Clinical Practice Guideline for Physical Therapy Assessment and Treatment in Patients With Nonspecific Neck Pain

Jasper D. Bier, Wendy G.M. Scholten-Peeters, J. Bart Staal, Jan Pool, Maurits W. van Tulder, Emmylou Beekman, Jesper Knoop, Guus Meerhoff, Arianne P. Verhagen

J.D. Bier, MSc, Department of General Practice, Erasmus University of Rotterdam, Rotterdam, PO Box 2040, 3000CA Rotterdam, the Netherlands. Address all correspondence to Mr Bier at: j.bier@erasmusmc.nl.

W.G.M. Scholten-Peeters, PhD, Faculty of Behavioral and Movement Sciences, Vrije Universiteit Amsterdam, Amsterdam Movement Sciences, The Netherlands.

J. Bart Staal, PhD, Radboud University Medical Centre, Radboud Institute for Health Sciences, IQ Healthcare, Nijmegen, the Netherlands, and Research Group for Musculoskeletal Rehabilitation, HAN University of Applied Sciences, Nijmegen, the Netherlands.

J. Pool, PhD, Institute of Human Movement Studies, Department of Lifestyle and Health, HU University of Applied Sciences, Utrecht, the Netherlands.

M.W. van Tulder, PhD, Faculty of Earth and Life Sciences, Institute of Health Sciences, VU University Amsterdam, the Netherlands.

E. Beekman, PhD, The Research Centre for Autonomy and Participation for Persons With a Chronic Illness, Zuyd University of Applied Sciences, Heerlen, the Netherlands.

J. Knoop, PhD, The Research Centre for Autonomy and Participation for Persons With a Chronic Illness, Zuyd University of Applied Sciences.

G. Meerhoff, MSc, The Research Centre for Autonomy and Participation for Persons With a Chronic Illness, Zuyd University of Applied Sciences.

A.P. Verhagen, PhD, Department of General Practice, Erasmus University of Rotterdam, Rotterdam, the Netherlands.

[Bier JD, Scholten-Peeters WGM, Staal JB, et al. Clinical practice guideline for physical therapy assessment and treatment in patients with nonspecific neck pain. *Phys Ther.* 2018;98:162–171.]

Published Ahead of Print: December 4, 2017
Accepted: November 30, 2017
Submitted: October 28, 2016

The Royal Dutch Society for Physical Therapy (KNGF) issued a clinical practice guideline for physical therapists that addresses the assessment and treatment of patients with nonspecific neck pain, including cervical radiculopathy, in Dutch primary care. Recommendations were based on a review of published systematic reviews.

During the intake, the patient is screened for serious pathologies and corresponding patterns. Patients with cervical radiculopathy can be included or excluded through corresponding signs and symptoms and possibly diagnostic tests (Spurling test, traction/distraction test, and Upper Limb Tension Test). History taking is done to gather information about patients' limitations, course of pain, and prognostic factors (eg, coping style) and answers to health-related questions.

In case of a normal recovery (treatment profile A), management should be hands-off, and patients should receive advice from the physical therapist and possibly some simple exercises to supplement "acting as usual."

In case of a delayed/deviant recovery (treatment profile B), the physical therapist is advised to use, in addition to the recommendations for treatment profile A, forms of mobilization and/or manipulation in combination with exercise therapy. Other interventions may also be considered. The physical therapist is advised not to use dry needling, low-level laser, electrotherapy, ultrasound, traction, and/or a cervical collar.

In case of a delayed/deviant recovery with clear and/or dominant psychosocial prognostic factors (treatment profile C), these factors should first be addressed by the physical therapist, when possible, or the patient should be referred to a specialist, when necessary.

In case of neck pain grade III (treatment profile D), the therapy resembles that for profile B, but the use of a cervical collar for pain reduction may be considered. The advice is to use it sparingly: only for a short period per day and only for a few weeks.

In 2012, the Global Burden of Disease Study stated that neck pain is globally the fourth largest physical complaint with regard to years lived with a disability.[1] The estimated 1-year incidence of neck pain has been reported to vary from 10.4% to 21.3%.[2] Data from 2003 for the Dutch population 25 years old or older showed that the neck is the third most common location for musculoskeletal complaints, after the lower back and the shoulder region.[3] The total costs of spinal pain in the Netherlands in 2011 were 1.3 billion euros (1.5% of the total health care costs and 0.2% of the gross domestic product); 40% of these costs were thought to be related to neck pain, and 29% of the total costs were related to primary care, of which physical therapy is a part.[4]

Background

Definition of Neck Pain and Scope of the Guideline

Neck pain is described as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage" in the neck region, which starts at the superior nuchal line and continues down to the level of the scapular spine.[5] Neck pain includes whiplash-associated disorder, cervicogenic headache, and cervical radicular syndrome. Neck pain has been divided into 4 grades by the Neck Pain Task Force (NPTF) (Tab. 1).[6] The neck pain guideline covers neck pain grades I to III. Grades I and II include 2 specific subgroups: trauma-related neck pain (previously known as whiplash or whiplash-associated disorder) and work-related neck pain (based on a patient's statement on the cause or onset of pain).[7,8]

Clinical Course and Prognosis

In a general population, 50% to 85% of patients with neck pain will report neck pain 1 to 5 years later.[9] A Dutch cohort study of patients with neck pain in primary care found that after 1 year, 76% of the patients stated that they were fully recovered or much improved, although 47% reported that they still had (some) neck pain.[10] In about 45% of patients with acute neck pain, the pain and disability decreased in the first 6 weeks, but no further decrease occurred afterward (Figs. 1 and 2).[11] Neck pain in the working population seems to be quite persistent and takes a recurrent course; 60% to 80% of workers with neck pain will report neck pain 1 year later.[12] In the population with trauma-related neck pain, an improvement in pain and disability mainly occurs within the first 3 months following the accident.[13] A systematic review found recovery rates ranging from 16% to 99%.[14] Approximately 50% of people with neck pain continue to experience some degree of neck pain 6 to 12 months following an accident.[15,16]

Prognosis is important in the process of clinical decision making. When the prognosis for a patient is favorable, the intervention may be limited to education and advice; however, a patient with a poor prognosis may need an in-depth evaluation followed by a specific therapy or intervention.[13]

Prognostic Factors

Knowledge about prognosis and prognostic factors is essential for determining an indication for physical therapy and/or an intervention strategy. When the current course of neck pain is favorable and there are no (or only a few) negative prognostic factors there is no indication for physical therapy besides giving information and advice. When recovery is delayed and the physical therapist can influence negative prognostic factors, there may be an indication for physical therapy. Despite much research and multiple reviews, a number of predictors provide low or very low confidence or inconclusive results.[13] A large survey suggested a gap between current best evidence and actual practice in establishing a prognosis for patients with neck pain.[17] Factors frequently found to be prognostic for persistent neck pain include a history of other musculoskeletal disorders, passive coping style, and psychosocial distress.[9,12,13,15,17–19]

The KNGF issued and funded a guideline for physical therapists and manual therapists who treat patients with nonspecific neck pain and related health complaints in Dutch primary care.[20,21] Its 4 aims are to increase the uniformity and quality of health care provided by physical therapists, define the boundaries and the domain of physical therapists in relation to patients with neck pain, ensure that patients receive optimal care, and support physical therapists in making decisions about diagnostic and therapeutic interventions.

Method of Guideline Development

The guideline committee was formed in September 2013. The guideline committee consisted of neck pain experts, physical therapists, and epidemiologists. Members were chosen for their expertise on the subject and their experience in previously published guideline development committees. The first author was responsible for collecting the data and drafting the guideline. The other authors were responsible for verifying the statements made in the CPG. The CPG was developed according to the method used for physical therapy guidelines previously issued by the KNGF.[20] The method consisted of 5 phases: preparation, development, validation, implementation, and evaluation and update. This article focuses on phases 1 to 3. The AGREE II instrument was used to assist in development.[22]

We searched for studies on the prognosis for patients with neck pain, accuracy of diagnostic tests, and effectiveness of therapeutic interventions within the domains of physical therapy and manual therapy.[21,23–25] These interventions have all been described by the KNGF and are (in alphabetical order) cervical collar, cognitive behavioral treatment, dry needling, education, electrotherapy, exercise, joint mobilization, kinesiology tape, low-level laser therapy, manipulation, massage, neurodynamics, pillow, thermal agents, traction, shock wave, and workplace interventions.[25]

Best evidence was sought from recent systematic reviews, randomized controlled trials, and prospective observational studies.[20] We used recent documents from the NPTF[6–9,12,15,26–35] and the International Collaboration on Neck Pain[13,16–18,36]; recently published guidelines, such as the guideline from the Canadian Chiropractic Association and

Table 1.
Neck Pain Task Force Classification

Grade Level	Symptoms
I	Neck pain and associated disorders with no signs or symptoms suggestive of major structural pathology and no or minor interference with activities of daily living
II	No signs or symptoms of major structural pathology but major interference with activities of daily living
III	No signs or symptoms of major structural pathology but presence of neurologic signs, such as decreased deep tendon reflexes, weakness, or sensory deficits
IV	Signs or symptoms of major structural pathology; major structural pathologies include (but are not limited to) fracture, vertebral dislocation, injury to the spinal cord, infection, neoplasm, or systemic disease, including inflammatory arthropathies

the American Physical Therapy Association[37,38]; and Cochrane reviews.[39–50] Additional relevant articles were found through PubMed searches using MESH headings or free text words in combination with the central search term "neck" or "cervical."

Critical Appraisal Process

The authors appraised all included articles for quality. Articles were assessed using generally accepted and appropriate tools, such as QUADAS for diagnostic tests and PEDro for randomized controlled trials. All intervention studies were assessed as having high, unclear, or low risk of bias and subsequently appraised for quality using the Grading of Recommendations Assessment, Development and Evaluation system.[51] The levels of evidence are presented in Table 2.[51]

Evidence based on randomized controlled trials begins as high-quality evidence, but confidence in the evidence may be decreased for several reasons, including:

- Study limitations (studies have a high risk of bias)
- Inconsistency of results (studies show clinical or statistical heterogeneity)
- Indirectness of evidence (the study population differs from the target population of the guideline)
- Imprecision (too few studies or included patients, eg, < 300 patients or events)
- Reporting bias, publication bias, or a fatal flaw

Once evidence was graded, it was translated into recommendations for clinicians. When the clinical experience of the guideline committee had a role in the recommendations, this is explicitly stated. Cost-effectiveness did not influence the recommendations, and none of the guideline committee members had any conflict of interest besides working partly in primary care. The recommendations were formulated to reflect the evidence. For example, the term "is recommended" was used when evidence indicated that the intervention was effective, and the term "is not recommended" was used when evidence indicated that the intervention was not effective. In the case of weak or unclear evidence, the term "may consider" or "may be considered" was used.[52] When possible, the recommendations were stated separately for patients with trauma-related neck pain, work-related neck pain, or neck pain grade III. Table 3 contains a summary of the recommendations.

External Review by Stakeholders

After the first draft was finalized, the board of directors of the KNGF gave feedback on the guideline. This feedback did not result in any changes in the recommendations in the guideline.

The guideline then underwent an external review by stakeholders. These organizations were the Dutch Patients and Clients Federation, the Dutch Association of Manual Therapists, the Dutch General Practitioners Association, the Dutch Society for Psychosomatic Physical Therapy, the Dutch Association for Occupational Physical Therapists, the Dutch Association of Orthopedic Surgeons, the Dutch Association of Rehabilitation Physicians, the Dutch Association of Anesthesiology, and the Association of Dutch Healthcare Insurers.

Next, the KNGF issued a work field analysis, which was performed by 93 physical therapists, to review their opinion of the guideline and its feasibility through a written feedback form. A second method was used to measure the care provided by 20 physical therapists though performance indicators before and after they attended a presentation about the guideline. A focus group meeting with the latter group was held to evaluate the results and experiences. Revisions were made to the document on the basis of the feedback.

The comments from the work field analysis and an update of the search resulted in the final guideline. The guideline and the supporting documents have been published in Dutch at www.fysionet-evidencebased.nl and are accessible for members and nonmembers of the KNGF.

Results

In the Netherlands, a patient with neck pain can be referred to a physical therapist by a general practitioner or a medical specialist. The patient can also consult a physical therapist without a referral; this is called direct access to physical therapist services. The guideline was constructed according to the different phases of the physical therapist assessment: intake, physical examination, analysis, treatment, and evaluation of treatment.

Intake

During the first consultation, the patient will undergo a screening procedure to assess whether physical therapist treatment is indicated. The physical therapist first evaluates complaints and symptoms and checks for any red flags. Red flags are patterns of signs or symptoms (warning signs) that may indicate

Figure 1.
Time course of pain.

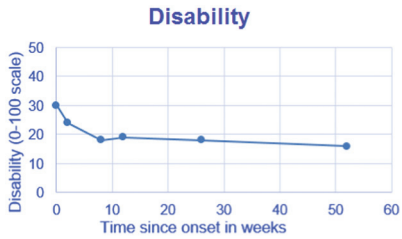

Figure 2.
Time course of disability.

serious pathology requiring further medical diagnostics. Red flags (Tab. 4) may indicate a specific pathology, such as neck pain grade IV.

The physical therapist analyzes, within the clinical reasoning process, whether the red flags are consistent with the patient's complaints on the basis of age, sex, incidence and prevalence, information on onset of complaints, and signs and symptoms. If red flags are present and not explicable by a known pattern of neck pain, then the patient must be referred to a general practitioner or return to his or her general practitioner.[53] The evidence supporting the red flags for neck pain is weak and inconsistent because many red flags are rather generic (such as unexplained weight loss) and have high false positivity rates.[29,43,54] If no red flags are present, then the diagnostic process continues with an intake.

Dutch physical therapists cannot refer patients for diagnostic imaging; this task is reserved for general practitioners or medical specialists. The use of diagnostic imaging to rule in or rule out a specific serious pathology (grade IV) has low to moderate reliability.[34] A remarkable situation in diagnostic imaging is the relatively high proportion of positive findings in people who are healthy.[55,56]

The initial aim in the diagnostic process is to identify the patient's problems by formulating an initial hypothesis about the diagnosis and further refining this hypothesis (clinical reasoning).[57] During history taking, the physical therapist gathers information about the patient's deficits in body structure and functions, limitations in daily activity, and restriction of participation. Also, it is important to gather information about the patient's environmental and personal factors that can lead to chronicity. It is known that certain psychosocial factors can negatively influence neck pain.

During the diagnostic process, the physical therapist helps the patient to structure treatment goals and health management strategies on the basis of clinical data, the patient's preferences, and professional knowledge and judgment.[58] The physical therapist tries to quantify the information from the intake, when necessary, with measurement instruments, if available. The physical therapist is advised to use the numeric pain rating scale[59,60] to quantify pain and the Patient-Specific Functional Scale[59,61] to quantify limitations in activity.

During the intake, it is important to identify possible neck pain grade III because the approach and policy are different from those for neck pain grades I and II. Possible neck pain grade III will be accompanied by certain signs and symptoms in addition to the pain[62]: sensory symptoms in the arm, such as paresthesia and numbness; sensory changes; cervical range of motion described as limited and painful; and motor disturbances, such as upper limb weakness and/or muscle atrophy.

Physical Examination

Differentiating between neck pain grades I and II and neck pain grade III can be done during the physical examination, when specific provocation or reduction tests can be used. Research has shown that the following tests are the most valid: the Upper Limb Tension Test for the nervus medianus, the Spurling test (a combination of side bending and extension of the cervical spine), and the traction/distraction test.[63] A negative Upper Limb Tension Test result is considered to be valid as a highly sensitive test (sensitivity range = 0.72–0.97; specificity range = 0.11–0.33) for ruling out cervical radiculopathy.[63,64] The Spurling test (sensitivity range = 0.90–1.00; specificity range = 0.94–1.00) and the traction/distraction test (sensitivity = 0.44; specificity range = 0.90–0.97) are considered to be valid as specific tests for ruling in cervical radiculopathy.[63–65]

Other clinical tests are not recommended in the physical examination of the neck because they vary and are not very standardized. That is why their accuracy is quite variable and overall insufficient.[34] This does not mean that physical examination should not take place. In the clinical reasoning process, the physical examination aims to further refine the diagnostic hypothesis on the basis of the findings from the intake—for example, to rule in or rule out a certain hypothesis. Furthermore, it also aims to quantify the level of physical functional limitations and to assess secondary factors that could negatively influence the recovery process. Common forms of physical examination are inspection at rest, inspection during movement, and assessment of physical functions such as joint function, muscle control, and movement patterns. In an evaluation of the validity of physical examination or provocation tests, the reliability of the procedure is also an issue. Studies evaluating the reliability of physical examination of the neck often find low to moderate reliability (kappa = 42%–82%).[66,67]

Analysis

When the physical therapist finds no reason to suspect neck pain grade IV during the intake, he or she will have to differentiate among neck pain grades I, II, and III. When neurologic signs, such as numbness, paresthesia, and muscle weakness, are found during the intake and the physical examination, the patient likely has neck pain grade III (radiculopathy). In this case, the physical

Table 2.
Quality of Evidence and Definitions

Quality Level	Definition
High	Further research is very unlikely to change our confidence in the estimate of effect
Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
Very low	Any estimate of effect is very uncertain

therapist is advised to consult the patient's general practitioner to report the findings and discuss the treatment options.

The physical therapist uses the information from history taking to analyze the pain severity, limitations in activity, and restriction of participation. On the basis of the data collected, the patient's health problem can be analyzed. When the physical therapist assumes that the patient will have delayed recovery, he or she should check for any factors that may explain the persistent nature of the neck pain episode. The physical therapist should assess whether the prognostic factors found during history taking can be influenced and/or whether therapy can be given according to the guideline. The use of questionnaires to quantify psychosocial prognostic factors may be considered.[68–71]

On the basis of the history taking and the findings of the physical examination, the physical therapist assigns a treatment profile to the patient. The guideline committee recommends the use of the following treatment profiles: profile A, neck pain grade I/II, normal course; profile B, neck pain grade I/II, delayed course without dominant psychosocial influence; profile C, neck pain grade I/II, delayed course with dominant psychosocial influence; profile D, neck pain grade III.

Treatment

For treatment profile A, the physical therapist will inform the patient about the expected course of pain and provide some take-home exercises. The physical therapist is advised to limit the treatment to 3 sessions.

For treatment profile B, the physical therapist's goals are to guide the patient to a quick return to normal daily activity and to prevent chronicity. The following treatments have, on average, a moderate level of evidence showing a positive effect, in contrast to a placebo or other treatments, and are therefore recommended: mobilization,[72] manipulation,[72–74] and exercise therapy.[75] The recommended intervention is a combination of these.[76] There is a very low level of evidence that information and education for patients with neck pain is effective, but in the opinion of the guideline committee, it is an essential part of therapy.[18,50]

A physical therapist may consider the following treatments for a patient with neck pain, preferably in addition to the recommended treatment: cognitive behavioral treatment/graded activity,[77] cervical collar for patients with neck pain grade III,[18,50] massage,[45] neurodynamics or neural tissue management,[41] pillow,[18] kinesiology tape,[78–80] thermal agents,[36] and workplace interventions.[81] The level of evidence for these treatments is low or very low. These treatments have small effects, in contrast to other treatments or placebo. The studies reporting on these treatments were of low quality, showed small effect sizes, or showed conflicting evidence.

The level of evidence for the following treatments is low or very low: dry needling,[82–84] low-level laser,[36,85,86] electrotherapy,[36,48,87] ultrasound,[36,42,87] traction,[47] and cervical collar for neck pain grades I and II.[18,50] These treatments have no effects, in contrast to other treatments or placebo. These treatments are not recommended for patients with neck pain. Studies on these interventions did not show any additional benefit over that of a placebo or another intervention.

For treatment profile C, the therapy corresponds to that for profile B. The difference is the dominant psychosocial influence (psychosocial prognostic factors). Because these factors are regarded as being "responsible" for the delayed course of the neck pain, they should be addressed prior to (or simultaneously with) the application of other interventions. A physical therapist may consider addressing these factors, when possible, or may refer a patient to a specialist, when necessary.

For treatment profile D, the therapy resembles that for profile B but differs in the use of the cervical collar. Such a collar may be considered for pain reduction in this patient population but only when used sparsely, for a short period per day for a few weeks.

Evaluation of Treatment

The treatment is ended as soon as the agreed-upon treatment goals have been achieved. Even if the goals have not been achieved, the treatment will have to be concluded at some stage. For instance, it is not useful to continue the treatment if no progress has been made after 6 weeks because the chances of achieving progress after this period are small. This scenario must be discussed explicitly with the patient before the final treatment session; the discussion should address whether the patient will be referred to a general practitioner.

The effectiveness of the treatment must be evaluated during the course of the treatment and at the final session. Besides an evaluation of the patient's goals, the use of the following measurement instruments at intake is recommended: the numeric pain rating scale for pain; the Patient-Specific Functional Scale for patient-specific complaints; and other instruments used during the intake, provided that these are suitable for evaluation. Both the numeric pain rating scale and the Patient-Specific Functional Scale have a minimal clinically important change of 2 points. This

Table 3.
Summary of Recommendations

Item	Recommendation and Quality of Evidence
Classification	It is recommended that clinicians classify patients as: Grade I: neck pain and associated disorders with no signs or symptoms suggestive of major structural pathology and no or minor interference with activities of daily living Grade II: no signs or symptoms of major structural pathology but major interference with activities of daily living Grade III: no signs or symptoms of major structural pathology but presence of neurologic signs, such as decreased deep tendon reflexes, weakness, or sensory deficits Grade IV: signs or symptoms of major structural pathology; major structural pathologies include (but are not limited to) fracture, vertebral dislocation, injury to the spinal cord, infection, neoplasm, or systemic disease, including inflammatory arthropathies *Recommendation based on expert opinion*
Exclusion of neck pain grade IV	It is recommended that clinicians use red flags as a means to identify serious pathological conditions. Red flags are indicators for serious pathological conditions. These conditions include fracture, vertebral artery dissection, spinal cord injury, cervical myelopathy, infection, neoplasm, and systemic disease. *Recommendation based on low quality of evidence*
Inclusion or exclusion of neck pain grade III	It is recommended that clinicians use the Spurling test and the traction/distraction test to rule in neck pain grade III and the upper limb tension test to rule out neck pain grade III. *Recommendation based on high quality of evidence*
Course of the pain	It is recommended that clinicians determine the course of the neck pain. For normal recovery, neck pain should decrease in the first 3 wk and limitation in daily activity should decrease in the first 6 wk. *Recommendation based on expert opinion*
Subgrouping	It is recommended that clinicians subgroup all patients (grades I–IV), when applicable, as having trauma-related neck pain or work-related neck pain. These subgroups are known to have different prognostic factors that might influence their recovery. *Recommendation based on high quality of evidence*
Prognosis	It is recommended that clinicians identify factors that might influence a delayed recovery. These factors, when modifiable, should be addressed in the course of treatment. *Recommendation based on expert opinion*
Outcome measure	It is recommended that clinicians use the numeric pain rating scale and the Patient-Specific Functional Scale to quantify a patient's baseline status relative to pain, function, and disability and to monitor a patient's status throughout the course of treatment. *Recommendation based on expert opinion*
Treatment profile	On the basis of history taking and physical examination, a patient should be assigned a treatment profile: profile A, neck pain grade I/II, normal course; profile B, neck pain grade I/II, delayed course without dominant psychosocial influence; profile C, neck pain grade I/II, delayed course with dominant psychosocial influence; profile D, neck pain grade III. *Recommendation based on expert opinion*
Intervention: cervical mobilization or manipulation combined with exercise therapy	It is recommended that clinicians primarily apply cervical mobilization or manipulation combined with exercise therapy in patients with neck pain grade I or II. *Recommendation based on high quality of evidence*
Intervention: dry needling, low-level laser, electrotherapy, ultrasound, traction, and cervical collar	It is not recommended that clinicians use dry needling, low-level laser, electrotherapy, ultrasound, or traction for patients with neck pain grades I, II, and III and cervical collar for patients with neck pain grades I and II. *Recommendation based on low quality of evidence*
Intervention: other	Clinicians may consider the use of cognitive behavioral treatment/graded activity, massage, neurodynamics or neural tissue management, pillow, kinesiology tape, thermal agents, and workplace interventions for patients with neck pain grades I, II, and III and cervical collar for patients with neck pain grade III when the primarily advised treatments are ineffective or not sufficiently effective. *Recommendation based on low quality of evidence*

Table 4.
Red Flags Per Possible Serious Pathology

Possible Pathology	Corresponding Red Flags
Fracture	Older age,[91] history of trauma,[34,91] corticosteroid use, osteoporosis[34]
Vertebral artery dissection	Cerebrovascular symptoms or signs[92]
Injury to the spinal cord or cervical myelopathy	Neurologic symptoms, eg, widespread neurologic signs in both arms or in the leg(s), such as sensory deficits or loss of muscle strength in the limbs and bowel and bladder dysfunction[34]
Infection (including urinary tract infection or skin infection)	Symptoms and signs of infection (eg, fever, night sweats), risk factors for infection (eg, underlying disease process, immunosuppression, penetrating wound, intravenous drug abuse, exposure to infectious diseases)[34]
Neoplasm	History of malignancy, failure to improve with 1 mo of treatment, unexplained weight loss,[34,38] age of > 50 y, dysphagia, headache, vomiting[34]
Systemic disease (herpes zoster, ankylosing spondylitis, inflammatory arthritis, rheumatic arthritis)	Headache, fever, unilateral skin rash, burning pain, itching[93]

cutoff is used to measure a patient's improvement.[59,88]

Discussion

Limitations of the Guideline

The CPG is primarily based on systematic reviews performed by the Cochrane network, the International Collaboration on Neck Pain, and the NPTF; this choice was made because of limitations in time and funds. Other stakeholders, including patients, were invited after the first concept was finalized. To strengthen support, it would be better to include these stakeholders at an earlier stage. In this guideline, profile C was used when recovery was delayed on the basis of psychosocial factors. No evidence was available for this choice, and no evidence that addressing these psychosocial factors will lead to recovery from neck pain is available. The same can be said for addressing other prognostic factors.

The CPG is issued for Dutch physical therapist practice. This means that only interventions that are within the professional domain of Dutch physical therapists, as defined by the KNGF, are included. The validation process also took place only in the Netherlands. Both factors may influence the international generalizability of the guideline.

Similarities to and Differences From International Guidelines

A recently updated CPG on neck pain, issued by the Orthopedic Section of the American Physical Therapy Association (APTA), shows similarities concerning treatment advice but differs in the subgrouping of patients.[89] Whereas we used grades I to IV, as advised by the NPTF, the APTA guideline uses the International Statistical Classification of Diseases and Related Health Problems. The prognostic factors can be found in both guidelines. The APTA CPG recommends more tools to appraise these constructs. Also, the APTA CPG places more emphasis on clinical prediction rules, whereas the Dutch CPG does not address these at all because they are not regarded as valid enough to be recommended. Both guidelines address the same treatments: manual therapy, exercise, multimodal treatments, education, and physical agents (dry needling, laser, ultrasound, and transcutaneous electrical nerve stimulation). The Dutch CPG for physical therapists provides less direction on the form of manipulation, exercise, or other modalities and when to use each form. Among the differences in treatment recommendations are that dry needling and laser are not recommended in the Dutch CPG.

The Ontario Protocol for Traffic Injury Management (OPTIMa) published a guideline in 2016.[90] This guideline focuses on the same grades of neck pain but limits the duration of neck pain to 6 months. In the recommendations of treatments, OPTIMa makes a distinction between 0 to 3 months and 3 to 6 months. The Dutch guideline does not make that distinction. The OPTIMa guideline also recommends the use of nonsteroidal antiinflammatory drugs, electrotherapy, acupuncture, and botulin toxin injections. These treatments are not regarded as physical therapist treatments in the Netherlands. Two differences in recommended treatments are that laser is a treatment for consideration in the OPTIMa guideline, but the Dutch guideline advises against its use. Also, the use of a cervical collar may be considered in the Dutch guideline but not in the OPTIMa guideline.

This CPG is available in full (in Dutch) at www.fysionet-evidencebased.nl.

Author Contributions

Concept/idea/research design: J.D. Bier , E. Beekman, J. Knoop, G. Meerhoff, J. Pool, W.G.M. Scholten-Peeters, J.B. Staal, M.W. van Tulder, A.P. Verhagen
Writing: J.D. Bier, E. Beekman, J. Knoop, J. Pool, W.G.M. Scholten-Peeters, M.W. van Tulder, A.P. Verhagen
Data collection: J.D. Bier, A.P. Verhagen
Data Analysis: J.D. Bier, M.W. van Tulder, A. Verhagen
Project management: G. Meerhoff, A.P. Verhagen
Fund procurement: A.P. Verhagen
Providing participants: J. Knoop
Providing facilities//equipment: G. Meerhoff
Providing institutional liaisons: G. Meerhoff, A.P. Verhagen
Clerical/secretarial support: G. Meerhoff
Consultation (including review of manuscript before submitting): E. Beekman, J. Knoop, G. Meerhof, J. Pool, W.G.M. Scholten-Peeters, J.B. Staal, M.W. van Tulder Guideline Development Group (in alphabetical order):

Emmylou Beekman, PhD; provided earlier research, gave feedback on the clinical practice guideline (CPG).
Jasper D. Bier, MSc; secretary to the Guideline Development Group, primary author of the CPG, evaluated the studies and the level of evidence for the included studies, developed informational material for patients and physical therapists, provided education and presentations for implementation purposes.
Jesper Knoop, PhD; checked for consistency between the different documents and initiated implementation of the CPG.
Guus Meerhoff, MSc; checked for consistency between the different documents and initiated implementation of the CPG.
Jan Pool, PhD, participant in the Guideline Development Group, determined direction of the CPG, gave input to the secretary and feedback on the CPG.
Wendy G.M. Scholten-Peeters, PhD; participant in the Guideline Development Group, determined direction of the CPG, gave input to the secretary and feedback on the CPG.
J. Bart Staal, PhD; participant in the Guideline Development Group, determined direction of the CPG, gave input to the secretary and feedback on the CPG.
Maurits W. van Tulder, PhD, participant in the Guideline Development Group, determined direction of the CPG, gave input to the secretary and feedback on the CPG.
Arianne P. Verhagen, PhD; chairman of the Guideline Development Group, determined direction of the CPG, evaluated the studies and the level of evidence for the included studies, gave input to the secretary and feedback on the CPG, provided education and presentations for implementation purposes.

Funding

This study was supported by a grant from KNGF (Royal Dutch Society for Physical Therapy). The society played had no role in the content of the final guideline.

Disclosure

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest. J.D. Bier reported that his institution received a grant from KNGF (Royal Dutch Society for Physical Therapy). E. Beekman reported that she received money to travel to meetings for the study or other purposes as well as payment for writing or reviewing the manuscript from the Royal Dutch Society for Physical Therapy. No other disclosures were reported.

DOI: 10.1093/ptj/pzx118

References

1 Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380:2163–2196.

2 Hoy DG, Protani M, De R, Buchbinder R. The epidemiology of neck pain. *Best Pract Res Clin Rheumatol*. 2010;24:783–792.

3 Picavet HS, Schouten JS. Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC(3)-study. *Pain*. 2003;102:167–178.

4 National Institute for Public Health and Environment (RIVM). De kosten van zorg in 2011. www.kostenvanziekten.nl. Accessed November 29, 2017.

5 International Associaton for the Study of Pain (IASP). IASP pain terminology. IASP website. https://www.iasp-pain.org/Taxonomy. Accessed November 29, 2017.

6 Guzman J, Hurwitz EL, Carroll LJ, et al. A new conceptual model of neck pain: linking onset, course, and care—the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S14–S23.

7 Holm LW, Carroll LJ, Cassidy JD, et al. The burden and determinants of neck pain in whiplash-associated disorders after traffic collisions: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S52–S59.

8 Cote P, van der Velde G, Cassidy JD, et al. The burden and determinants of neck pain in workers: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S60–S74.

9 Carroll LJ, Hogg-Johnson S, van der Velde G, et al. Course and prognostic factors for neck pain in the general population: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S75–S82.

10 Vos CJ, Verhagen AP, Passchier J, Koes BW. Clinical course and prognostic factors in acute neck pain: an inception cohort study in general practice. *Pain Med*. 2008;9:572–580.

11 Hush JM, Lin CC, Michaleff ZA, Verhagen A, Refshauge KM. Prognosis of acute idiopathic neck pain is poor: a systematic review and meta-analysis. *Arch Phys Med Rehabil*. 2011;92:824–829.

12 Carroll LJ, Hogg-Johnson S, Cote P, et al. Course and prognostic factors for neck pain in workers: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S93–S100.

13 Walton DM, Carroll LJ, Kasch H, et al. An overview of systematic reviews on prognostic factors in neck pain: results from the International Collaboration on Neck Pain (ICON) Project. *Open Orthop J*. 2013;7:494–505.

14 Walton D. A review of the definitions of "recovery" used in prognostic studies on whiplash using an ICF framework. *Disabil Rehabil*. 2009;31:943–957.

15 Carroll LJ, Holm LW, Hogg-Johnson S, et al. Course and prognostic factors for neck pain in whiplash-associated disorders (WAD): results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S83–S92.

16 Walton DM, Macdermid JC, Taylor T; ICON. What does 'recovery' mean to people with neck pain? Results of a descriptive thematic analysis. *Open Orthop J*. 2013;7:420–427.

17 Walton DM, Macdermid JC, Santaguida PL, Gross A, Carlesso L, Icon. Results of an international survey of practice patterns for establishing prognosis in neck pain: the ICON Project. *Open Orthop J*. 2013;7:387–395.

18 Gross AR, Kaplan F, Huang S, et al. Psychological care, patient education, orthotics, ergonomics and prevention strategies for neck pain: a systematic overview update as part of the ICON Project. *Open Orthop J*. 2013;7:530–561.

19 Walton DM, Macdermid JC, Giorgianni AA, Mascarenhas JC, West SC, Zammit CA. Risk factors for persistent problems following acute whiplash injury: update of a systematic review and meta-analysis. *J Orthop Sport Phys Ther*. 2013;43:31–43.

20 van der Wees PJ, Hendriks HJM, Heldoorn M, Custers JWH, de Bie RA. Methode voor Ontwikkeling, Implementatie en Bijstelling van KNGF-Richtlijnen. Amersfoort/Maastricht, the Netherlands: Royal Dutch Society for Physical Therapy (KNGF); 2007. https://www.fysionet-evidencebased.nl/index.php/wcf-projecten?task=callelement&format=raw&item_id=252&element=cb421be0-0068c-4444c-ad94-519bc296ec0e&method=download. Accessed November 29, 2017.

21 de Vries C, Hagenaars L, Kiers H, Schmitt M. Beroepsprofiel Fysiotherapeut. Amersfoort, the Netherlands: Royal Dutch Society for Physical Therapy (KNGF); 2014. https://www.kngf.nl/binaries/content/assets/kngf/onbeveiligd/vakgebied/vakinhoud/beroepsprofielen/2014-01_kngf_beroepsprofiel-ft_20131230_2.pdf. Accessed November 29, 2017.

22 Brouwers MC, Kho ME, Browman GP, et al. AGREE II: advancing guideline development, reporting, and evaluation in health care. *Prev Med*. 2010;51:421–424.

23 *The Professional Profile of the Physical Therapist*. Amersfoort, the Netheralnds: Dutch Royal Society for Physical Therapy (KNGF); 2006. https://azslide.com/the-professional-profile-of-the-physical-therapist_5969ffeb1723dd0efde2c671.html. Accessed November 29, 2017.

24 Bot M, Maas R, van Dolder R, Boeve C, Weerman P, Coppoolse R. *Beroepscompetentieprofi el Manueel Therapie*. Dutch Association for Manual Therapy (NVMT) website. http://archief.nvmt.fysionet.nl/bcp0912.pdf. Published 2009. Accessed November 29, 2017.

25 Royal Dutch Society for Physical Therapy (KNGF). *Overzicht van de Formeel Door Het KNGF Ingenomen Standpunten Ten Aanzien van Therapieën*. Published 2013. Updated April 1, 2014. KNGF website. https://www.kngf.nl/binaries/content/assets/kngf/onbeveiligd/kngf/missie-visie/standpunten/kngf-standpunten-ten-aanzien-van-therapieen0916.pdf. Accessed November 29, 2017.

26 Carroll LJ, Cassidy JD, Peloso PM, et al. Methods for the best evidence synthesis on neck pain and its associated disorders: the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S33–S38.

27 Balague F. The Bone and Joint Decade (2000–2010) Task Force on Neck Pain and Its Associated Disorders: a clinician's perspective. *J Manip Physiol Ther.* 2009;32(2 suppl):S5–S6.

28 Carragee EJ, Hurwitz EL, Cheng I, et al. Treatment of neck pain: injections and surgical interventions—results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S153–S169.

29 Haldeman S, Carroll LJ, Cassidy JD, et al. Research priorities and methodological implications: the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S214–S220.

30 Guzman J, Haldeman S, Carroll LJ, et al. Clinical practice implications of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders: from concepts and findings to recommendations. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S199–S213.

31 Haldeman S, Carroll LJ, Cassidy JD; Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. The empowerment of people with neck pain: introduction—the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S8–S13.

32 Hogg-Johnson S, van der Velde G, Carroll LJ, et al. The burden and determinants of neck pain in the general population: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S39–S51.

33 Hurwitz EL, Carragee EJ, van der Velde G, et al. Treatment of neck pain: noninvasive interventions—results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S123–S152.

34 Nordin M, Carragee EJ, Hogg-Johnson S, et al. Assessment of neck pain and its associated disorders: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S101–S122.

35 Reardon R, Haldeman S; Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. Self-study of values, beliefs, and conflict of interest: the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine (Phila Pa 1976)*. 2008;33(4 suppl):S24–S32.

36 Graham N, Gross AR, Carlesso LC, et al. An ICON overview on physical modalities for neck pain and associated disorders. *Open Orthop J.* 2013;7:440–460.

37 Bryans R, Decina P, Descarreaux M, et al. Evidence-based guidelines for the chiropractic treatment of adults with neck pain. *J Manip Physiol Ther.* 2014;37:42–63.

38 Childs JD, Cleland JA, Elliott JM, et al. Neck pain: clinical practice guidelines linked to the International Classification of Functioning, Disability and Health from the Orthopedic Section of the American Physical Therapy Association. *J Orthop Sports Phys Ther.* 2008;38:A1–A34.

39 Verhagen AP, Scholten-Peeters GG, van Wijngaarden S, de Bie RA, Bierma-Zeinstra SM. Conservative treatments for whiplash. *Cochrane Database Syst Rev.* 2007;(2):CD003338.

40 Gross A, Forget M, St George K, et al. Patient education for neck pain. *Cochrane Database Syst Rev.* 2012;(3):CD005106.

41 Gross A, Miller J, D'Sylva J, et al. Manipulation or mobilisation for neck pain. *Cochrane Database Syst Rev.* 2010;(1):CD004249.

42 Griffin XL, Smith N, Parsons N, Costa ML. Ultrasound and shockwave therapy for acute fractures in adults. *Cochrane Database Syst Rev.* 2012;(2):CD008579.

43 Williams CM, Henschke N, Maher CG, et al. Red flags to screen for vertebral fracture in patients presenting with low-back pain. *Cochrane Database Syst Rev.* 2013;(1):CD008643.

44 Aas R, Tuntland H, Holte K, et al. Workplace interventions for neck pain in workers. *Cochrane Database Syst Rev.* 2011;(4):CD008160.

45 Patel KC, Gross A, Graham N, et al. Massage for mechanical neck disorders. *Cochrane Database Syst Rev.* 2012;(9):CD004871.

46 Trinh K, Graham N, Gross A, et al. Acupuncture for neck disorders. *Cochrane Database Syst Rev.* 2006;(3):CD004870.

47 Graham N, Gross A, Goldsmith CH, et al. Mechanical traction for neck pain with or without radiculopathy. *Cochrane Database Syst Rev.* 2008;(3):CD006408.

48 Kroeling P, Gross A, Graham N, et al. Electrotherapy for neck pain. *Cochrane Database Syst Rev.* 2013;(8):CD004251.

49 Verhagen AP, Karels C, Bierma-Zeinstra SM, et al. Ergonomic and physiotherapeutic interventions for treating work-related complaints of the arm, neck or shoulder in adults. *Cochrane Database Syst Rev.* 2006;(3):CD003471.

50 Kay TM, Gross A, Goldsmith CH, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev.* 2012;(8):CD004250.

51 Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ. 2008;336:924–926.

52 Schünemann H, Brozek J, Guyatt G, Oxman A. GRADE handbook. https://gdt.gradepro.org/app/handbook/handbook.html. Updated October 2013. Accessed November 28, 2017.

53 Heerkens YF, Hendriks HJM, de Graaf-Peters VB. Fysiotherapeutische verslaglegging. *Ned Tijdschr voor Fysiother.* 2011;121. Supplement to *Nederlands tijdschrift voor Fysiotherapie*. http://www.kngfrichtlijnen.nl/index.php/component/kngf/?task=article.download&doc=fys_versl_praktijkrichtlijn9741381220529.pdf. Accessed November 29, 2017.

54 Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report. *Chiropr Osteopat.* 2010;18:3.

55 Boden SD, McCowin PR, Davis DO, Dina TS, Mark AS, Wiesel S. Abnormal magnetic-resonance scans of the cervical spine in asymptomatic subjects: a prospective investigation. *J Bone Joint Surg Am.* 1990;72:1178–1184.

56 Matsumoto M, Fujimura Y, Suzuki N, et al. MRI of cervical intervertebral discs in asymptomatic subjects. *J Bone Joint Surg Br.* 1998;80:19–24.

57 Engelbert R, Wittink H. *Klinisch Redeneren Volgens de HOAC II*. Uitgeverij, the Netherlands: Bohn Stafleu van Loghum; 2010.

58 Edwards I, Jones M, Carr J, Braunack-Mayer A, Jensen GM. Clinical reasoning strategies in physical therapy. *Phys Ther.* 2004;84:312–315.

59 Cleland JA, Childs JD, Whitman JM. Psychometric properties of the Neck Disability Index and numeric pain rating scale in patients with mechanical neck pain. *Arch Phys Med Rehabil.* 2008;89:69–74.

60 Holdgate A, Asha S, Craig J, Thompson J. Comparison of a verbal numeric rating scale with the visual analogue scale for the measurement of acute pain. *Emerg Med.* 2003;15:441–446.

61 Pietrobon R, Coeytaux RR, Carey TS, Richardson WJ, DeVellis RF. Standard scales for measurement of functional outcome for cervical pain or dysfunction: a systematic review. *Spine (Phila Pa 1976)*. 2002;27:515–522.

62 Rodine RJ, Vernon H. Cervical radiculopathy: a systematic review on treatment by spinal manipulation and measurement with the Neck Disability Index. *J Can Chiropr Assoc.* 2012;56:18–28.

63 Rubinstein SM, Pool JJ, van Tulder MW, Riphagen II, de Vet HC. A systematic review of the diagnostic accuracy of provocative tests of the neck for diagnosing cervical radiculopathy. *Eur Spine J.* 2007;16:307–319.

64 Cook C, Hegedus E. Diagnostic utility of clinical tests for spinal dysfunction. *Man Ther.* 2011;16:21–25.

65 Shabat S, Leitner Y, David R, Folman Y. The correlation between Spurling test and imaging studies in detecting cervical radiculopathy. *J Neuroimaging.* 2012;22:375–378.

66 Lucas N, Macaskill P, Irwig L, Moran R, Bogduk N. Reliability of physical examination for diagnosis of myofascial trigger points: a systematic review of the literature. *Clin J Pain.* 2009;25:80–89.

67 van Trijffel E, Anderegg Q, Bossuyt PM, Lucas C. Inter-examiner reliability of passive assessment of intervertebral motion in the cervical and lumbar spine: a systematic review. *Man Ther.* 2005;10:256–269.

68 Vlaeyen JWS, Kole-Snijders AMJ, Rotteveel AM, Ruesink R, Heuts P. The role of fear of movement (re)injury in pain disability. *J Occup Rehabil.* 1995;5: 235–252.

69 Cleland JA, Fritz JM, Childs JD. Psychometric properties of the Fear-Avoidance Beliefs Questionnaire and Tampa Scale of Kinesiophobia in patients with neck pain. *Am J Phys Med Rehabil.* 2008;87:109–117.

70 Terluin B, van Marwijk HW, Adèr HJ, et al. The Four-Dimensional Symptom Questionnaire (4DSQ): a validation study of a multidimensional self-report questionnaire to assess distress, depression, anxiety and somatization. *BMC Psychiatry.* 2006;6:34.

71 Terluin B, Smits N, Miedema B. The English version of the four-dimensional symptom questionnaire (4DSQ) measures the same as the original Dutch questionnaire: a validation study. *Eur J Gen Pract.* 2014;20:320–326.

72 Gross A, Langevin P, Burnie SJ, et al. Manipulation and mobilisation for neck pain contrasted against an inactive control or another active treatment. *Cochrane Database Syst Rev.* 2015;(9):CD004249.

73 Michaleff ZA, Ferreira ML. Physiotherapy rehabilitation for whiplash associated disorder II: a systematic review and meta-analysis of randomised controlled trials. *Br J Sports Med.* 2012;46:662–663.

74 Driessen MT, Lin CW, van Tulder MW. Cost-effectiveness of conservative treatments for neck pain: a systematic review on economic evaluations. *Eur Spine J.* 2012;21:1441–1450.

75 Gross A, Kay TM, Paquin J-P, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev.* 2015;(1):CD004250.

76 Miller J, Gross A, D'Sylva J, et al. Manual therapy and exercise for neck pain: a systematic review. *Man Ther.* 2010;15:334–354.

77 Monticone M, Cedraschi C, Ambrosini E, et al. Cognitive-behavioural treatment for subacute and chronic neck pain. *Cochrane Database Syst Rev.* 2015;(5):CD010664.

78 Taylor RL, O'Brien L, Brown T. A scoping review of the use of elastic therapeutic tape for neck or upper extremity conditions. *J Hand Ther.* 2014;27:235–246.

79 Vanti C, Bertozzi L, Gardenghi I, Turoni F, Guccione AA, Pillastrini P. Effect of taping on spinal pain and disability: systematic review and meta-analysis of randomized trials. *Phys Ther.* 2015;95:493–506.

80 Morris D, Jones D, Ryan H, Ryan CG. The clinical effects of Kinesio(R) Tex taping: a systematic review. *Physiother Theory Pract.* 2013;29:259–270.

81 Hoe VC, Urquhart DM, Kelsall HL, Sim MR. Ergonomic design and training for preventing work-related musculoskeletal disorders of the upper limb and neck in adults. *Cochrane Database Syst Rev.* 2012;(8):CD008570.

82 Cagnie B, Castelein B, Pollie F, Steelant L, Verhoeyen H, Cools A. Evidence for the use of ischemic compression and dry needling in the management of trigger points of the upper trapezius in patients with neck pain: a systematic review. *Am J Phys Med Rehabil.* 2015;94:573–583.

83 Ong J, Claydon LS. The effect of dry needling for myofascial trigger points in the neck and shoulders: a systematic review and meta-analysis. *J Bodyw Mov Ther.* 2014;18:390–398.

84 Mejuto-Vazquez MJ, Salom-Moreno J, Ortega-Santiago R, Truyols-Dominguez S, Fernandez-de-Las-Penas C. Short-term changes in neck pain, widespread pressure pain sensitivity, and cervical range of motion after the application of trigger point dry needling in patients with acute mechanical neck pain: a randomized clinical trial. *J Orthop Sports Phys Ther.* 2014;44:252–260.

85 Gross AR, Dziengo S, Boers O, et al. Low level laser therapy (LLLT) for neck pain: a systematic review and meta-regression. *Open Orthop J.* 2013;7:396–419.

86 Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials. *Lancet.* 2009;374:1897–1908.

87 Jeon JH, Jung YJ, Lee JY, et al. The effect of extracorporeal shock wave therapy on myofascial pain syndrome. *Ann Rehabil Med.* 2012;36:665–674.

88 Pool JJ, Ostelo RW, Hoving JL, Bouter LM, de Vet HC. Minimal clinically important change of the Neck Disability Index and the Numerical Rating Scale for patients with neck pain. *Spine (Phila Pa 1976).* 2007;32:3047–3051.

89 Blanpied PR, Gross AR, Elliott JM, et al. Neck pain: revision 2017. *J Orthop Sports Phys Ther.* 2017;47:A1–A83.

90 Côté P, Wong JJ, Sutton D, et al. Management of neck pain and associated disorders: a clinical practice guideline from the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Eur Spine J.* 2016;25:2000–2022.

91 Stiell IG, Clement CM, O'Connor A, et al. Multicentre prospective validation of use of the Canadian C-Spine Rule by triage nurses in the emergency department. *CMAJ.* 2010;182:1173–1179.

92 Silbert PL, Mokri B, Schievink WI. Headache and neck pain in spontaneous internal carotid and vertebral artery dissections. *Neurology.* 1995;45:1517–1522.

93 Dworkin RH, Johnson RW, Breuer J, et al. Recommendations for the management of herpes zoster. *Clin Infect Dis.* 2007;44(Suppl 1):S1–S26.