{58, 62, 95, 136}

**III**  
For patients with chronic neck pain with headache, there was no benefit for in using endurance, isometric, and stretching exercise, when compared to manipulation, for reducing pain, headache frequency, or headache duration, over the short and long term.\textsuperscript{15, 58, 95}

**Multimodal Therapy**  
**Chronic**  
**III**  
For patients with chronic neck pain with headache, there was a benefit, when compared to a control, in using mobilization, manipulation and exercise (stretching, strengthening, and endurance), for reducing pain, headache frequency, headache intensity, and improving function and global perceived effect, over the short and long term.\textsuperscript{16, 21, 47, 62, 78, 118, 136, 140}

**III**  
For patients with mechanical neck pain, with or without radiating pain, and with or without headache, mobilization/manipulation combined with stretching/strengthening reduced pain over the short and long term, and improved function over the long term.\textsuperscript{62}

**IV**  
For patients with chronic neck pain with headache who also report at least one sign of temporomandibular dysfunction, there was a benefit in using manual therapy and exercise interventions focused on the temporomandibular joint, when compared to manual therapy and exercise focused on the craniocervical region, for reducing pain and improving function over the short and intermediate term.\textsuperscript{21}

**Guidance for Implementation of Recommendations**

- Clinicians should integrate the recommendations below with consideration of the results of the patient evaluation (eg, physical impairments most related to the patient's reported activity limitation or concerns, severity and irritability of the condition, patient values and motivating factors)
- With patients in this category, clinicians should follow the screening and assessment procedures outlined in the IFOMPT framework before implementing interventions.
- Treatments for subgroups of patients having neck pain with headache need to be further research development, including patients post concussive and patients also experiencing temporomandibular symptoms.
Suboccipital strength training may be of particular benefit. Available adherence strategies (e.g., McLean et al\textsuperscript{114}) for adoption and maintenance of home exercise should be integrated to maximize clinical benefit over the long term.

**2016 Recommendations**

For patients with *acute* neck pain with headache, clinicians:

C may utilize C1-C2 self-sustained natural apophyseal glide (self-SNAG) exercise.

For patients with *subacute* neck pain with headache, clinicians:

B should provide cervical manipulation and mobilization.

C may provide C1-C2 self-sustained natural apophyseal glide (self-SNAG) exercise.

For patients with *chronic* neck pain with headache, clinicians:

B should provide cervical or cervico-thoracic manipulation or mobilizations combined with shoulder girdle and neck stretching, strengthening, and endurance exercise.

**NECK PAIN WITH RADIATING PAIN**

**2008 Recommendations**

B Recommendation: Clinicians should consider the use of upper quarter and nerve mobilization procedures to reduce pain and disability in patients with neck and arm pain

C Recommendation: Specific repeated movements or procedures to promote centralization are not more beneficial in reducing disability when compared to other forms of interventions

B Recommendation: Clinicians should consider the use of mechanical intermittent cervical traction, combined with other interventions such as manual therapy and strengthening exercises, for reducing pain and disability in patients with neck and neck-related arm pain.

**Evidence Update**

**Manual Therapy**

**Acute**

IV For patients with acute to chronic neck pain with radiating pain, there was no benefit from using: combined cervical lateral glides, thoracic mobilizations, and nerve mobilization procedures for the median nerve, when compared to general strengthening, for reducing pain and disability, over the immediate term\textsuperscript{13} one session of mobilization performed perpendicular to the facet plane at most symptomatic
segment compared to the same mobilization three levels above or below for reducing pain over the immediate term.59

Exercise
Acute
IV
For patients with acute neck pain with radiating pain, there was a benefit, when compared to a control, in using cervical mobilizing and stabilizing exercises for reducing pain but not for improving function over the immediate term. The benefit for relief of pain was not sustained over the short156 or intermediate term.58, 95, 146

IV
For patients with acute to subacute neck pain with radiating pain, there was no benefit in using cervical stretching and strengthening exercises, when compared to wearing a semi-hard cervical collar, for reducing pain and improving function, over the immediate, short, and intermediate term.146, 156

Multimodal Therapy
Chronic
III
For patients with mechanical neck pain, with or without radiating pain, and with or without headache, there was a benefit, when compared to a control, in using mobilization/manipulation combined with stretching and strengthening exercises for reducing pain over the short and long term, and for improving function over the long term.62

For patients with chronic neck pain with radiating pain, there was no benefit in using:

III manual therapy plus exercise, when compared to advice plus sham ultrasound, or when compared to manual therapy, or when compared exercise alone, for reducing pain or improving function, over the short and long term.146

IV manual therapy plus exercise, when compared to rigid or soft collar, or when compared to surgery, for reducing pain or improving function, over the immediate and long term.13, 146

Education
Chronic
III
For patients with chronic neck pain with radiating pain, there was a benefit, when compared to a control using patient education and counseling that encourage exercise and moderate to heavy physical activities related to work, for reducing pain, but not for improving function or reducing disability over the long term.146
IV
For patients with chronic neck pain with radiating pain, there was no benefit, when compared to a control for adding job stress education to ergonomic interventions for reducing pain, ergonomic risk, or work stress, or for improving function, over the intermediate and long term.\textsuperscript{181}

Physical Agents
Acute
IV
For patients with acute neck pain with radiating pain, there was a benefit, when compared to a control, in using:
- 905nm laser for reducing pain, improving function, global perceived effect, and quality of life over the immediate and intermediate term.\textsuperscript{55, 63, 91} Graham et al\textsuperscript{55} reported mild adverse events equal in treatment and placebo groups, including tiredness, nausea, headache, and increased pain following laser treatment.
- a cervical collar for reducing arm pain over the short but not intermediate term.\textsuperscript{172}

V
For patients with acute neck pain with radiating pain, there was a benefit, when compared to a control, in using a semi-rigid collar for reducing pain over the short-term, but no benefit for reducing pain over the intermediate term, or for improving function over the short, intermediate, or long term.\textsuperscript{63}

III
For patients with acute and chronic neck pain with radiating pain, there was no benefit, when compared to a control, in using continuous traction for reducing pain or disability over the immediate, short, and intermediate term.\textsuperscript{55, 172}

IV
For patients with acute and chronic neck pain with radiating pain, there was no benefit in using a collar, when compared to multimodal physical therapy, for reducing pain over the short term.\textsuperscript{172}

IV
For neck pain with radiating pain and a diagnosis of mild cervical myelopathy, mechanical traction as part of multimodal non-operative management resulted in increased gait speed but no difference in neurological status or performance of daily living activities as compared to operative management.\textsuperscript{142} Rhee et al\textsuperscript{142} also strongly recommended that traction, as part of non-operative management, should not be routinely prescribed for patients with moderate to severe cervical myelopathy.

Chronic
III
For patients with chronic neck pain with radiating pain, there was a benefit, when compared to a control, in using intermittent traction for reducing pain in the short term.55

IV
For patients with chronic neck pain with radiating pain, acupuncture was more beneficial than multimodal physical therapy (details not provided) in reducing pain in the short term.55

IV
For patients with chronic neck pain with radiating pain, there was no benefit, when compared to a control, in using electric muscular stimulation, or modified galvanic current for reducing pain over the immediate term.55

Guidance for Implementation of Recommendations
- Clinicians should integrate the recommendations below with consideration of the results of the patient evaluation (e.g., related impairments, severity and irritability of the condition, and values)
- Since the 2008 Neck Pain Clinical Practice Guideline, there has been little advancement in our knowledge of how to conservatively treat neck pain with radiating pain. While one meta-analysis showed benefit from manual therapy and exercise in a population that included a mixture of neck pain categories, other studies that were selective to neck pain with radiating pain were not able to show similar benefits from this approach.
- Because of the detrimental effects of prolonged use, collars should be restricted to a limited time in the acute phase only, and only in individuals who do not obtain relief from other treatments.
- In the US, acupuncture is limited to those practitioners who are trained and certified acupuncturists
- Available adherence strategies (eg, McLean, et al114) for adoption and maintenance of home exercise should be integrated to maximize clinical benefit over the long term.

2016 Recommendations
For patients with acute neck pain with radiating pain, clinicians:
C may utilize mobilizing and stabilizing exercises, non-provoking nerve mobilization exercises, laser, and short term use of a cervical collar

For patients with chronic neck pain with radiating pain, clinicians:
B should provide mechanical intermittent cervical traction, combined with other interventions such as cervical and thoracic mobilization/manipulation and nerve mobility exercises.
B should provide education and counseling to encourage participation in occupational and exercise activities
C may use acupuncture
<table>
<thead>
<tr>
<th>Impairment-Based Category (with ICD-10 Associations)</th>
<th>Common Symptoms</th>
<th>Impairments of Body Function</th>
<th>Recommended Interventions</th>
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</table>
| **Neck pain with mobility deficit**  
  • Cervicalgia  
  • Pain in thoracic spine | • Unilateral neck pain  
  • Limitation in neck motion  
  • Associated (referred) shoulder girdle or upper extremity pain may be present | • Limited cervical range of motion  
  • Neck pain reproduced at end ranges of active and passive motions  
  • Restricted cervical and thoracic segmental mobility  
  • Neck and referred pain reproduced with provocation of the involved cervical or upper thoracic segments or cervical musculature | **Acute**  
  • Thoracic manipulation  
  • Cervical manipulation / mobilization  
  • Cervical ROM exercise  
  • Scapulothoracic and upper extremity strengthening  
  • Advice to stay active |
| | | | **Subacute**  
  • Thoracic manipulation  
  • Cervical manipulation/mobilization  
  • Neck/shoulder endurance exercise |
| | | | **Chronic**  
  • Thoracic manipulation  
  • Cervical manipulation/ mobilization  
  • Cervical / scapulothoracic neuromuscular exercise, stretching/strengthening, deep neck flexor strengthening  
  • Dry needling, laser, intermittent traction |
| **Neck pain with movement coordination impairments**  
  (whiplash associated disorder)  
  • Sprain and strain of cervical spine | • Symptoms initiated after precipitating trauma / whiplash injury  
  • Associated (referred) shoulder girdle or upper extremity pain | • Strength, endurance, and coordination deficits of the deep neck flexor muscles  
  • Neck pain with mid-range motion that worsens with end-range positions  
  • Neck and referred pain reproduced by provocation of the involved cervical segments  
  • Significant muscle spasm adjacent to involved segments may inhibit accurate assessment of clinical cervical instability. Findings should be considered along with patient history and symptom behavior. | **If a quick and early recovery is expected:**  
  • Education  
  • Advice to remain active  
  • Training in a home exercise program of pain-free cervical motion  
  • Monitoring for acceptable progress. |
| | | | **In clinic treatment:**  
  **Acute and Subacute**  
  • Education and counseling  
  • Cervical mobilization / manipulation  
  • Thoracic manipulation  
  • Active cervical mobility, strengthening, endurance, postural, and range of motion, exercise  
  • TENS  
  **Chronic**  
  • Education and counseling  
  • Cervical mobilization / manipulation  
  • Strengthening, endurance, flexibility, coordination exercise |
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<td>• Neck pain with radiating (narrow band of lancinating) pain in the involved extremity</td>
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<td>• Headache is precipitated or aggravated by neck movements or sustained positions</td>
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<td>• Headache reproduced with provocation of the involved upper cervical segments</td>
<td>• Neck and neck-related radiating pain reproduced or relieved with items in radiculopathy test item cluster</td>
</tr>
<tr>
<td>• Limited cervical range of motion</td>
<td>• May have upper extremity sensory, strength, or reflex deficits associated with the involved nerve(s)</td>
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<tr>
<td>• Restricted upper cervical segmental mobility</td>
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<tr>
<td>• Strength and endurance deficits of the deep neck flexor muscles</td>
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<tr>
<td>• Stretching, strengthening and endurance exercise</td>
<td>• Stretching / strengthening</td>
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<td>• Intermittent traction</td>
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<tr>
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<td>• Education and counseling to encourage participation in occupational and exercise activity</td>
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50. Fritz JM, Thackeray A, Brennan GP, Childs JD. Exercise only, exercise with mechanical traction, or exercise with over-door traction for patients with cervical radiculopathy, with or without consideration of status on a previously described subgrouping rule: a randomized clinical trial. The Journal of orthopaedic and sports physical therapy. 2014;44:45-57.


Physical Therapy Reviews


Linton SJ, Ryberg M. Do epidemiological results replicate? The prevalence and health
Society, th


APPENDIX A - Search Strategies

Below is an example EMBASE search strategy for articles related to the Physical Agents section of Interventions

Modalities =#1
'th'combined modality therapy'/de OR 'electrostimulation therapy'/exp OR 'electrostimulation'/de OR 'traction therapy'/exp OR 'photortherapy'/exp OR 'physiotherapy'/exp OR 'rehabilitation'/exp OR 'ultrasound therapy'/exp OR 'laser'/de OR 'cryotherapy'/exp OR 'cryoanesthesia'/de OR 'ice'/de OR 'acupuncture'/exp OR Modalit* OR 'electric stimulation' OR 'electrical stimulation' OR electrotherapy OR tens OR 'transcutaneous electric nerve stimulation' OR electroacupuncture OR acupuncture OR needling OR heat OR cold OR traction OR laser OR lasers OR rehabilitiation OR 'physical therapy' OR ultrasound OR ultrasonic OR cryotherapy OR hyperthermia OR 'vapocoolant spray' OR cryoanesthesia OR ice OR faradic OR traction OR iontophoresis OR phonophoresis OR phototherapy OR hydrotherapy OR 'light therapy' OR diathermy OR ultraviolet OR infrared OR ((trigger* OR dry) and needl*)

neck anatomy =#2
'neck'/exp OR 'cervical plexus'/de OR 'cervical spine'/de OR 'atlantoaxial joint'/de OR 'atlantooccipital joint'/de OR 'spinal root'/de OR 'brachial plexus'/de OR 'atlas'/de OR 'axis'/de OR 'thoracic spine'/de OR (brachial NEAR/3 plexus) OR neck OR (thoracic NEAR/3 spine) OR (thoracic NEAR/3 outlet) OR (thoracic NEAR/3 vertebra*) OR trapezius OR odontoid* OR occip* OR atlant* OR ((cervical OR cervico*) NOT ('gynecologic disease'/exp OR 'uterus/exp OR uterus OR cervix'))

pain =#3
'pain'/exp OR Pain* OR ache* OR sore* OR stiff* OR discomfort OR injur* OR neuropath* OR neuralgia* OR neurodynia*

eck pain =#4
'atlantoaxial dislocation'/de OR 'neck pain'/de OR 'brachial plexus neuropathy'/de OR 'neck injury'/exp OR 'thorax outlet syndrome'/de OR 'torticollis'/de OR 'cervical pain' OR neckache* OR neck ache* OR whiplash OR cervicodynia* OR cervicalgia* OR brachialgia* OR 'brachial neuritis' OR brachial neuralgia* OR 'cervicobrachial neuritis' OR cervicobrachial neuralgia* OR neck pain* OR neck injur* OR brachial plexus neuropath* OR 'brachial plexus neuritis' OR monoradicul* OR monoradicl* OR 'torticollis' OR 'thoracic outlet syndrome' OR 'cervical dystonia' OR (headache* AND cervic*)

disc problems =#5
'vertebra dislocation'/exp OR 'intervertebral disk disease'/exp OR (('intervertebral disk'/exp OR disks OR disk OR discs OR disc) AND (herniat* OR slipped OR prolapse* OR displace* OR degenerat* OR bulge OR bulged OR bulging))

diseases =#6
'radiculopathy'/exp OR 'temporomandibular joint disorder'/de OR 'myofascial pain'/de OR 'musculoskeletal disease'/exp OR 'neuritis'/exp OR radiculopath* OR radiculitis OR temporomandibular OR (myofascial NEAR/3 pain*) OR (thoracic outlet syndrome*) OR 'spinal osteophytosis' OR neuritis OR spondylosis OR spondylitis OR spondylopathies OR spondylolysis OR spondylodiscitis OR spondylarthrosis OR osteoarthritis OR fibromyalgia OR sprain* OR strain*

disease rehab =#7
'radiculopathy'/exp/dm_rh OR 'temporomandibular joint disorder'/dm_rh OR 'myofascial pain'/dm_rh OR 'musculoskeletal disease'/exp/dm_rh OR 'neuritis'/exp/dm_rh

neck pain rehab =#8
'atlantoaxial dislocation'/dm_rh OR 'neck pain'/dm_rh OR 'brachial plexus neuropathy'/dm_rh OR 'neck injury'/exp/dm_rh OR 'thorax outlet syndrome'/dm_rh OR 'torticollis'/dm_rh

Systematic Review Filter =#9
'meta analysis'/de OR 'systematic review'/de OR 'systematic review (topic)'/de OR Meta analy* OR metaanaly* OR meta* OR Systematic review* OR systematic overview* OR Cochrane OR embase OR psyclit OR psychlit OR psycinfo OR psychinfo OR cinahl OR cinhal OR science citation index OR bds OR cancerlit OR 'web of science' OR Reference list* OR bibliography* OR hand search* OR 'relevant journals' OR manual search* OR (('selection criteria' OR data NEAR/3 extract*) AND (review OR reviews))

Embase Session Results

No.
Query
Results

500
#18

957
#17
#16 AND [english]/lim AND ([embase]/lim OR [embase classic]/lim)

979
#16
'meta analysis'/de OR 'meta analysis (topic)'/de OR 'systematic review'/de OR 'systematic review (topic)'/de OR meta AND analy* OR metaanaly* OR meta AND analy* OR systematic AND review* OR systematic AND overview* OR cochrane OR embase OR psyclit OR psychlit OR psycinfo OR psychinfo OR cinahl OR sciencedirect OR science AND citation AND index OR baidu OR cancerlit OR 'web of science' OR reference AND list* OR bibliograph* OR hand AND search* OR 'relevant journals' OR manual AND search* OR ('selection criteria' OR data NEAR/3 extract* AND (review OR reviews))

atlantoaxial dislocation'/dm_rh OR 'neck pain'/dm_rh OR 'brachial plexus neuropathy'/dm_rh OR 'neck injury'/exp/dm_rh OR 'thorax outlet syndrome'/dm_rh OR 'torticollis'/dm_rh

radiculopathy'/exp/dm_rh OR 'temporomandibular joint disorder'/dm_rh OR 'myofascial pain'/dm_rh OR 'musculoskeletal disease'/exp/dm_rh OR 'neuritis'/exp/dm_rh

radiculopathy'/exp OR 'temporomandibular joint disorder'/de OR 'myofascial pain'/de OR 'musculoskeletal disease'/exp OR 'neuritis'/exp OR radiculopathy* OR radiculitis OR temporomandibular OR myofascial NEAR/3 pain* OR (thoracic AND outlet AND syndrome*) OR 'spinal osteophytosis' OR neuritis OR spondylosis OR splondylitis OR spondylolisthesis OR spondylolysis OR arthritis OR osteoarthritis OR spondylarthitis OR fibromyalgia OR sprain* OR strain*

vertebra dislocation/exp OR 'intervertebral disk disease'/exp OR ('intervertebral disk'/exp OR disks OR disc OR discs OR disc AND (herniat* OR slipped OR prolapse* OR displace* OR degenerat* OR bulge OR bulged OR bulging))

atlantoaxial dislocation'/de OR 'neck pain'/de OR 'brachial plexus neuropathy'/de OR 'neck injury'/exp OR 'thorax outlet syndrome'/de OR 'torticollis'/de OR 'cervical pain' OR neckache* OR neck AND ache* OR whiplash OR cervicodynia* OR cervicalgia* OR brachialgia* OR 'brachial neuritis' OR brachial AND neuralgia* OR 'cervicobrachial neuritis' OR cervicobrachial AND neuralgia* OR neck AND pain* OR neck AND injur* OR brachial AND plexus AND neuropath* OR 'brachial plexus neuritis' OR monoradicul* OR monoradicl* OR 'torticollis OR 'hazardous outlet syndrome' OR 'cervical dystonia' OR (headache* AND cervic*)

painless'/exp OR pain* OR ache* OR sore* OR stiff* OR discomfort OR injur* OR neuropath* OR neuralgia* OR neurodynia*

#9 AND #15
83,564
#15
#8 OR #10 OR #11 OR #12 OR #13 OR #14
2,689
#14
#2 AND #7
31,349
#13
#1 AND #2 AND #6
1,956
#12
#1 AND #2 AND #5
4,332
#11
#1 AND #4
71,583
#10
#1 AND #2 AND #3
75,731
#9
Below is an example Medline-OVID search for articles related to Interventions. We only used articles published between January 2007 and November 2014.

Medline-OVID
1. Neck Pain/
2. exp Brachial Plexus Neuropathies/
3. exp neck injuries/ or exp whiplash injuries/
4. cervical pain.mp.
5. neckache.mp.
6. whiplash.mp.
7. cervicodynia.mp.
8. cervicalgia.mp.
9. brachialgia.mp.
10. brachial neuritis.mp.
11. brachial neuralgia.mp.
12. neck pain.mp.
13. neck injur*.mp.
14. brachial plexus neuropath*.mp.
15. brachial plexus neuritis.mp.
16. thoracic outlet syndrome/ or cervical rib syndrome/
17. Torticollis/
18. exp brachial plexus neuropathies/ or exp brachial plexus neuritis/
19. cervico brachial neuralgia.ti,ab.
20. cervicobraehial neuralgia.ti,ab.
21. (monoradicul* or monoradicl*).tw.
22. or/1-21
23. exp headache/ and cervic*.tw.
24. exp genital diseases, female/
25. genital disease*.mp.
26. or/24-25
27. 23 not 26
28. 22 or 27
29. neck/
30. neck muscles/
31. exp cervical plexus/
32. exp cervical vertebrae/
33. atlanto-axial joint/
34. atlanto-occipital joint/
35. Cervical Atlas/
36. spinal nerve roots/
37. exp brachial plexus/
38. (odontoid* or cervical or occip* or atlant*).tw.
39. axis/ or odontoid process/
40. Thoracic Vertebrae/
41. cervical vertebrae.mp.
42. cervical plexus.mp.
cervical spine.mp.
neck adj3 muscles.mp.
brachial adj3 plexus.mp.
thoracic adj3 vertebrae.mp.
neck.mp.
thoracic adj3 spine.mp.
thoracic adj3 outlet.mp.
trapezius.mp.
cervical.mp.
cervico*.mp.
51 or 52
exp genital diseases, female/
genital disease*.mp.
exp *Uterus/
54 or 55 or 56
53 not 57
29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 58
exp pain/
pain.mp.
ache.mp.
sore.mp.
stiff.mp.
discomfort.mp.
injur*.mp.
neuropath*.mp.
or/60-68
59 and 69
Radiculopathy/
temporomandibular joint disorders/ or exp temporomandibular joint dysfunction syndrome/
myofascial pain syndromes/
exp "Sprains and Strains"/
Spinal Osteophytosis/
exp Neuritis/
Polyradiculopathy/
exp Arthritis/
Fibromyalgia/
spondylitis/ or discitis/
spondylolisthesis/
radiculopathy.mp.
radiculitis.mp.
temporomandibular.mp.
myofascial pain syndrome*.mp.
thoracic outlet syndrome*.mp.
spinal osteophytosis.mp.
neuritis.mp.
spondylisis.mp.
spondylitis.mp.
spondylolisthesis.mp.
or/71-91
59 and 92
exp neck/
cervical vertebrae/
Thoracic Vertebrae/
neck.mp.
thoracic adj3 vertebrae.mp.
cervical.mp.
cervico*.mp.
or/102-104
106. 101 not 105
107. (thoracic adj3 spine).mp.
108. cervical spine.mp.
109. 94 or 95 or 96 or 97 or 98 or 106 or 107 or 108
110. Intervertebral Disk/
111. (disc or discs).mp.
112. (disk or disks).mp.
113. 110 or 111 or 112
114. 109 and 113
115. herniat*.mp.
116. slipped.mp.
117. prolapse*.mp.
118. displace*.mp.
119. degenerat*.mp.
120. (bulge or bulged or bulging).mp.
121. 115 or 116 or 117 or 118 or 119 or 120
122. 114 and 121
123. intervertebral disk degeneration/ or intervertebral disk displacement/
124. intervertebral disk displacement.mp.
125. intervertebral disc displacement.mp.
126. intervertebral disk degeneration.mp.
127. intervertebral disc degeneration.mp.
128. 123 or 124 or 125 or 126 or 127
129. 109 and 128
130. 28 or 70 or 93 or 122 or 129
131. animals/ not (animals/ and humans/)
132. 130 not 131
133. exp *neoplasms/
134. exp *wounds, penetrating/
135. 133 or 134
136. 132 not 135
137. Neck Pain/rh [Rehabilitation]
138. exp Brachial Plexus Neuropathies/rh
139. exp neck injuries/rh or exp whiplash injuries/rh
140. thoracic outlet syndrome/rh or cervical rib syndrome/rh
141. Torticollis/rh
142. exp brachial plexus neuropathies/rh or exp brachial plexus neuritis/rh
143. 137 or 138 or 139 or 140 or 141 or 142
144. Radiculopathy/rh
145. exp temporomandibular joint disorders/rh or exp temporomandibular joint dysfunction syndrome/rh
146. myofascial pain syndromes/rh
147. exp "Sprains and Strains"/rh
148. exp Spinal Osteophytosis/rh
149. exp Neuritis/rh
150. Polyradiculopathy/rh
151. exp Arthritis/rh
152. Fibromyalgia/rh
153. spondylitis/rh or discitis/rh
154. spondylolysis/rh or spondylolisthesis/rh
155. or/144-154
156. 59 and 155
157. exp Combined Modality Therapy/
158. Exercise/
159. Physical Exertion/
160. exp Exercise Therapy/
161. exp Electric Stimulation Therapy/
162. Transcutaneous Electric Nerve Stimulation/
163. pulsed electro magnetic field.mp.
164. pulsed electromagnetic field.tw.
165. Electromagnetic Fields/
166. Magnetic Field Therapy/
167. Electric Stimulation/
168. exp Orthotic Devices/
169. kinesiotaping.tw.
170. tapering.tw.
171. oral splints.tw.
172. Occclusal Splints/
173. pillow?.tw.
174. collar?.tw.
175. Traction/
176. traction.tw.
177. exp Laser Therapy/
178. laser therapy.tw.
179. exp Rehabilitation/
180. Ultrasonic Therapy/
181. exp Phototherapy/
182. Lasers/
183. exp Physical Therapy Modalities/
184. repetitive magnetic stimulation.tw.
185. exp Cryotherapy/
186. Hydrotherapy/
187. exp Hyperthermia, Induced/
188. vapocoolant spray.mp.
189. Cryoanesthesia/
190. ice/
191. posture* correction.mp.
192. feldenkrais.mp.
193. (alexander adj (technique or method)).tw.
194. Relaxation Therapy/
195. Biofeedback, Psychology/
196. faradic stimulation.mp.
197. or/157-196
198. 136 and 197
199. 143 or 156 or 198
200. animals/ not (animals/ and humans/)
201. 199 not 200
202. guidelines as topic/
203. practice guidelines as topic/
204. guideline.pt.
205. practice guideline.pt.
206. (guideline? or guidance or recommendations).ti.
207. consensus.ti.
208. or/202-207
209. 201 and 208
210. 136 and 208
211. 209 or 210
212. limit 211 to yr="2006 -Current"
213. limit 211 to yr="1902 - 2005"
214. meta-analysis/
215. exp meta-analysis as topic/
216. (meta analy* or metaanaly* or met analy* or metanaly*).tw.
217. review literature as topic/
218. (collaborative research or collaborative review* or collaborative overview*).tw.
219. (integrative research or integrative review* or integrative overview*).tw.
220. (quantitative adj3 (research or review* or overview*)).tw.
221. (research integration or research overview*).tw.
222. (systematic adj3 (review* or overview*)).tw.
223. (methodologic* adj3 (review* or overview*)).tw.
224. exp technology assessment biomedical/
225. (hta or thas or technology assessment*).tw.
226. ((hand adj2 search*) or (manual* adj search*)).tw.
227. ((electronic adj database*) or (bibliographic* adj database*)).tw.
228. ((data adj2 abstract*) or (data adj2 extract*)).tw.
229. (analys* adj3 (pool or pooled or pooling)).tw.
230. mantel haenszel.tw.
231. (cochrane or pubmed or pub med or medline or embase or psycinfo or psyclit or psychinfo or psychlit or cinahl or science citation index).ab.
Below is an example Medline-OVID search for articles related to Manual Therapy. We only used articles published between January 2007 and November 2014

Medline-OVID
Last Update April 21, 2012
1. Neck Pain/
2. exp Brachial Plexus Neuropathies/
3. exp neck injuries/ or exp whiplash injuries/
4. cervical pain.mp.
5. neckache.mp.
6. whiplash.mp.
7. cervicodynia.mp.
8. cervicalgia.mp.
9. brachialgia.mp.
10. brachial neuritis.mp.
11. brachial neuralgia.mp.
12. neck pain.mp.
13. neck injur*.mp.
14. brachial plexus neuropath*.mp.
15. brachial plexus neuritis.mp.
16. thoracic outlet syndrome/ or cervical rib syndrome/
17. Torticollis/
18. exp brachial plexus neuropathies/ or exp brachial plexus neuritis/
19. cervico brachial neuralgia.ti,ab.
20. cervicobrachial neuralgia.ti,ab.
21. (monoradicul* or monoradicl*).tw.
22. or/1-21
23. exp headache/ and cervic*.tw.
24. exp genital diseases, female/
25. genital disease*.mp.
26. or/24-25
27. 23 not 26
28. 22 or 27
29. neck/
30. neck muscles/
31. exp cervical plexus/
32. exp cervical vertebrae/
33. atlanto-axial joint/
34. atlanto-occipital joint/
35. Cervical Atlas/
36. spinal nerve roots/
37. exp brachial plexus/
38. (odontoid* or cervical or occip* or atlant*).tw.
39. axis/ or odontoid process/
40. Thoracic Vertebrae/
41. cervical vertebrae.mp.
42. cervical plexus.mp.
43. cervical spine.mp.
44. (neck adj3 muscles).mp.
45. (brachial adj3 plexus).mp.
46. (thoracic adj3 vertebrae).mp.
47. neck.mp.
48. (thoracic adj3 spine).mp.
49. (thoracic adj3 outlet).mp.
50. trapezius.mp.
51. cervical.mp.
52. cervico*.mp.
53. 51 or 52
54. exp genital diseases, female/
55. genital disease*.mp.
56. exp *Uterus/
57. 54 or 55 or 56
58. 53 not 57
59. 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 58
60. exp pain/
61. exp injuries/
62. pain.mp.
63. ache.mp.
64. sore.mp.
65. stiff.mp.
66. discomfort.mp.
67. injur*.mp.
68. neuropath*.mp.
69. or/60
70. 59 and 69
71. Radiculopathy/
72. exp temporomandibular joint disorders/ or exp temporomandibular joint dysfunction syndrome/
73. myofascial pain syndromes/
74. exp "Sprains and Strains"/
75. exp Spinal Osteophytosis/
76. exp Neuritis/
77. Polyradiculopathy/
78. exp Arthritis/
79. Fibromyalgia/
80. spondylitis/ or discitis/
81. spondylosis/ or spondyloysis/ or spondylolisthesis/
82. radiculopathy.mp.
83. radiculitis.mp.
84. temporomandibular.mp.
85. myofascial pain syndrome*.mp.
86. thoracic outlet syndrome*.mp.
87. spinal osteophytosis.mp.
88. neuritis.mp.
89. spondylosis.mp.
90. spondylitis.mp.
91. spondylolisthesis.mp.
92. or/71-91
93. 59 and 92
94. exp neck/
95. exp cervical vertebrae/
96. Thoracic Vertebrae/
97. neck.mp.
98. (thoracic adj3 vertebrae).mp.
99. cervical.mp.
100. cervico*.mp.
101. 99 or 100
102. exp genital diseases, female/
103. genital disease*.mp.
104. exp *Uterus/
105. or/102-104
106. 101 not 105
107. (thoracic adj3 spine).mp.
108. cervical spine.mp.
109. 94 or 95 or 96 or 97 or 98 or 106 or 107 or 108
110. Intervertebral Disk/
111. (disc or discs).mp.
112. (disk or disks).mp.
113. 110 or 111 or 112
114. 109 and 113
115. herniat*.mp.
116. slipped.mp.
117. prolapse*.mp.
118. displace*.mp.
119. degenerat*.mp.
120. (bulge or bulged or bulging).mp.
121. 115 or 116 or 117 or 118 or 119 or 120
122. 114 and 121
123. intervertebral disk degeneration/ or intervertebral disk displacement/
124. intervertebral disk displacement.mp.
125. intervertebral disc displacement.mp.
126. intervertebral disk degeneration.mp.
127. intervertebral disc degeneration.mp.
128. 123 or 124 or 125 or 126 or 127
129. 109 and 128
130. 28 or 70 or 93 or 122 or 129
131. animals/ not (animals/ and humans/)
132. 130 not 131
133. exp *neoplasms/
134. exp *wounds, penetrating/
135. 133 or 134
136. 132 not 135
137. Neck Pain/rh, th [Rehabilitation, Therapy]
138. exp Brachial Plexus Neuropathies/rh, th
139. exp neck injuries/rh, th or exp whiplash injuries/rh, th
140. thoracic outlet syndrome/rh, th or cervical rib syndrome/rh, th
141. Torticollis/rh, th
142. exp brachial plexus neuropathies/rh, th or exp brachial plexus neuritis/rh, th
143. or/137-142
144. Radiculopathy/rh, th
145. exp temporomandibular joint disorders/rh, th or exp temporomandibular joint dysfunction syndrome/rh, th
146. myofascial pain syndromes/rh, th
147. exp "Sprains and Strains"/rh, th
148. exp Spinal Osteophytosis/rh, th
149. exp Neuritis/rh, th
150. Polyradiculopathy/rh, th
151. exp Arthritis/rh, th
152. Fibromyalgia/rh, th
153. spondylitis/rh, th or discitis/rh, th
154. spondylitis/rh, th or spondylolysis/rh, th or spondylolisthesis/rh, th
155. or/144-154
156. 59 and 155
157. acupuncture/ or chiropractic/
158. exp Musculoskeletal Manipulations/
159. massage.tw.
160. mobil?ation.tw.
161. Acupuncture Therapy/
162. (acupuncture or acu-puncture or needling or acupressure or mox?bustion).tw.
163. ((neck or spine or spinal or cervical or chiropractic* or musculoskeletal* or musculo-skeletal*) adj3 (adjust* or manipulat* or mobiliz* or mobilis*)).tw.
164. (manual adj therap*).tw.
165. (manipulati* adj (therap* or medicine)).tw.
166. (massag* or reflexolog* or rolfing or zone therap*).tw.
167. Nimmo.mp.
168. exp Vibration/tu [Therapeutic Use]
169. (vibration adj5 (therap* or treatment*)).tw.
170. (Chih Ya or Shiatsu or Shiatzu or Zhi Ya).tw.
171. (flexion adj2 distraction*).tw.
172. (myofascial adj3 (release or therap*)).tw.
173. muscle energy technique*.tw.
174. trigger point.tw.
175. propriocceptive Neuromuscular Facilitation*.tw.
176. cyriax friction.tw.
177. (lomilomi or lomi-lomi or trager).tw.
178. aston patterning.tw.
179. (strain adj counterstrain).tw.
180. (craniosacral therap* or cranio-sacral therap*).tw.
181. (amma or ammo or effleurage or petrissage or hacking or tapotment).tw.
182. Complementary Therapies/
183. ((complement* or alternat* or osteopthic*) adj (therap* or medicine)).tw.
184. (Tui Na or Tuina).tw.
185. or/157-184
186. 136 and 185
187. 143 or 156 or 186
188. animals/ not (animals/ and humans/)
189. 187 not 188
190. exp randomized controlled trials as topic/
191. randomized controlled trial.pt.
192. controlled clinical trial.pt.
193. (random* or sham or placebo*).tw.
194. placebos/
195. random allocation/
196. single blind method/
197. double blind method/
198. ((singl* or doubl* or trebl* or tripl*) adj25 (blind* or dumm* or mask*)).ti,ab.
199. (rct or rcts).tw.
200. (control* adj2 (study or studies or trial*)).tw.
201. or/190-200
202. 189 and 201
203. limit 202 to yr="2006 -Current"
204. limit 202 to yr="1902 -Current"
205. limit 202 to yr="1902 -2005"
206. guidelines as topic/
207. practice guidelines as topic/
208. guideline.pt.
209. practice guideline.pt.
210. (guideline? or guidance or recommendations).ti.
consensus.ti.
or/206-211
189 and 212
limit 213 to yr="2006 -Current"
limit 213 to yr="1902 -2005"
meta-analysis/
exp meta-analysis as topic/
(meta analy* or metaanaly* or met analy* or metanaly*).tw.
review literature as topic/
(collaborative research or collaborative review* or collaborative overview*).tw.
(integrative research or integrative review* or integrative overview*).tw.
(quantitative adj3 (research or review* or overview*)).tw.
(research integration or research overview*).tw.
(systematic* adj3 (review* or overview*)).tw.
(methodologic* adj3 (review* or overview*)).tw.
exp technology assessment biomedical/
(hta or thas or technology assessment*).tw.
((hand adj2 search*) or (manual* adj search*)).tw.
((electronic adj database*) or (bibliographic* adj database*)).tw.
((data adj2 abstract*) or (data adj2 extract*)).tw.
(analys* adj3 (pool or pooled or pooling)).tw.
mantel haenszel.tw.
(cohane or pubmed or pub med or medline or embase or psycinfo or psyclit or psychinfo or cinahl or science citation index).ab.
or/216-233
189 and 234
limit 235 to yr="2006 -Current"
limit 235 to yr="1902 -2005"
(ac or to or po or co).fs.
(safe or safety or unsafe).tw.
(side effect* or side event*).tw.
((adverse or undesirable or harm* or injurious or serious or toxic) adj3 (effect* or event* or reaction* or incident* or outcome*)).tw.
(abnormalit* or toxicit* or complication* or consequence* or noxious or tolerabilit*).tw.
or/238-242
189 and 243
(limit 244 to yr="2006 -Current"
limit 244 to yr="1902 -2005"
limit 202 to ed=20100701-20120321
limit 213 to ed=20100701-20120321
limit 235 to ed=20100701-20120321
limit 245 to ed=20100701-20120321
APPENDIX B - Search Dates and Results

April 25, 2014
Neck Pain Modalities (Petes note: ICON Review of Reviews by Graham covered SRs up to 2010)

<table>
<thead>
<tr>
<th>Database</th>
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<th>Date conducted</th>
<th># results</th>
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<td>2010 - 2014</td>
<td>4-21-14</td>
<td>153</td>
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<td>CINAHL</td>
<td>EBSCO</td>
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<td>2010 - 2014</td>
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May 29, 2015
Update through November 2014:

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9-29-14
Education (some overlap with ICON whose search went 2000 - 2010)

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9-29-14
Cervical Orthoses (some overlap with ICON whose search went 2000 - 2010)

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<td>EMBASE</td>
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<td>2010 - current</td>
<td>9-29-14</td>
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<tr>
<td>Total</td>
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<td></td>
<td>91</td>
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APPENDIX C. Criteria for inclusion and exclusion of studies for Intervention

Systematic reviews and meta-analyses published in peer-reviewed journals will be reviewed.

Exclusions: experimental and quasi-experimental trials, cohort, case series, and cross-sectional studies, meeting abstracts, press releases, theses, non-systematic review articles, case reports, and articles that cannot be retrieved in English.

Inclusion criteria

- screening / differential diagnosis
OR
- diagnosis / classification
OR
- patient reported outcome measures related to neck pain.
OR
- measurement properties of physical impairments, or of activity limitation/participation restriction using data from a sample of patients with neck pain
AND
- adults (>=18 years old)
AND
interventions within the scope of physical therapist practice for neck pain, to include:
  - manual therapy
  - exercise
  - multimodal physical therapy treatments
  - patient education
  - physical agents
    - heat and cold
    - electrotherapeutic modalities
    - laser
    - inserted needle techniques (will attempt to specify triggerpoint dry needling vs acupuncture)
    - traction
    - ultrasound
    - orthoses (neck braces)

Exclusion criteria

We will exclude articles reporting on:
- primarily infants, children or adolescents (<18 years old)
- post surgical neck pain
- cervical vertebral fracture
- non-musculoskeletal neck pain:
  - visceral or vascular referral
  - integumentary
- topics outside the scope of physical therapist practice
- pharmacological interventions
APPENDIX D - Flow Diagram of articles leading to Intervention Recommendations.

Records identified through database searching (n = 10,059)

Grey literature and additional records identified from other sources (n = 101)

Update search (n = 1,457)

Records after duplicates removed (n = 3,564)

Records screened (n = 3,564)

Title & Abstract excluded (n = 2970)

Full-text excluded = 506
Incorrect Publication type = 120
Not / Incorrect Intervention = 238
Incorrect population = 76
Unable to obtain pdf = 3
Unable to translate = 3
Other = 66

Full-text articles assessed for eligibility (n = 594)

Articles used in Intervention Recommendations
(Some articles contributed to more than one category) (n = 60)

Manual Therapy N = 35
Exercise N = 29
Education N = 6
Physical Agents N = 8
Other N = 2

Articles used in Other Sections (n = 28)
APPENDIX E. Articles Included in Recommendations by Topic

Impairment/Function-Based Diagnosis

Prevalence


Screening for Serious Pathology


Detsky ME, McDonald DR, Baerlocher MO, Tomlinson GA, McCrory DC, Booth CM. Does this patient with headache have a migraine or need neuroimaging? Jama. 2006;296:1274-1283.


Risk Factors


Clinical Course and Prognosis


**Pathoanatomical Features / Differential Diagnosis**


**Imaging Studies**


EXAMINATION

Outcome Measures


Vernon H. The psychometric properties of the Neck Disability Index. Archives of physical medicine and rehabilitation. 2008;89:1414-1415; author reply 1415-1416.

Activity Limitation and Participation Restriction Measures:


Physical Impairment Measures


**Diagnosis / Classification**


Fritz JM, Thackeray A, Brennan GP, Childs JD. Exercise only, exercise with mechanical traction, or exercise with over-door traction for patients with cervical radiculopathy, with or without consideration of status on a previously described subgrouping rule: a randomized clinical trial. The Journal of orthopaedic and sports physical therapy. 2014;44:45-57.


Takasaki H, May S. Mechanical Diagnosis and Therapy has similar effects on pain and disability as ‘wait and see’ and other approaches in people with neck pain: a systematic review. Journal of physiotherapy. 2014;60:78-84.


**INTERVENTION**

**Neck Pain with Mobility Deficits**


Gross A, Langevin P, Burnie SJ, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. The Cochrane Library. 2015


Neck Pain with Movement Coordination Impairments


**Neck Pain with Headache**


Gross A, Langevin P, Burnie SJ, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. The Cochrane Library. 2015;


**Neck Pain with Radiating Pain**


Gross A, Langevin P, Burnie SJ, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. The Cochrane Library. 2015;


### APPENDIX F. Levels of Evidence Table*

<table>
<thead>
<tr>
<th>Level</th>
<th>Intervention/ Prevention</th>
<th>Pathoanatomic/Risk/ Clinical Course/Prognosis/ Differential Diagnosis</th>
<th>Diagnosis/Diagnostic Accuracy</th>
<th>Prevalence of Condition/Disorder</th>
<th>Exam/Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High quality SR† containing consistent findings from multiple high-quality primary sources‡</td>
<td>Systematic review of prospective cohort studies</td>
<td>Systematic review of high-quality diagnostic studies</td>
<td>Systematic review, high-quality cross-sectional studies</td>
<td>Systematic review of prospective cohort studies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-quality prospective cohort study§</td>
<td>High-quality diagnostic study with validation</td>
<td>High-quality cross-sectional study¶</td>
<td>High-quality prospective cohort study</td>
</tr>
<tr>
<td>II</td>
<td>High or acceptable quality SR, containing mostly consistent findings from generally high quality primary sources</td>
<td>Systematic review of retrospective cohort study</td>
<td>Systematic review of exploratory diagnostic studies or consecutive cohort studies</td>
<td>Systematic review of studies that allows relevant estimate</td>
<td>Systematic review of lower-quality prospective cohort studies</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Lower-quality prospective cohort study</td>
<td>High-quality exploratory diagnostic studies</td>
<td>Lower-quality cross-sectional study</td>
<td>Lower-quality prospective cohort study</td>
</tr>
<tr>
<td></td>
<td>Consistent findings from at least 1 high quality large (n&gt;100 in each arm) RCT.</td>
<td>High-quality retrospective cohort study</td>
<td>Consecutive retrospective cohort</td>
<td>Consecutive retrospective cohort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Consecutive cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consistent findings from more than one small, high quality RCT</td>
<td>Outcomes study or ecological study</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>High or acceptable quality SR, containing mostly consistent findings from moderate primary sources.</td>
<td>Lower-quality retrospective cohort study</td>
<td>Lower-quality exploratory diagnostic studies</td>
<td>Local nonrandom study</td>
<td>High-quality cross-sectional study</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>High-quality cross-sectional study</td>
<td>Nonconsecutive retrospective cohort</td>
<td></td>
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<tr>
<td></td>
<td>Mostly consistent findings from one high quality RCT or more than one moderate quality RCT</td>
<td>Case-control study</td>
<td></td>
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</tr>
<tr>
<td>IV</td>
<td>High or acceptable quality SR, where higher quality primary sources tend to favor a clear direction.</td>
<td>Case series</td>
<td>Case-control study</td>
<td></td>
<td>Lower-quality cross-sectional study</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Inconsistent findings from case controlled studies or retrospective studies, or inconsistent findings from RCTs where the higher quality trials tend to favor a clear direction (even when lower quality trials favor the opposite)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Consensus statements from content experts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*Based on a scale created by the Oxford Centre for Evidence-Based Medicine. Levels are used to evaluate the quality of evidence for clinical practice guidelines.

†SR = Systematic Review.
‡High-quality primary sources are defined by the Oxford Centre for Evidence-Based Medicine.
§High-quality prospective cohort studies are defined by the Oxford Centre for Evidence-Based Medicine.
¶High-quality cross-sectional studies are defined by the Oxford Centre for Evidence-Based Medicine.
| V | Inconsistent evidence drawn from a low rated (score of 5 or below on AMSTAR or SIGN scales) SR that may indicate the balance of evidence favoring one direction but with very low confidence, regardless of the quality of the primary sources  
Or  
Case series or individual expert opinion, or direct or indirect evidence from physiology, bench research or theoretical constructs | Individual expert opinion | Individual expert opinion | Individual expert opinion | Expert opinion |

Abbreviations: SR, systematic review; RCT, randomized clinical trial.

* Adapted from Phillips et al62 (http://www.cebm.net/index.aspx?o=1025). See also APPENDIX G.
† Systematic reviews were rated using AMSTAR or SIGN where 8 or higher received a "high", 6-7 received an "acceptable", 5-4 received a "low", and below 4 received a "very low" score. Very low quality reviews were not used.
‡ Quality of the primary sources were calibrated to "high", "moderate", "low", and "very low" levels. Results from very low quality primary sources were not used.
§ Quality cohort study includes greater than 80% follow-up.
║ High-quality diagnostic study includes consistently applied reference standard and blinding.
¶ High-quality prevalence study is a cross-sectional study that uses a local and current random sample or censuses
Weaker diagnostic criteria and reference standards, improper randomization, no blinding, and less than 80% follow-up may add bias and threats to validity.
APPENDIX G - Procedures for Assigning Levels of Evidence

- Levels of evidence were assigned based on the study design, the quality of the study, and the quality of the primary sources (if the study is a systematic review or meta-analysis), using the Levels of Evidence table (APPENDIX F).

- Quality of systematic reviews (or review of reviews) was assessed using a critical appraisal tool (AMSTAR, or the closely related SIGN II), and the review was assigned 1 of 4 overall quality ratings based on the critical appraisal results:
  - High = AMSTAR or SIGN score of 8 or better
  - Acceptable = AMSTAR or SIGN score of 6 or 7
  - Low = AMSTAR or SIGN score of 5 or 4
  - Very low = AMSTAR or SIGN score of 4 or less (Reviews scored very low were not used in this revision)

- Quality of primary sources was calibrated to a four level scale. If the quality of the primary sources were not available in the systematic review, or if the quality appraisal tool was unique or not familiar to the guideline authors, or if the quality ratings differed between reviews, the primary source was graded by the guideline authors using the GRADE system and methods described in the text. Sources receiving a rating of very low were not used in this guideline.
  - GRADE system*
    - Study starts with a "high" rating
    - Downgrades at least one level for violations of
      - risk of bias
      - precision
      - directness
      - publication bias
    - Results in 4 levels of quality of evidence
      - high
      - moderate
      - low
      - very low
  - PEDro system (http://abiebr.com/set/1-introduction-and-methodology/determining-levels-evidence)
    - high = score of 9 or better
    - moderate = score of 6-8
    - low = score of 4 or 5
    - very low = score of 3 or lower

### APPENDIX H - AMSTAR Scores

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APPENDIX I: Imaging Conditions Cited in Suspected Spine Trauma of American College of Radiology Appropriateness Criteria

Canadian Cervical Spine Rule

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