Special Issue

Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Neck Pain

Introduction. A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of neck pain. Methods. Evidence from randomized controlled trials (RCTs) and observational studies was identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies. Developing Recommendations. An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established. Validating the Recommendations. A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%. Results. For neck pain, therapeutic exercises were the only intervention with clinically important benefit relative to a control (grade A for pain and function, grade B for patient global assessment). There was good agreement with this recommendation from practitioners (93%). For several interventions and indications (eg, thermotherapy, therapeutic ultrasound, massage, electrical stimulation), there was a lack of evidence regarding efficacy. Conclusions. This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing guidelines that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with neck pain where evidence was insufficient to make recommendations. [Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Neck Pain. *Phys Ther.* 2001;81:1701–1717.]

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Key Words: *Clinical practice guidelines, Evidence-based practice, Meta-analysis, Neckpain, Physical therapy, Practitioner feedback survey, Rehabilitation, Systematic reviews.*

INTRODUCTION

Neck pain is the second largest cause of time off work, after low back pain (LBP).[1,2] Acute neck pain is usually the result of injury or accident, most often road vehicle accidents associated with whiplash. Some prognostic studies have suggested that chronic neck pain is related to repetitive working conditions. However, there is also an association between depression and chronic neck pain and LBP.

The most commonly prescribed intervention for the management of neck pain by general practitioners is rest, followed by analgesics.[3,4] Neck pain is one of the most common conditions for referral to a physical therapist. Despite the prevalence of neck pain, there is a lack of evidence for commonly used rehabilitation interventions.[5] The most recent guidelines for the management of neck pain are the Quebec Task Force on Spinal Disorders (QTF)[6] and the *British Medical Journal* (BMJ)[7] guidelines. These guidelines are both in the process of being updated.

The purpose of this article is to describe the Philadelphia Panel evidence-based clinical practice guidelines

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(EBCPGs) of rehabilitation interventions for nonspecific neck pain. The aim of the developing the EBCPGs was to improve appropriate use of rehabilitation interventions for neck pain. The target users of these guidelines are physical therapists, physiatrists, orthopedic surgeons, rheumatologists, family physicians, and neurologists.

METHODS

The detailed methods of the EBCPGs development process are summarized in an accompanying paper in this issue (see article titled "Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology"). Briefly, an *a priori* protocol was defined that was followed for the conduct of separate systematic reviews for each intervention.

Studies were eligible if they were randomized controlled trials (RCTs), nonrandomized controlled clinical trials (CCTs), or case control or cohort studies that evaluated the intervention of interest in a population of more than 10 patients with nonspecific neck pain. *Nonspecific neck pain* was defined as pain in the neck area, with or without radiation to the extremities. The outcomes of interest were functional status, pain, ability to work, patient global improvement, patient satisfaction, and quality of life. The interventions included massage, thermal therapy (hot or cold packs), electrical stimulation, electromyographic (EMG) biofeedback, transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasound, therapeutic exercises, and combinations of these rehabilitation interventions. Control groups that received active treatments were included. Concurrent interventions were allowed if they were given in the same way to both the experimental and control groups (eg, home exercises, educational booklets, advice on posture). However, concurrent interventions that were given to one group but not the other group were not accepted (eg, education by means of lectures for the control group was not accepted). No limitations based on methodological quality were imposed. Only English-, French-, and Spanish-language articles were accepted. Abstracts were not included.

A structured literature search was developed based on the sensitive search strategy for RCTs recommended by the Cochrane Collaboration[8] and modifications proposed by Haynes et al.[9] The search strategy was expanded to identify case control, cohort, and nonrandomized studies. The search was conducted in the electronic databases of MEDLINE, EMBASE, Current Contents, CINAHL, and the Cochrane Controlled Trials Register up to July 1, 2000. In addition, the registries of the Cochrane Field of Rehabilitation and Related Therapies and the Cochrane Musculoskeletal Group and the Physiotherapy Evidence Database (PEDro) were searched. The references of all included trials were searched for relevant studies. Content experts were contacted for additional studies.

Two independent reviewers (VAR, JP) appraised the titles and abstracts of the literature search, using a checklist with the *a priori* defined selection criteria. Relevant studies were retrieved and the full articles were assessed by 2 independent reviewers for inclusion. Data were extracted by 2 independent reviewers from included articles, using predetermined extraction forms regarding the population characteristics, details of the interventions, trial design, allocation concealment, and outcomes. Methodological quality was assessed with a 5-point validated scale that assigns 2 points each for randomization and double-blinding and 1 point for description of withdrawals.[10,11] Differences in data extraction and quality assessment were resolved by consensus.

STATISTICAL ANALYSIS

Data were analyzed at 3 approximate time points posttherapy: 1 month, 6 months, and 12 months. If outcomes were reported at different intervals, the closest time was used for these time points.

Because prognosis is thought to be dependent on disease duration, the analysis was conducted for 2 categories of neck pain: acute (<4 weeks duration) and chronic (>12 weeks duration). If the population contained patients with mixed acute and chronic disease duration, the study was excluded.

Where possible, data from individual trials were combined using meta-analysis with the Review Manager (RevMan) computer program, Version 4.1 for Windows.* Continuous data were analyzed using weighted mean differences, where the difference between the treatment and control groups from each study included in the meta-analysis is weighted by the inverse of the variance and the outcome is reported in the original units (eg, centimeters). Where the same conceptual outcome was measured with different scales (eg, pain, functional status), the data were analyzed with standardized mean differences (SMDs). The SMD is calculated as the mean difference between treatment and control groups divided by standard deviation, and weighted by the inverse of the variance. Dichotomous data were analyzed using relative risk. The confidence that the different trials measured the same treatment effect (homogeneity of effect) was tested using a chi-square statistic. When homogeneity was not significant, fixed-effects models were used. With significant heterogeneity, random-effects models were used.

* Oxford, England: The Cochrane Collaboration, 2000.

Table 1.
Details of Philadelphia Panel Classification System

	Clinical Importance	Statistical Significance	Study Design[a]
Grade A	>15%	$P<.05$	RCT (single or meta-analysis)
Grade B	>15%	$P<.05$	CCT or observational (single or meta-analysis), with a quality score of 3 or more on the 5-point Jadad methodologic quality checklist
Grade C+	>15%	Not significant	RCT or CCT or observational (single or meta-analysis)
Grade C	<15%	Unimportant[b]	Any study design
Grade D	<0% (favors control)		Well-designed RCT with >100 patients

[a] RCT=randomized controlled trial, CCT=controlled clinical trial.
[b] For grade C, statistical significance is unimportant (ie, clinical importance is not met; therefore, statistical significance is irrelevant).

To calculate clinical improvement (defined as 15% improvement relative to a control), the absolute benefit and the relative difference in the change from baseline were calculated. Absolute benefit was calculated as the improvement in the treatment group less the improvement in the control group, in the original units. Relative difference in the change from baseline was calculated as the absolute benefit divided by the baseline mean (weighted for the treatment and control groups). For dichotomous data, the relative percentage of improvement was calculated as the difference in the percentage of improvement between the treatment and control groups.

The recommendations were graded by their level of evidence (I or II) and by the strength of evidence (A, B, or C). This grading system is shown in Table 1 and is described more fully elsewhere (see article titled "Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology"). Briefly, grade A recommendations indicate that a clinically important benefit (>15%) and statistical significance were shown in one or more RCTs. Grade B recommendations were assigned for interventions with a clinically important benefit (>15%) that is statistically significant in nonrandomized trials. Because there is less confidence in the results of nonrandomized studies, grade B recommendations required that the study be assigned a quality score of 3 or more on a 5-point scale (2 points for randomization, 2 points for blinding, 1 point for description of withdrawals). Grade C recommendations were assigned to interventions that have been compared with a control and have shown no evidence of effect in controlled trials. A master grid showing each rehabilitation intervention assessed and the strength and level of evidence is shown in Table 2. The report follows the same order as this grid (from left to right, top to bottom) for those interventions for which eligible studies were found.

Clinically important benefit was shown only for therapeutic exercises for chronic neck pain (Tab. 3). There was no evidence of clinically important benefit for 3 other interventions (Tab. 4). Insufficient data were available for 4 interventions (Tab. 5). No trials were identified for ice, heat, or EMG biofeedback. The Philadelphia Panel EBCPGs are compared with other published guidelines in Appendix 1.

Table 2.
Master Grid of Interventions for Neck Pain[a]

	Acute	Chronic
Exercise/neuromuscular re-education	nd	↗ A, I
Traction	↗ C, I	↗ C, II
Therapeutic ultrasound	nd	↗ C, I
TENS	↗ C, I	ID
Massage	nd	ID
Thermotherapy	nd	nd
Electrical stimulation	ID	ID
EMG biofeedback	nd	nd
Combined rehabilitation interventions	nd	ID

[a] TENS=transcutaneous electrical nerve stimulation, EMG=electromyographic, nd=no data, ID=insufficient data, A=benefit demonstrated, C=no benefit demonstrated, level I=evidence from randomized controlled trials, level II=evidence from controlled clinical trials.

RESULTS AND RECOMMENDATIONS

Literature Search

The literature search identified 3,476 articles. Of these, 203 were retrieved for closer screening. Of these, 8 trials met all selection criteria. The distribution of these trials by intervention is shown in Figure 1.

A survey questionnaire was sent to 324 practitioners for feedback on the 9 grade A or B recommendations. Their comments were reviewed by the Philadelphia Panel and were incorporated in this EBCPG document. Of the 324 practitioners surveyed from the American Academy of Family Physicians (AAFP), American Academy of Orthopaedic Surgeons (AAOS), American College of Physicians (ACP), American Physical Therapy Association (APTA), American College of Rheumatology Health Professionals (ARHP), and Physiatric Association of

Table 3.
Grade A Guidelines: Clinically Important Benefit Demonstrated[a]

Guideline	Recommendation	Outcomes	Relative Difference	Study Design
Individual, supervised, therapeutic exercises for chronic nonspecific neck pain	Grade B Grade A Grade A No data	Patient global assessment Function Pain Return to work	33%–41% 49% 36% No data	1 CCT (N=47) 1 RCT (N=60)

[a] CCT=controlled clinical trial, RCT=randomized controlled trial.

Table 4.
Grade C Rehabilitation Interventions: No Clinically Important Benefit Demonstrated[a]

Guideline	Recommendation	Outcomes	Relative Difference	Study Design
TENS for acute neck pain	Grade C	Pain	No effect	1 RCT (N=20)
Therapeutic ultrasound for chronic neck pain	Grade C	Pain	No effect	1 RCT (N=26)

[a] TENS=transcutaneous electrical nerve stimulation, RCT=randomized controlled trial.

Table 5.
Rehabilitation Interventions With Insufficient Data[a]

Intervention and indication	Details
Mechanical traction for acute neck pain	One CCT (N=135) was excluded due to poor quality (quality=1 out of 5). No other data available.
Mechanical traction for chronic nonspecific neck pain	One CCT (N=73, quality=0) was excluded due to low quality.[21] No other trials were available.
TENS for chronic neck pain	Effect on pain measured immediately after 1 treatment session; no ongoing therapy schedule or follow-up. Panel agreed the therapy was not relevant to practice (too short).
Electrical stimulation for chronic neck pain	Effect on pain measured immediately after 1 treatment session; no ongoing therapy schedule or follow-up. Panel agreed the therapy was not relevant to practice (too short).
Combined rehabilitation interventions for chronic neck pain	Types of intervention poorly defined and not comparable to each other.
Massage for chronic neck pain	Head-to-head trial. No evidence versus placebo available.

[a] CCT=controlled clinical trial, TENS=transcutaneous electrical nerve stimulation.

Spine, Sports, and Occupational Rehabilitation (PASSOR), 9 were inappropriate samples (wrong specialty) and 21 could not be reached due to incorrect addresses. Of the 294 practitioners who were appropriately sampled and received the questionnaire, 149 responded (51% response rate). Of these, 11 (4%) refused to participate and 138 (47%) completed the survey.

ACUTE NECK PAIN (<4 WEEKS)

Mechanical Traction for Acute Neck Pain (<4 Weeks), Level II (CCT), Grade ID (Insufficient Data)

Summary of Trials: One nonrandomized controlled trial (N=135) of patients following an acute neck injury was excluded due to the poor quality of the trial (quality=1 out of 5).[12] One RCT of continuous traction was excluded because the patient population included a mix of patients with acute and chronic neck pain, which could not be separated.[13]

Efficacy: No reliable data.

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found no evidence for traction for acute neck pain. This is in agreement with the QTF,[6] which found no scientific evidence for traction for acute neck pain.

Recommendation: The Philadelphia Panel recommended that there is insufficient evidence to include or exclude (ID) mechanical traction alone as an intervention for acute nonspecific neck pain.

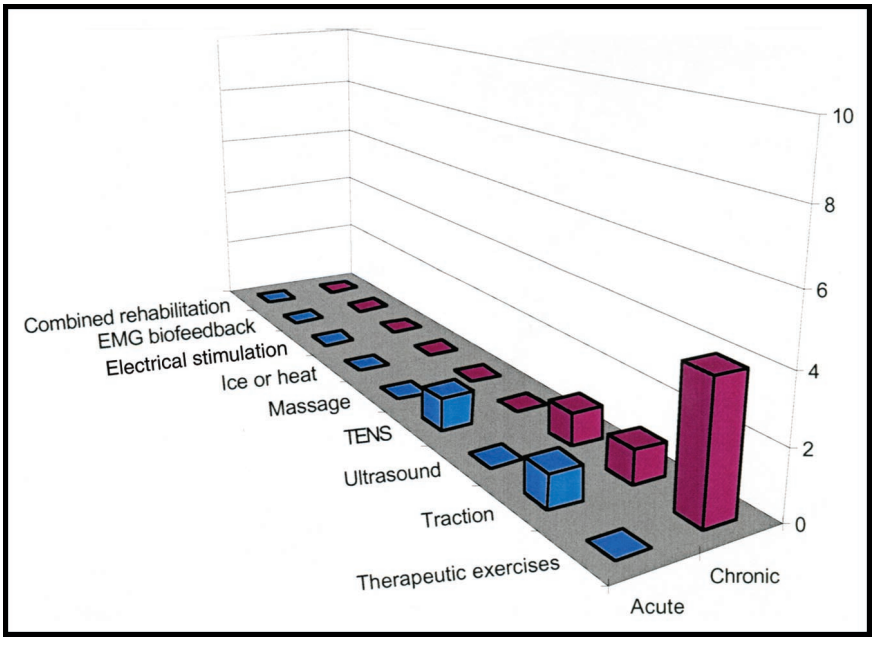

Figure 1.
Cityscape of acute and chronic neck pain. EMG=electromyographic, TENS=transcutaneous electrical nerve stimulation.

TENS for Acute Neck Pain (<4 Weeks), Level I (RCT), Grade C for Pain (No Benefit Demonstrated)

Summary of Trials: One RCT (N=20) of TENS (15 minutes, 3 per week at 0.2 milliseconds, 80 Hz) versus neck collar for patients with acute neck pain (<3 days) and no neurological signs was included.[14]

Efficacy: None demonstrated. There was no difference in patient-assessed pain after 1 week or 3 months between a neck collar and TENS[14] (Fig. 2).

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found good scientific evidence (level I, RCT) that TENS did not show evidence of effect on pain. In contrast, the QTF[6] found no evidence for TENS in acute neck pain.

Clinical Recommendation in Comparison With Other Guidelines: The Philadelphia Panel recommends that there is poor evidence to include or exclude TENS alone (grade C for pain) as an intervention for acute neck pain.

Interventions for Acute Neck Pain With Insufficient Evidence

No evidence from controlled trials or cohort studies was found for EMG biofeedback, thermotherapy, massage, electrical stimulation, therapeutic exercises, or combined interventions for acute neck pain.

For therapeutic exercises, one RCT of manual therapy combined with exercises was excluded because manual therapy was not given to the control group.[15] Another RCT, which compared continuing normal activities with neck collar and time off work, was excluded because of lack of an appropriate control group (ie, the effects of neck collar and sick leave could not be separated).[16]

For combined interventions, one RCT of combined rehabilitation interventions was excluded because manual therapy was given to the treatment group but not to the control group.[17]

CHRONIC NECK PAIN (>12 WEEKS)

Therapeutic Exercises for Chronic Neck Pain (>12 Weeks), Level I (RCT), Grade A for Pain and Function, Grade B for Patient Global Assessment (Clinically Important Benefit)

Summary of Trials: Three RCTs (N=223) were included.[18–20] One CCT (N=73) was included.[21] Three comparative RCTs were excluded due to lack of an appropriate control group.[22–24] One RCT was excluded because the treatment was a multifactor, behavioral intervention.[25]

Efficacy: One CCT (N=47) found significant and clinically important patient global assessment with isometric exercises with a risk difference of 41% relative to an untreated control group[21] (Tab. 6, Fig. 3). For group fitness classes, 2 RCTs (N=195) showed no difference between group classes and control for pain or sick leave at 1 or 6 months[19,20] (Fig. 4). Individual sessions of therapeutic exercises that included proprioceptive re-education (consisting of slow neck movements to follow a moving target) relieved pain and improved functional status, by 36% and 33%, respectively, relative to a waiting list control in one RCT (N=60)[18] (Tab. 7, Fig. 5).

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found good scientific evidence (level I), which showed clinically important benefit on pain and function with supervised, isometric or slow neck movement exercises. No data were available on return to work with individualized exercises.

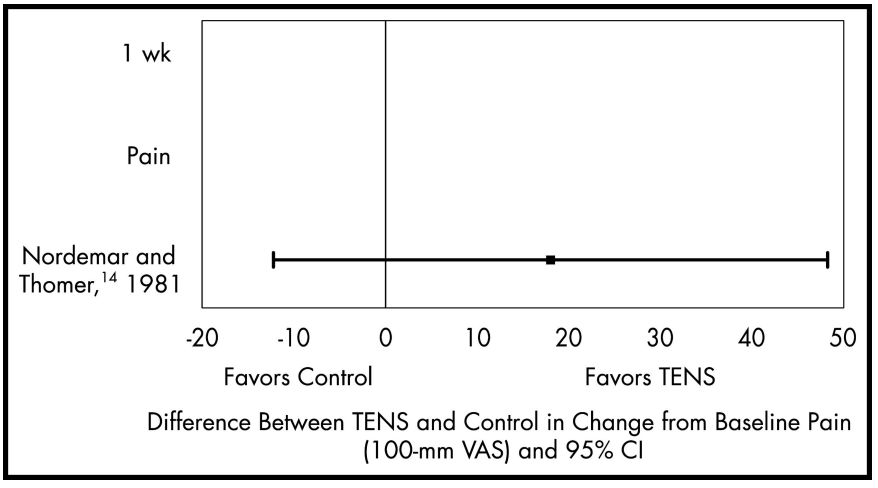

Figure 2.
Transcutaneous electrical nerve stimulation (TENS) versus placebo for acute neck pain: pain at 1 week. VAS=visual analog scale, CI=confidence interval.

Clinical Recommendation in Comparison With Other Guidelines: The Philadelphia Panel recommends that there is good evidence to include supervised exercise programs alone (including proprioceptive and traditional exercises) for the management of chronic (>12 weeks) neck pain (grade A for pain and function, grade B for patient global assessment).

Practitioner Agreement

- Response rate for this EBCPG: 47%
- Percentage of practitioners giving comments for this EBCPG: 24%
- Agree with recommendation: 93%
- Think a majority of my colleagues would agree: 86%
- Will (or already) follow this recommendation: 96%

Practitioner Comments

1. Negative trials are not described in Table 3.[19,20]

2. Not all options for chronic neck pain have been evaluated by this panel.

3. Postural exercises should be evaluated/described.

4. I believe stretching is more important.

Panel's Response: The 2 negative trials used group aerobic fitness programs and are shown in Figure 4. The Philadelphia Panel evaluated selected interventions, as described in the "Methods" section. This may not have been clear in the practitioner feedback survey. No trials of postural exercises were found. Stretching was a component of the effective programs and has now been included in the guideline statement.

Mechanical Traction for Chronic Neck Pain (>12 Weeks), Level II (CCT), Insufficient Data (ID)

Summary of Trials: One CCT (N=73) of patients with cervical pain radiating to the extremities was excluded[21] due to low quality (quality=0 out of 5). One RCT was excluded because the population included a mix of both patients with acute and chronic neck pain.[26] One RCT of patients with cervical radiculopathy was excluded because no acceptable outcomes were measured (only EMG activity).[27] One RCT of continuous traction was excluded because the patient population included a mix of patients with acute and chronic neck pain, which could not be separated.[13]

Efficacy: Insufficient data. The excluded CCT demonstrated an improvement relative to the control (untreated group) in patient-assessed improvement with intermittent mechanical traction. However, due to the low quality of the trial, the validity of this effect is uncertain.

Strength of Published Evidence in Comparison With Other Guidelines: The Philadelphia Panel found insufficient data for mechanical traction similar to the QTF,[6] which found no scientific evidence.

Clinical Recommendation in Comparison With Other Guidelines: There are insufficient data to make a recommendation regarding mechanical traction alone in chronic neck pain.

Therapeutic Ultrasound for Chronic Neck Pain (>12 Weeks), Level II, Grade C for Pain (No Evidence of Benefit)

Summary of Trials: One RCT (N=26) of patients with myofascial trigger point neck pain was included.[28]

Efficacy: None demonstrated. There was no difference in pain between therapeutic ultrasound and placebo therapeutic ultrasound. Other outcomes were not assessed (Fig. 6).

Strength of Published Evidence in Comparison with Other Guidelines: The Philadelphia Panel found good scientific evidence (level I) that showed no benefit of therapeutic ultrasound on pain relief for chronic neck pain. The QTF[6] found no scientific evidence.

Table 6.
Patient Global Assessment at 1 Month Post-exercise Therapy for Chronic Neck Pain[a]

Study	Treatment Group	Outcome	No. Improved	No. of Patients	Risk (% of Occurrence)	Risk Difference
Goldie and Landquist,[21] 1970	E: isometric exercise	Patient global improvement	17	24	71%	41%
	C: untreated control		7	23	30%	

[a] E=exercise group, C=control group.

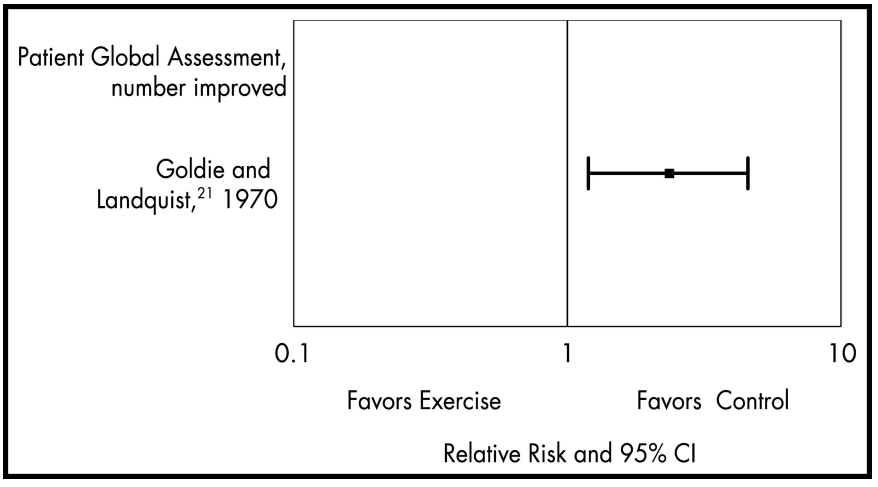

Figure 3.
Resisted exercises versus untreated: patient global assessment at 1 month. CI=confidence interval.

Clinical Recommendation in Comparison With Other Guidelines: The Philadelphia Panel recommends that there is poor evidence to include or exclude therapeutic ultrasound alone (grade C for pain) as an intervention for chronic neck pain.

Interventions for Chronic Neck Pain With Insufficient Data

Interventions that could not be assessed due to lack of controlled studies were EMG biofeedback, massage, thermotherapy, electrical stimulation, TENS, and combined rehabilitation interventions.

For combined interventions, one RCT was excluded because manual therapy was included in the "physiotherapy" group, but not the control group.[29]

DISCUSSION

Evidence-based practice is rapidly growing in the rehabilitation domain.[30] The Philadelphia Panel concluded that therapeutic strengthening and proprioceptive exercises are the only rehabilitation interventions examined for cervical pain that have been shown in one or more controlled trials to provide a clinically important benefit. As with all such reviews, there are a number of limitations.

As for LBP, the effectiveness of conservative treatment of cervical syndrome is a complex issue.[5,31–34] Rehabilitation specialists often use concomitant treatment interventions within the same treatment session for a particular patient with a cervical syndrome. Certain rehabilitation interventions such as cryotherapy, ultrasound application, and massage are used for pain relief in the acute stage or as a treatment preparation before the main intervention.[35] These treatment approaches are chosen based on empirical experience.[35,36] The use of single and specific interventions does not reflect the complexity of the global approach adopted by rehabilitation specialists in clinical settings. The practice of rehabilitation requires a better theoretical basis[37,38] supported by well-designed controlled research.[39]

The measurement of treatment effects is complex.[40,41] Standardized measurement of outcomes is needed to facilitate scientific advances in clinical care for cervical syndromes. Little is known about valid and sensitive outcome measures in the spine.[42] The Philadelphia Panel agreed that the primary outcomes of clinical importance are: pain, functional status, patient global assessment, quality of life, return to work, and patient satisfaction.

The effectiveness of physical rehabilitation interventions for cervical syndrome is affected by psychosocial, physical, and occupational factors.[1,43–54] Management recommendations suggest that these factors should be considered in the clinical evaluation of patients with cervical pain.[48] These factors could not be addressed in this review.

Several methodological biases may be present in the clinical trials of cervical pain. The lack of precise diagnoses contributes to a misclassification bias.[4,46,55–60] For example, the terminology used to describe cervical syndrome was vague and included terms such as "tension

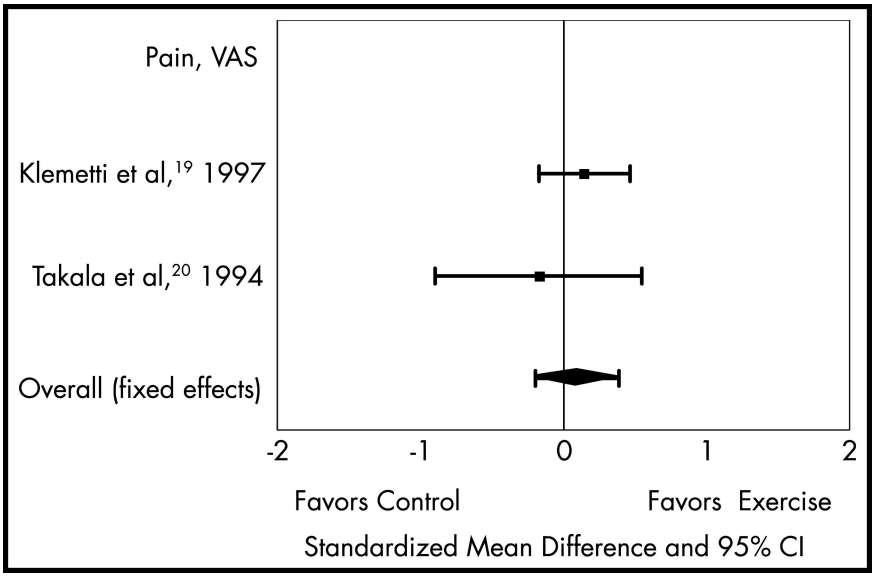

Figure 4.
Group exercises versus control for chronic neck pain: pain at 1 month. VAS=visual analog scale, CI=confidence interval.

neck," "frequent neck symptoms," and "cervical pain." A wide variety of clinical characteristics such as age, prevalent versus incident cases, stages of the disease, level of pain, and presence or absence of neurological deficits may have resulted in selection bias. Differences in disease duration were minimized in these guidelines by excluding studies with a mix of patients with acute and chronic conditions or mixed diagnoses. Characteristics of the device parameters and of the therapeutic application[37] could also affect the treatment effect observed. The tendency for trials with nonsignificant results to not be published may result in an overestimate of the treatment effect due to publication bias.[61] We could not assess the presence of publication bias due to the small number of trials. A language bias was introduced because the Philadelphia Panel reviewed only studies published in English, French, or Spanish.

The quality of studies on cervical syndrome rarely reached 2 out of 5 or greater on the Jadad scale (Appendix 2). Randomization (3/6 studies) was rarely fully adequate (ie, performed using computerized random number lists). Insufficient information about the treatment assignment procedure was noted in several RCTs. Inappropriate blinding (5/6 studies) could lead to an overestimate of the treatment effect. Complete blinding is difficult to achieve because of visual and other sensory differences between treatment and placebo as well as unintended communication between patient and evaluator.[62] Few investigators (1/6 studies) reported adequate information regarding withdrawals and loss to follow-up or indicated whether they were considered in the data analysis. These weaknesses contribute to the lower quality assessment scores in many of the systematic reviews conducted on rehabilitation interventions for cervical syndrome.

Ottenbacher[63] lists several difficulties for rehabilitation specialists: (1) discriminate between clinical and statistical significance, (2) low statistical power in detecting minimal clinical important differences, and (3) lack of replication of rehabilitation studies to strengthen evidence-based practice. Some studies (3/6 studies) did not use adequate sample sizes to detect important differences with confidence (Appendix 2). These issues contribute to nonconclusive results for several interventions. The Philadelphia Panel agreed that clinical importance be defined as an improvement of 15% or more relative to a control (see article titled "Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions: Overview and Methodology"). Grade A or B recommendations were required to demonstrate both clinical importance and statistical significance.

The Philadelphia Panel EBCPGs for the management of cervical pain are mainly in agreement with previous and recent EBCPGs[7] for neck pain described in Appendix 1. The Philadelphia Panel EBCPGs for cervical pain have the advantage that they were developed based on a systematic grading of the evidence determined by an expert, transdisciplinary panel and the evidence was derived from systematic reviews and meta-analyses using the Cochrane Collaboration methodology.[64] The finalized guidelines were circulated for feedback from practitioners to verify their applicability and ease of use for practicing clinicians. This rigorous methodological procedure provides considerable credibility for rehabilitation specialists who intend to use these EBCPGs for cervical management in their daily practice.

Therapeutic Exercises

Our meta-analysis showed that proprioceptive and traditional therapeutic exercises are effective for pain relief in chronic cervical pain. No included studies considered exercises for acute or subacute conditions. In contrast to our results, 3 recent reviews concluded that there was insufficent evidence regarding therapeutic exercises for neck pain.[5,32,33] Functional exercises including proprioceptive phasic exercises have been described as effective in another review.[65] Types of exercise, intensity, and progression need to be clarified according to patient

Table 7.
Pain at 1 Month After Exercises for Chronic Neck Pain[a]

Study	Treatment Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
Revel et al,[18] 1994	E: proprioceptive re-education	Pain, VAS 100 mm	30	50.5	28.7	−17.50 (I) on 100-mm VAS	−36% (I)
	C: control		30	45.9	41.6		

[a] E=exercise group, C=control group, VAS=visual analog scale.

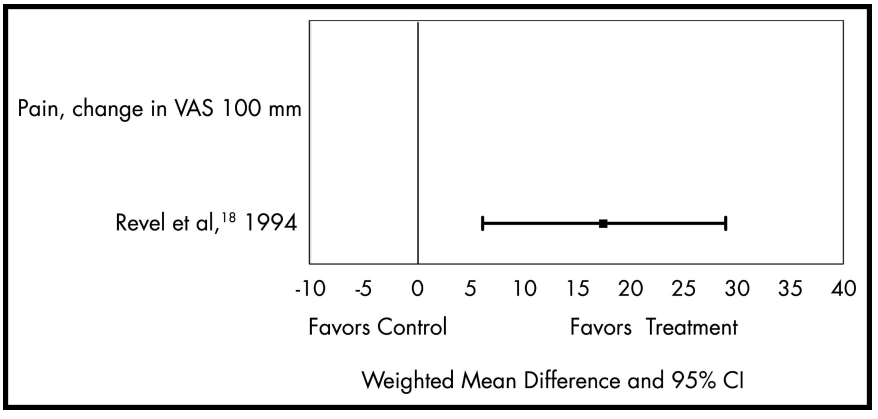

Figure 5.
Proprioceptive exercises for chronic neck pain: pain at 2 months. VAS=visual analog scale, CI=confidence interval.

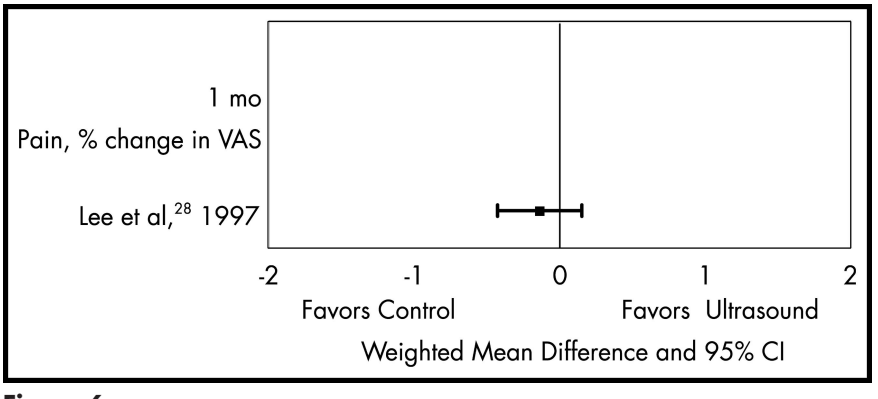

Figure 6.
Therapeutic ultrasound versus placebo for chronic neck pain: pain at 1 month. VAS=visual analog scale, CI=confidence interval.

specific classification of physical dysfunction, needs, treatment goals, and outcomes.[4,66,67]

Mechanical Traction

Although 3 RCTs have been conducted in acute[12] and chronic[21] cervical pain, the results did not meet the criteria for a consistent clinically important benefit for intermittent traction. Static traction was not used by investigators in the included studies.

These results are mainly in concordance with previous systematic reviews for acute and chronic cervical pain management,[5,32,42] even though these authors did not clearly distinguish between manual and mechanical traction. Our systematic review included patients with cervical pain with neurological signs in 1 of the 2 trials.[21] Pennie et al[12] did not report whether their subjects with cervical soft tissue injuries exhibited neurological signs. According to the information provided by these trials, none of the included subjects had disk involvement. Furthermore, exclusion criteria, such as acute strain, sprains, presence of inflammation, or joint instability of the spine, were not consistently reported in the primary trials. The proposed clinical indication for static or sustained traction is the presence of a nuclear disk protrusion.[68,69] Thus, the use of intermittent traction by Goldie et al[21] is questionable.[70] This point shows the importance of identifying homogenous subgroups of patients with neck pain based on precise differential physical dysfunction diagnostic classes, such as nerve root adhesion, hypomobility dysfunction, and sacroiliac hypermobility.[71] The effectiveness of intermittent mechanical traction was not demonstrated by the existing studies, mainly due to the inclusion of patients with neurological signs, which required more likely a mechanical traction in static mode. Other confounding variables such as neck position, traction force, duration of traction, angle of pull, and position of the patient need to be further investigated.[72]

Therapeutic Ultrasound

Our systematic review found no evidence of clinically important benefit of therapeutic ultrasound for chronic cervical syndrome.[28] No studies were found on therapeutic ultrasound for acute neck conditions. Other research work is obviously needed for cervical syndrome at different stages of the condition. The Philadelphia Panel recommendation (level II, grade C) disagrees with the QTF quidelines,[6] which recommended therapeutic ultrasound for muscle spasm and pain relief, though no scientific evidence was described. The BMJ[7] guidelines did not evaluate therapeutic ultrasound.

The single trial available was of medium quality (3 out of 5 on the Jadad scale[10,11]). The type of therapeutic ultrasound was continuous in this study.[28] It is usually recommended for chronic pain,[73] but does not seem to be effective. Other confounding variables such as randomization method, characteristics of the device, size of the head, and study duration (1 week) may have contributed to the lack of treatment effect of therapeutic ultrasound in this trial.[35,37] These results concur with a previous systematic review,[35] even though it was conducted for various musculoskeletal conditions.

TENS

The Philadelphia Panel recommended that there was poor evidence to include or exclude TENS for acute neck pain, based on the lack of measured effect in one RCT.[14] These results agree with other systematic reviews of cervical pain.[5,32] The Philadelphia Panel EBCPGs (level I, grade C) are in agreement with QTF guidelines,[6] which do not recommend TENS for cervical pain. However, the QTF guidelines[6] do not differentiate between electroanalgesia and TENS. The BMJ guidelines[7] did not evaluate TENS for pain relief. Specific therapeutic application of TENS is of key importance. Vibratory stimulation has been recommended as part of the TENS application.[74–76] Nordemar et al[14] did not mention the use of vibratory stimulation in their study. There is a need for strict and rigorous RCTs of TENS using combined vibratory stimulation. Identification of the appropriate target clientele may be also an important factor.[77]

EMG Biofeedback, Therapeutic Massage, Thermotherapy, Electrical Stimulation, and Combined Rehabilitation Interventions

There are many studies in the scientific literature showing the positive physiological effects of these interventions.[78–82] Despite the physiological effects, either there are no clinical data or there is insufficient clinical information on the effectiveness of EMG biofeedback, therapeutic massage, thermotherapy, electrical stimulation, and combined rehabilitation interventions for acute and chronic cervical syndrome.[83–85]

The Philadelphia Panel was unable to make a clinical recommendation regarding these specific interventions. This is in agreement with BMJ[7] and QTF[6] guidelines, which did not evaluate these interventions.

Overall

The main difficulty in determining the effectiveness of rehabilitation interventions is the lack of well-designed prospective RCTs. An enormous research effort should be done in conducting RCTs for almost each rehabilitation interventions for acute or chronic cervical syndrome. This situation is critical compared with the neck pain research area. Future research in physical therapy should also adopt rigorous methods such as the use of an appropriate placebo (and double-blind procedure), adequate randomization, homogeneous sample of patients based on rigorous selection and diagnosis criteria, and adequate sample size to detect clinically important differences with confidence.

CONCLUSION

There is scientific evidence to support and recommend the use of proprioceptive and therapeutic exercises for chronic neck pain. There is a lack of evidence at present regarding whether to include or exclude the use of thermotherapy, therapeutic massage, EMG biofeedback, mechanical traction, therapeutic ultrasound, TENS, electrical stimulation, and combined rehabilitation interventions in the daily practice of physical rehabilitation of patients with acute and chronic neck pain.

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Appendix 1.
Strength of Published Evidence and Clinical Recommendations of Previous Evidence-Based Clinical Practice Guidelines (EBCPGs) for Acute and Chronic Neck Pain[a]

Rehabilitation Intervention		Philadelphia Panel (2001)	Québec Task Force[6] (1987)	BMJ[7] (2000)
Previous EBCPGs for Acute Neck Pain (<4 Weeks)				
Therapeutic exercises	Quality of published evidence	N/A	Common practice, but no scientific evidence	N/A
	Clinical recommendations	No data found	Listed as option to increase strength, ROM, and endurance	Good evidence that early mobilization physical therapy and return to normal activity were more effective than rest or immobilization for acute whiplash
Mechanical traction	Quality of published evidence	Fair scientific evidence (level I) for mechanical traction	Not in common practice, but no scientific evidence	N/R
	Clinical recommendations	Insufficient evidence to include or exclude (grade ID) mechanical traction alone as an intervention for acute nonspecific neck pain	Listed as option to increase ROM	Insufficient evidence on the effects of traction in people with uncomplicated neck pain without neurological deficit
Therapeutic ultrasound	Quality of published evidence	N/A	Common practice, but no scientific evidence	N/C
	Clinical recommendations	No data found	Ultrasound is grouped with thermotherapy and listed as an option to diminish muscle spasm and relieve symptomatic pain	N/C
TENS	Quality of published evidence	Good scientific evidence (level I) for TENS	Not in common practice, but no scientific evidence	N/C
	Clinical recommendations	Poor evidence to include or exclude (grade C for pain) TENS alone as an intervention for acute LBP	Electroanalgesia is listed as an option for symptomatic pain relief	N/C
EMG biofeedback	Quality of published evidence	N/A	Common practice, but no scientific evidence	N/R
	Clinical recommendations	No data found	EMG biofeedback is listed as an option to diminish muscle spasm	Insufficient evidence on the effects of biofeedback in uncomplicated neck pain without severe neurological deficit
Therapeutic massage	Quality of published evidence	N/A	Common practice, but no scientific evidence	N/C
	Clinical recommendations	No data found	Therapeutic massage is listed as an option to diminish muscle spasm	N/C
Thermotherapy	Quality of published evidence	N/A	Common practice, but no scientific evidence	N/R
	Clinical recommendations	No data found	Thermotherapy is listed as an option to diminish muscle spasm and inflammation and relieve symptomatic pain	Insufficient evidence on the effects of heat or cold in uncomplicated neck pain without severe neurological deficit

Appendix 1.
Continued

Rehabilitation Intervention		Philadelphia Panel (2001)	Québec Task Force[6] (1987)	BMJ[7] (2000)
Previous EBCPGs for Acute Neck Pain (<4 Weeks) (continued)				
Electrical stimulation	Quality of published evidence	N/A	N/C	N/C
	Clinical recommendations	No data found	N/C	N/C
Combined rehabilitation interventions	Quality of published evidence	N/A	N/C	N/R
	Clinical recommendations	No data found	Recommended that physical therapists use physical modalities and interventions at their own discretion with the objectives of relieving spasm, reducing inflammation, reducing pain, and increasing strength, ROM, endurance, and physical and functional status	Insufficient evidence of the effects of physical treatments in uncomplicated neck pain without severe neurological deficit
Previous EBCPGs for Chronic Neck Pain (>12 Weeks)				
Therapeutic exercises	Quality of published evidence	Good scientific evidence (level I) for therapeutic exercises	Common practice, but no scientific evidence	N/R
	Clinical recommendations	Good evidence (grade A for pain and function, grade B for patient global assessment) to include supervised therapeutic exercises	Listed as option to increase strength, ROM, and endurance	Insufficient evidence of the effects of exercises in people with uncomplicated neck pain without neurological deficit
Mechanical traction	Quality of published evidence	Insufficient evidence	Common practice, but no scientific evidence	N/R
	Clinical recommendations	Insufficient data to make a recommendation	Listed as option to increase ROM	Insufficient evidence of the effects of traction in people with uncomplicated neck pain without neurological deficit
Therapeutic ultrasound	Quality of published evidence	Fair scientific evidence (level II) for therapeutic ultrasound	Common practice, but no scientific evidence	N/C
	Clinical recommendations	Poor evidence to include or exclude (grade C for pain) therapeutic ultrasound alone as an intervention for chronic LBP	Therapeutic ultrasound is grouped with thermotherapy and listed as an option to diminish muscle spasm and relieve symptomatic pain	N/C
TENS	Quality of published evidence	N/A	Usefulness demonstrated by nonrandomized controlled trial	N/C
	Clinical recommendations	No data found	Electroanalgesia is listed as an option for symptomatic pain relief	N/C

Appendix 1.
Continued

Rehabilitation Intervention	Evidence-Based CPGs	Philadelphia Panel (2001)	Québec Task Force[6] (1987)	BMJ[7] (2000)
Previous EBCPGs for Chronic Neck Pain (>12 Weeks) (continued)				
EMG biofeedback	Strength of published evidence	N/A	Common practice, but no scientific evidence	N/R
	Clinical recommendations	No data found	EMG biofeedback is listed as an option to diminish muscle spasm	Insufficient evidence on the effects of biofeedback in people with uncomplicated neck pain without neurological deficit
Therapeutic massage	Strength of published evidence	N/A	Common practice, but no scientific evidence	N/C
	Clinical recommendations	No data found	Therapeutic massage is listed as an option to diminish muscle spasm, but not for reduction of pain or not to increase function status	N/C
Thermotherapy	Strength of published evidence	N/A	Common practice, but no scientific evidence	N/R
	Clinical recommendations	No data found	Thermotherapy is listed as an option to diminish muscle spasm and inflammation and to relieve symptomatic pain	Insufficient evidence of the effects of heat or ice in people with uncomplicated neck pain without neurological deficit
Electrical stimulation	Strength of published evidence	N/A	N/C	N/C
	Clinical recommendations	No data found	N/C	N/C
Combined rehabilitation interventions	Strength of published evidence	N/A	N/C	N/R
	Clinical recommendations	No data found	Recommended that physical therapists use physical modalities and interventions at their own discretion with the objectives of relieving spasm, reducing inflammation, reducing pain, and increasing strength, ROM, endurance, and physical and functional status	Insufficient evidence of the effects of physical treatments in people with uncomplicated neck pain without neurological deficit

[a] N/A=not applicable, N/R=not reported, N/C=not considered, ROM=range of motion.

Appendix 2.
Characteristics of Included Trials[a]

Author/Year	Sample Size	Population	Symptom Duration	Age (y) (Mean, SD, Controls)	Treatment	Comparison Group	Concurrent Therapy	Sessions/ Week	Treatment Duration	Follow-up	Quality[10,11] (R, B, W)
Goldie and Landquist,[21] 1970	73	Cervical pain radiating down upper extremities	Chronic (mean=5 y)	Not reported	1. Isometric exercise 2. Intermittent traction (25–40 lb)	Untreated	Advice, paracetamol	3	3 wk	6 mo	0, 0, 0
Klemetti et al,[19] 1997	170	Tension neck	Chronic	42 y	Physical treatment + exercise	Untreated	None	2	4 wk	6 mo	0, 0, 0
Lee et al,[28] 1997	26	Myofascial trigger point	Chronic	43.7 (14.3)	1. Therapeutic ultrasound 0.5 W/cm^2 2. Electrotherapy 3. Therapeutic ultrasound + electrotherapy	Placebo ultrasound	None	1	1 session	None	1, 2, 0
Nordemar and Thomer,[14] 1981	20	No neurological symptoms in extremities	Acute <3 d	34 (25–43)	TENS	Neck collar (control)	Analgesics	3	2 wk	3 mo	1, 0, 1
Pennie and Agambar,[12] 1990	135	Neck soft-tissue injuries from accident	Acute	Not reported	Traction (intermittent)	Neck collar	Advice + home active exercises	2	8 wk	None	0, 1, 0
Revel et al,[18] 1994	30	>3 mo, rheumatology outpatients	Chronic	47 (25–74)	Proprioceptive exercises based on eye-head coupling	Waiting list control	None	2	8 wk	10 wk	1, 0, 0
Takala et al,[20] 1994	23	"Frequent neck symptoms"	Chronic	43 (38–49)	Exercise	Untreated	None, but crossover trial	N/A	2 mo	5 mo	1, 0, 0

[a] R=randomization, B=blinding, W=withdrawals, N/A=not available.