

Invited Topical Review

Physiotherapy management of neck pain

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KEY WORDS

Neck pain
Physical therapy
Literature review

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Introduction

Neck pain is defined as pain in the neck with or without pain referred into one or both upper limbs that lasts for at least 1 day.^{1,2} In 2008, the Task Force on Neck Pain defined the anatomical region of neck pain (Figure 1).³ This anatomical definition was developed based on consensus because the Task Force found more than 300 case definitions for neck pain. People with neck pain may also have accompanying headache or shoulder pain, but neck pain is the primary complaint.

Categorisation

In 2008, the Task Force on Neck Pain proposed a classification of people with neck pain into four categories.³ This classification is based on the Quebec Task Force classification of whiplash.⁴ The only difference between both classifications is that the Quebec Task Force also defined a Grade 0, which means that there was a trauma present but no pain. In the Task Force on Neck Pain classification, Grade I to III neck pain is regarded as non-specific neck pain (Table 1).³ Grade I and II neck pain are distinguished by the amount of interference with activities of daily living. A person with Grade III neck pain (also called cervical radiculopathy) also has objective neurologic signs (such as decreased deep tendon reflexes, weakness or sensory deficits) and positive findings on provocation and reduction tests. People with Grade IV neck pain suffer from major pathologies, and this grade corresponds with specific neck pain.

Incidence and prevalence

In the Global Burden of Disease study, out of the 291 conditions studied, neck pain was found to rank 21st in terms of overall burden and fourth in terms of overall disability; therefore, neck pain is a serious public health problem in the general population.^{1,2} Among all musculoskeletal disorders, low back pain (ranked first) and neck pain (ranked fourth) are the most common worldwide. Nevertheless, the amount of research involving people with low back pain greatly outweighs that involving people with neck pain.²

In 2017, the Global Burden of Disease study calculated that neck pain had: an age-standardised point prevalence of 3,551/100,000 people, with a 95% uncertainty interval (UI) from 3,140 to 3,978; and an annual incidence of 807/100,000 people (95% UI 714 to 913).² Both the incidence and prevalence of neck pain increased with age and were greater among females than males. The prevalence of neck pain did not change substantially between 1990 and 2010.² Up to 70% of people can expect to experience some neck pain in their lifetime, although in most cases neck pain will not seriously interfere with daily activities and participation.^{2,3,5}

The incidence of serious pathology (Grade IV) is low, up to 2% in referred patients,¹ while the incidence of cervical radiculopathy (Grade III) ranges from 6.3 to 21 per 10,000 people.⁶ This wide range is due to variation in the definitions of 'radiating or radicular symptoms' that are used in practice and research.^{6,7} Often the definition is not limited to 'the presence of neurological signs or sensory deficits' but includes only radiating symptoms. According to the Task Force on Neck Pain, these patients cannot be regarded as having a Grade III neck pain. The vast majority of patients have Grade I or II neck pain, often estimated to be > 90% of patients.¹

There are several factors that indicate an increased risk of developing neck pain. The most important of these prognostic factors are: trauma, work-related factors (low job satisfaction, poor perceived work support, high work stress levels), psychological factors (self-perceived depression, poor psychological health) and smoking.^{8–10} Degeneration of the cervical disc does not appear to be a risk factor.⁸ The economic burden of neck pain has not been evaluated extensively.^{1,2}

Diagnosis and assessment

The diagnostic process within physiotherapy practice consists of history taking, physical examination and, if deemed necessary, (referral for) diagnostic imaging. The aim of history taking is to find information that informs the patient's prognosis and whether the patient belongs to a subgroup that warrants a different management strategy. History taking leads to an initial hypothesis, which can be

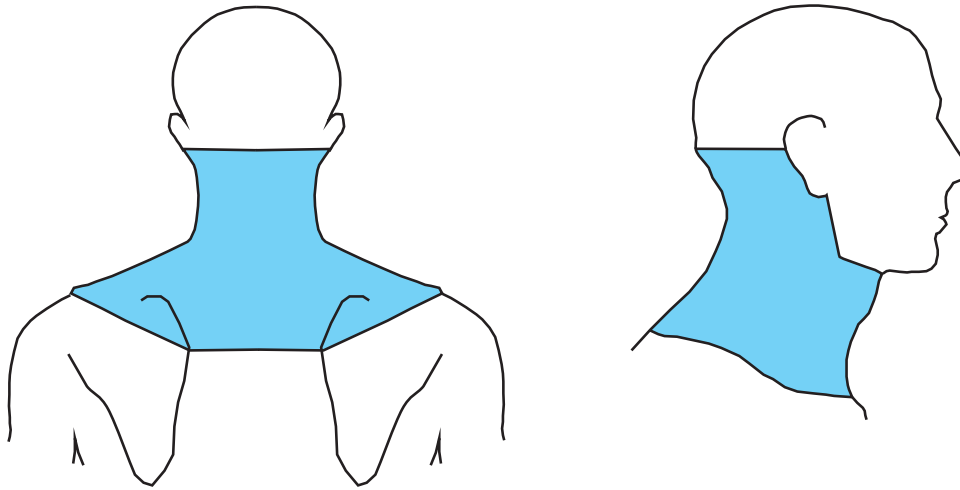


Figure 1. Posterior and lateral views of the anatomic region of the neck used in the Task Force on Neck Pain definition of neck pain.³

confirmed or excluded via physical examination (or diagnostic imaging). A flow chart of the diagnostic process is presented in Figure 2.

Red flags

First, a physiotherapist has to rule out serious pathology or red flags. Red flags are patterns of signs or symptoms (warning signals) that may indicate serious pathology requiring further medical diagnostic procedures.

The most well-known screening methods for a fracture among patients with neck pain after trauma are the Canadian cervical spine rule (C-Spine) and the National Emergency X-Radiography Utilization Study (NEXUS).^{11,12} According to a systematic review, the sensitivity of both methods is high; therefore, for patients with a negative result for either screening method, the possibility of fracture could reliably be excluded (high Sensitivity and a Negative test rules Out the diagnosis; SnNOut).¹¹ No red flags for a malignancy have been evaluated.

Other known screening tests are tests for higher cervical (ligament) instability or arteria vertebralis insufficiency. The aim of these tests is to identify patients at high risk of a serious complication when receiving cervical spinal manipulation. However, these screening methods have been poorly researched and to date have not been validated.^{13,14} Despite this, most guidelines for manual therapists and chiropractors recommend performing these screening tests.^{15,16}

History taking

The next step in the diagnostic process is to look at prognostic and differentiating factors in order to make an estimation of the patient's prognosis or subgroup, relevant to the management strategy (Figure 2).

Table 1
Grades of neck pain defined by the Task Force on Neck Pain.³

Grade	Explanation
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 in the upper extremity
IV	Signs or symptoms of major structural pathology, which include (but are not limited to) fracture, vertebral dislocation, injury to the spinal cord, infection, neoplasm, or systemic disease including inflammatory arthropathies

Historically patients with trauma-related neck pain (previously called a whiplash or a whiplash-associated disorder) are regarded as a subgroup of patients with neck pain. The distinguishing characteristic is that they have experienced a trauma (often a car accident). Greater severity of pain at baseline or at consultation is associated with a poorer prognosis.^{17,18}

Patients with work-related neck pain (ie, neck pain due to work that decreases on the weekend or during periods off work) are also regarded as a subgroup of patients with neck pain, as they seem to have a poorer prognosis.^{17,19} There is a wide variety of work-related prognostic factors that have shown to be related to this poorer prognosis.

To date, it is unclear whether patients with cervicogenic headache (ie, headache that typically develops after neck pain and is often exacerbated by neck movements) are a subgroup of headache patients or neck pain patients.²⁰⁻²² Unfortunately, data on prognosis and prognostic factors for this subgroup are lacking.

In the literature, there is no consensus regarding the classification of patients with or without cervical radiculopathy on the basis of symptoms and neurological investigation, except that the patients have pain radiating to the arm, often following a radicular pattern.^{6,7} According to the definition of the Task Force on Neck Pain, these patients have neurological symptoms or sensory deficits (such as sensory loss or altered reflexes).³ One small study showed that a loss of sensation and pain radiating to the elbow both have a high specificity and can therefore be used to diagnose (or rule in) a cervical radiculopathy (high Specificity and a Positive test rules In the diagnosis; SpIn).²³ Having radiating symptoms without these neurological symptoms and sensory deficits is regarded as Grade II neck pain. The prognosis of patients with cervical radiculopathy is favourable; the majority of patients recover within 4 to 6 months.²⁴ The categories discussed above (eg, trauma-related neck pain, cervicogenic headache, neck pain with radiculopathy and work-related neck pain) are similar to the categories in the clinical practice guideline by Blanpied et al (neck pain with movement control disorders (including whiplash-associated disorders), neck pain with headaches, neck pain with radiating pain, and neck pain with mobility deficit).²²

Physical examination

Physical examination may consist of inspection of the posture, palpation, measuring the range of motion, measuring muscle strength, testing reflexes, testing sensation and specific tests. The choice of which of these physical examination procedures will be performed depends on the findings from the history taking and whatever diagnosis or diagnoses those findings suggest. The aim of physical examination is to confirm or rule out that initial diagnosis.

Unfortunately, little is known regarding the diagnostic value of general physical examination for patients with neck pain. There is

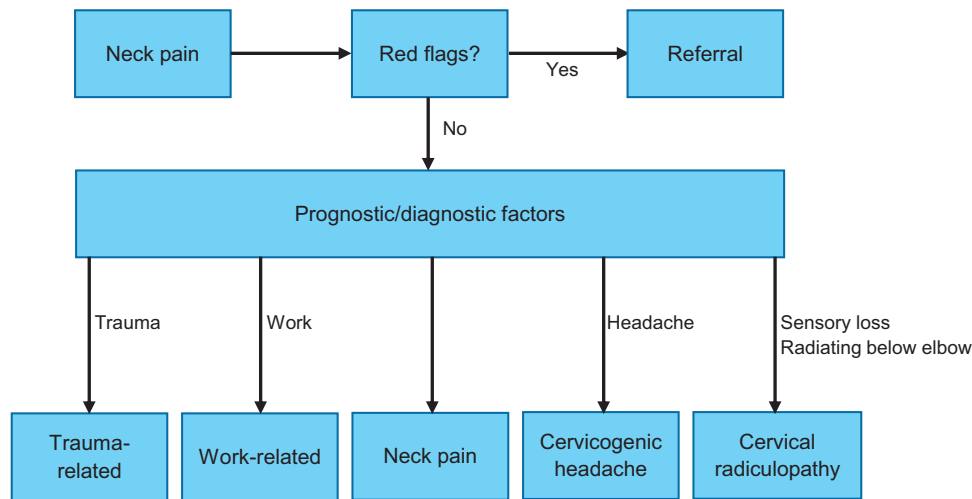


Figure 2. Flow chart of the diagnostic process.

also no information on the diagnostic value of specific tests to differentiate between neck pain patients and patients with trauma-related neck pain, work-related neck pain or cervicogenic headache. To confirm or rule out the initial diagnosis of cervical radiculopathy, guidelines advise specific tests.²⁵ The most well-known specific tests are: Spurling's test, the traction test, the Upper Limb Tension Test and the shoulder abduction test. Several studies show that the Spurling's test and the traction test both have a relatively high specificity. Specificity varies from 89 to 100% for Spurling's test and from 90 to 97% for the traction test.^{26,27} Therefore, both tests seem useful to confirm the initial hypothesis (SpPIn). On the other hand, the Upper Limb Tension Test can be used to rule out a cervical radiculopathy due to a high sensitivity varying from 87 to 93% (SnNOut).²⁶ The reproducibility of the specific tests (reported as a kappa value) ranges from 13 to 93%.²⁷ Although neurological testing of dermatomes and myotomes is recommended, its diagnostic validity has not been assessed.

Clinical prediction rules

Many clinical prediction rules exist, although most of them have been developed using unsatisfactory methods or have not been validated.²⁸ A systematic review found a total of 99 prediction models for neck pain or trauma-related neck pain, of which three were promising enough for use in physiotherapy and other primary care settings.²⁸ One of the promising models was developed for people with neck pain, and two specifically for people with trauma-related neck pain.²⁹⁻³¹ A consistent factor related to high likelihood of recovery included in all three models was age (< 35 years). Low initial disability score (< 32%, assessed with the Neck Disability Index) seemed relevant for the trauma-related neck pain models only.²⁸

The Keele Subgroup Targeted Treatment (STarT) Back Screening Tool was initially developed for people with acute low back pain, but was recently modified and validated for people with neck pain.³² It aims to stratify people with neck pain into low, medium and high risk for chronic complaints combined with a targeted treatment for each category, but the predictive validity is low.

Diagnostic imaging

Various guidelines recommend not to refer people with neck pain to imaging. Despite this, diagnostic imaging is sometimes used to confirm or rule out a specific pathology – most often a cervical radiculopathy (cervical disc herniation). The sensitivity and specificity of various imaging techniques varies from 27 to 96%.³³ Ruling out a fracture can best be done using a computed tomography (CT) scan, which has a sensitivity of 96 to 99%.³⁴ Specific magnetic resonance imaging (MRI) techniques seem to be valid for diagnosing a cervical disc herniation, with sensitivity and specificity between 95 and 97%.³⁵

However, imaging is usually discouraged unless there is severe trauma,³⁶ mainly because diagnostic imaging also produces a high number of false positives. In a study with 1,211 relatively healthy and asymptomatic participants who received diagnostic imaging using MRI, over 87% of the participants presented with a 'bulging disc' and 5.3% with a spinal cord compression.³⁷

Prognosis and course

In 2008, the Task Force on Neck Pain estimated that 50 to 85% of people with neck pain do not make a full recovery, indicating that neck pain has an episodic and recurrent character.⁸ In addition, a systematic review found that, in people with acute neck pain, the pooled mean pain score decreased by 45% during the first 6.5 weeks, but after that no further reduction in pain was found.³⁸ In this study the prognosis was calculated based on the recovery rates from cohort studies and from participants randomised to a control arm that did not receive any treatment. The prognosis for patients with cervical radiculopathy is more favourable than for patients with neck pain without radiculopathy.²⁴

In general, several factors have been identified in the literature that are likely related to a poorer prognosis: previous episodes of neck pain, concurrent low back pain, concurrent headaches, poor health, psychological factors (such as anxiety, worry, frustration and depression) and work-related symptoms (such as low job satisfaction, high physical job demands and little influence on work situation).^{17,19,39} In contrast, younger age, an active coping style and optimistic outlook appear to be related to a favourable prognosis.¹⁷

Physiotherapy treatment

The majority of neck pain guidelines on diagnosis and treatment of patients with neck pain recommend a combination of manual therapy, exercise and education as the preferred evidence-based physiotherapy treatments.^{25,40} Massage might be beneficial (inconsistent evidence) and psychological (behavioural) treatment and multidisciplinary treatment are effective in some subgroups of patients. All other interventions lack a clear evidence base.

Education

Education is defined as a process of enabling individuals to make informed decisions about their personal health-related behaviour.⁴¹ According to a Cochrane review, patient education (or the provision of information) is regarded as an essential part of communication between the physiotherapist and the patient.⁴² Unfortunately, that review failed to show evidence that education is beneficial in the treatment of neck pain patients. A more recent systematic review

concluded that structured patient education alone is equally beneficial compared with other conservative interventions for patients with neck pain with or without traumatic origin.⁴¹ The patient educational interventions that are evaluated and recommended by the guidelines are: reassuring patients that the pain is not a serious condition; providing information on pain and prognosis, including information that imaging is not recommended; advising to stay active; and educating about self-care, exercises and (stress) coping skills.^{36,41,42}

Exercise

Physical exercises vary widely from general land-based or aquatic exercise to neck-specific endurance, strength, stretching or McKenzie exercises. The most recent Cochrane review on exercises for mechanical neck disorders found that a wide variety of exercises had been evaluated, varying from breathing exercises to strength and endurance exercises.^{43,44} In this review, the quality of the evidence was categorised as very low, low, moderate or good, according to the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) system.⁴⁵ The review concluded that when exercise was compared with no treatment or placebo, or evaluated as an additional treatment: strength, endurance and stabilising exercises were beneficial in chronic neck pain (moderate-quality evidence); only strength and endurance exercises were beneficial in chronic cervicogenic headaches (moderate-quality evidence); and there was a small benefit of stretching, strengthening and stabilisation exercises in acute cervical radiculopathy (low-quality evidence). The standardised effect sizes varied from 0.3 to 0.7 (95% CI 0.1 to 1.3), which can be regarded as small to moderate effects. There were no studies that evaluated exercises in patients with acute neck pain. A recent network meta-analysis showed that no specific exercise was found to be superior in people with chronic non-specific neck pain.⁴⁶

Several researchers have assumed that changes in motor control in the deep cervical muscles contribute to the origin or persistence of neck pain.⁴⁷ A recent systematic review aimed to investigate this hypothesis and evaluated whether motor control exercises (ie, cranio-cervical flexion exercises) are more effective than no intervention for people with chronic neck pain. The authors found clinically relevant benefits (standardised effect sizes between 0.33 and 0.58) on pain and disability.⁴⁷

Mobilisation and manipulation

Physiotherapists often offer 'manual therapy', aiming to improve spinal joint motion and restore range of motion. Manual therapy consists of various techniques, including mobilisations and manipulations. Mobilisations are defined as using low-grade/velocity, small-amplitude or large-amplitude passive movement techniques within the patient's range of motion and within the patient's control. Manipulation is defined as a localised high-velocity and low-amplitude force directed at specific cervical or thoracic spinal segments near the end of the patient's range of motion and without their control.

A Cochrane review and another systematic review both found that cervical mobilisations and manipulations were equally beneficial (moderate-quality evidence) in patients with non-specific neck pain.^{48,49} According to the Cochrane review, cervical manipulations show a small beneficial effect (low-quality evidence), but thoracic manipulations show a larger beneficial effect when compared to an inactive treatment (moderate-quality evidence), indicating that thoracic manipulations were more beneficial than cervical manipulations.⁴⁸ A more recent systematic review evaluating the effectiveness of thoracic manipulations could not confirm this finding based on two studies that directly compared cervical with thoracic manipulations.⁵⁰ That review, on the other hand, found that thoracic manipulations were more beneficial than mobilisations and standard care (very low-quality evidence) with mean differences in pain on a 100-mm visual analogue scale of 14 mm (95% CI 6 to 22) and 13 mm (95% CI 4 to 22), respectively (Figure 3, with a detailed forest plot available in Appendix 1 on the eAddenda).

Mobilisation, manipulation, advice and exercise

Mobilisations and manipulations are rarely used as a unimodal intervention; more often they are administered in combination with advice and/or exercises.^{51–53} The combined treatment of exercise and manipulations seem to be more effective (moderate-quality evidence) than exercises alone for immediate pain, but not on all other outcomes for people with neck pain (Figure 4, with a detailed forest plot available in Appendix 2 on the eAddenda).⁵² Unfortunately, the effect size is small (SMD 0.15, 95% CI 0.00 to 0.30) and there is probably not a clinically relevant benefit of adding mobilisations or manipulations to exercises.

Massage

Massage therapy is one of the oldest treatment strategies for musculoskeletal pain. It involves mobilisation and manipulation of the soft tissues of the body through touch.⁵⁴ There is a wide spectrum of techniques that fall under the umbrella term of massage therapy. The different techniques vary in the manner in which touch is applied, as well as the amount of pressure that is applied.⁵⁴ Massage techniques commonly used by physiotherapist are known as conventional western massage and were found to be beneficial (in one small study) in the treatment of patients with neck pain compared with no treatment or placebo.⁴⁹

Non-physiotherapy management

Medication

People with neck pain might take over-the-counter medication, such as paracetamol or non-steroidal anti-inflammatory drugs (NSAIDs). Although physiotherapists cannot prescribe pain medication, it is important for them to know the evidence about relevant medications in order to help patients with their questions.

A recent systematic review evaluated the effectiveness of paracetamol in patients with musculoskeletal disorders but did not identify any trials evaluating paracetamol in patients with neck pain.⁵⁵ A few randomised trials evaluating NSAIDs for patients with neck pain exist; they showed NSAIDs to be better than placebo,⁵⁶ equally effective as muscle relaxants or acupuncture,^{57,58} but less beneficial than spinal manipulation and exercises.⁵⁹ The only high-quality study on NSAIDs in (sub)acute neck pain patients (72 patients) found diclofenac gel (a topical NSAID) to be more effective than placebo in reducing pain.⁶⁰ This evidence is supported by an overview of Cochrane reviews in patients with chronic pain on topical NSAIDs.⁶⁰ This overview found that topical diclofenac was effective with a number needed to treat of 9.8, based on data from six trials with 2,343 participants (moderate quality evidence). Oral NSAIDs also seem to be effective in patients with spinal pain compared with placebo (MD 16 mm on a 100-mm visual analogue scale, 95% CI 12 to 21), which was above the a priori defined 10-mm threshold for clinical relevance.⁶¹

Surgery

Patients with ongoing neck pain that is not responsive to conservative care are frequently referred to secondary care for further assessment with a chance to receive corticosteroid injections or surgery.

No systematic review has evaluated corticosteroid injections for neck pain, but some randomised trials exist.^{62–65} All of these trials evaluated corticosteroid injections in patients with cervical radiculopathy. Only one of the studies compared injection with physiotherapy interventions (education, electrophysical agents, massage and exercise).⁶⁴ In this three-arm trial, there were no important differences in the primary outcome (arm pain) between injections alone, physiotherapy interventions alone, or combined injections and physiotherapy.

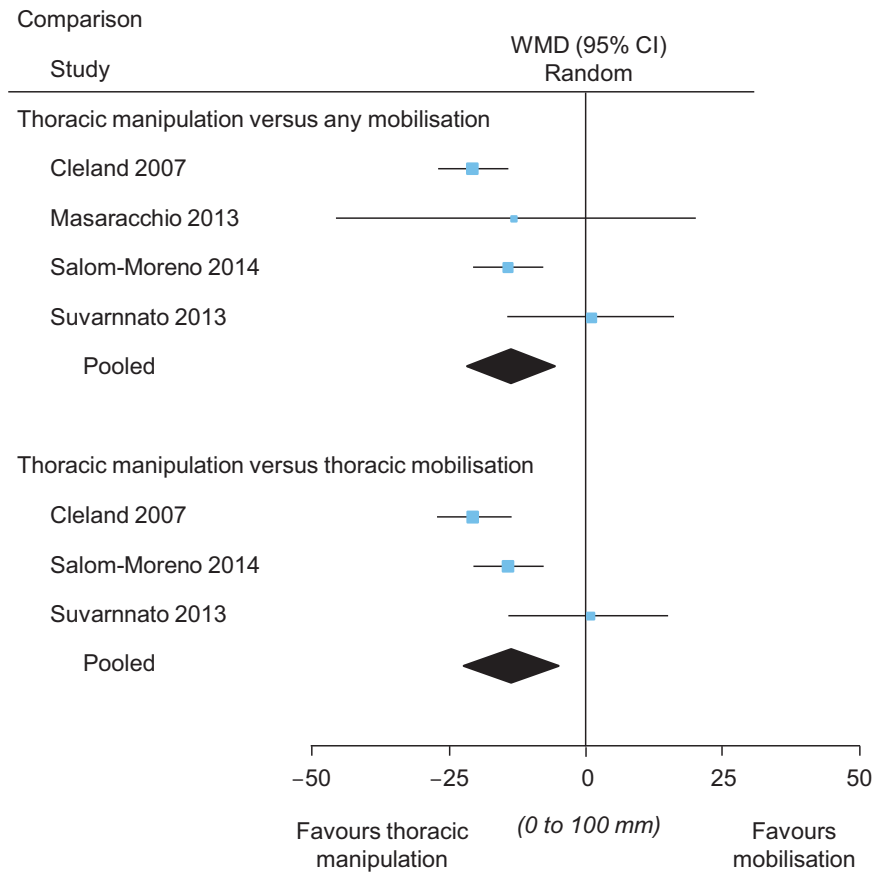


Figure 3. Weighed mean difference in immediate/short-term effect of thoracic spine manipulation versus mobilisation on neck pain severity, measured on a 100-mm visual analogue scale. The upper comparison pools all studies where thoracic manipulation was compared with any mobilisation, and the lower comparison is the subgroup of three studies where the thoracic manipulation was compared with thoracic mobilisation. Modified from Masaracchio et al.⁵⁰

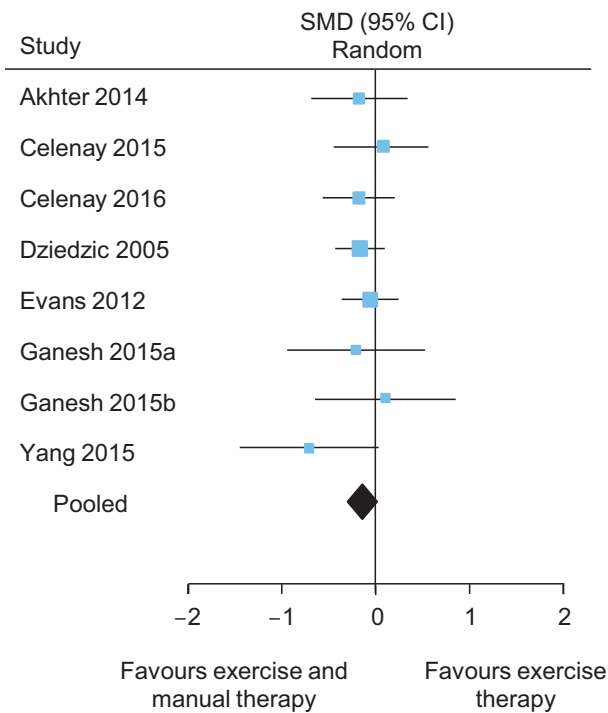


Figure 4. Standardised mean difference in immediate effect of combined exercise therapy and manual therapy versus exercise therapy alone on neck pain severity. Modified from Fredlin et al.⁵²

A systematic review including nine controlled studies found overall no important differences between surgery or conservative care in neck pain patients (very low quality evidence).⁶⁶ In addition, very small differences in benefits and harms between the various surgical techniques were found, and no additional benefit was found by adding fusion to anterior decompression techniques.^{67,68}

Future research

Most systematic reviews discussed above found: a limited number of studies on the target intervention, studies with overall (very) small sample sizes, a high proportion of studies with high risk of bias, and marked clinical heterogeneity between the studies. These findings hamper firm conclusions from being drawn and indicate that future research will likely change current conclusions and recommendations.

Compared to low back pain, with a more or less similar burden of disease, neck pain is a relatively understudied condition and more research is therefore warranted.² A recent Delphi consensus study on research priorities in neck pain research concluded that the main research priority was to evaluate the effectiveness and cost-effectiveness of all major interventions.⁶⁹ The second most important research priority was to evaluate how to best translate the research findings into clinical practice. Research into diagnostic assessments was priority 11 out of 15 priorities.

Research on risk stratification could be conducted using clinical prediction models/rules including evaluating the impact of such rules in risk-stratified neck pain trials. These studies increase the knowledge on the validity of diagnostic assessment and, for example, focus on which patients might benefit from which treatment strategies.⁷⁰

Further research could evaluate the optimal characteristics and dose of the most frequently used interventions. This may help to reduce the heterogeneity between studies.⁷¹

The Global Burden of Disease study on neck pain concludes that:

*increasing population awareness about neck pain and its risk factors as well as the importance of early detection and management is warranted to reduce the future burden of this condition.*²

This indicates a global patient/population education or mass media campaign. A recent systematic review on mass media campaigns in low back pain suggested that these campaigns might be effective for changing health beliefs.⁷²

Conclusion

Physiotherapists frequently see patients with neck pain in clinical practice; it is one of the four musculoskeletal disorders that have a major burden on society. Stratifying patients in either subgroups or based on their prognosis (prediction of recovery) might be useful in guiding physiotherapy management decisions. Manual therapy, exercise and education – usually in combination – seem to be the preferred evidence-based physiotherapy treatments for most patients with neck pain. Nevertheless, most interventions and management strategies are not based on firm evidence and effect sizes are small. Clinicians need to be aware of this and keep abreast of new findings in the many avenues of research into the management of neck pain.

eAddenda: Appendices 1 and 2 can be found online at <https://doi.org/10.1016/j.jphys.2020.12.005>.

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