Psychological Care, Patient Education, Orthotics, Ergonomics and Prevention Strategies for Neck Pain: An Systematic Overview Update as Part of the ICON§ Project

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Abstract: Objectives: To conduct an overview on psychological interventions, orthoses, patient education, ergonomics, and 1/2° neck pain prevention for adults with acute-chronic neck pain.

Search Strategy: Computerized databases and grey literature were searched (2006-2012).

Selection Criteria: Systematic reviews of randomized controlled trials (RCTs) on pain, function/disability, global perceived effect, quality-of-life and patient satisfaction were retrieved.

Data Collection & Analysis: Two independent authors selected articles, assessed risk of bias using AMSTAR tool and extracted data. The GRADE tool was used to evaluate the body of evidence and an external panel to provide critical review.

Main Results: We retrieved 30 reviews (5-9 AMSTAR score) reporting on 75 RCTs with the following moderate GRADE evidence. For acute whiplash associated disorder (WAD), an education video in emergency rooms (1RCT, 405participants) favoured pain reduction at long-term follow-up thus helping 1 in 23 people [Standard Mean Difference: -0.44(95%CI: -0.66 to -0.23)]. Use of a soft collar (2RCTs, 1278participants) was not beneficial in the long-term. For chronic neck pain, a mind-body intervention (2RCTs, 1 meta-analysis, 191participants) improved short-term pain/function in 1 of 4 or 6 participants. In workers, 2-minutes of daily scapula-thoracic endurance training (1RCT, 127participants) over 10 weeks was beneficial in 1 of 4 participants. A number of psychosocial interventions, workplace interventions, collar use and self-management educational strategies were not beneficial.

Reviewers’ Conclusions: Moderate evidence exists for quantifying beneficial and non-beneficial effects of a limited number of interventions for acute WAD and chronic neck pain. Larger trials with more rigorous controls need to target promising interventions.

Keywords: overview, psychological, education, orthotics, ergonomics, prevention, neck pain.

INTRODUCTION

Description of the Condition

Although neck pain can be recurrent, severe, disabling and is a socioeconomic burden on society [1, 2], it is most commonly simple and transient. It is estimated that one third of adults will experience neck pain over the course of one year [1]. The balance of evidence suggests that psychosocial distress has a negative impact on the course of neck pain [3-6], possibly to a greater extent than clinical or physical variables [7]. Chronic neck pain is associated with poor psychological health, including cognitive distress, anxiety and depressed mood, a potential loss of employment and associated reduction of income, increased stress, physical limitations/pain, a reduced self-concept, changes to their social life/status and issues relating to medical adherence [7, 8]. There are significant socioeconomic implications. The
most common presentations seen by psychologists after an Motor Vehicle Accident (MVA) are pain, depression and post-traumatic stress [8]. Helping people/patients change behavior may be an important factor when addressing lifestyle modifications needed for neck pain prevention and management [8]. This overview (review of review) addresses a diverse group of seemingly eclectic interventions that include interventions that may help people understand, independently self-manage, potentially limit the impact of injury on their neck pain/disability or prevent potential injury. Some interventions are intended to manage psychological distress related to neck pain and others such as patient education strategies, use of orthosis (i.e. collar), ergonomic workplace interventions, and prevention strategies, affect change in some aspect of the individual or their environment to aide in the management of neck pain.

Description of the Intervention

A number of psychological treatments (i.e. cognitive-behavioral approach, interpersonal behavioral activation, supportive counselling, etc.), psychosocial interventions (i.e. multidisciplinary care, psychologist as advisor to other health professionals), and mind-body wellness approaches (i.e. yoga) exist [8]. Psychological interventions delivered by a psychologist, psychosocial intervention delivered by non-psychologists health professionals and mind body wellness delivered by a certified instructor are options considered by physicians and other health practitioners when psychological distress arises in the presence of neck pain [8].

Patient education is a foundational component of health care and an essential part of communication between patient and the healthcare provider [9, 10]. The World Health Organization (WHO) defines therapeutic patient education as education helping patients acquire or maintain the skills they need to manage their life with a disease in the best possible way [10].

Medical devices are generally defined as products (article, instrument, apparatus or component) used for medical or therapeutic aims including: (a) the diagnosis, treatment, mitigation or prevention of a disease, disorder or abnormal physical state, or its symptoms, and (b) restoring, correcting or modifying a body function or the body. Class I medical devices (orthosis) such as specific pillows, collar use or taping may be recommended.

Ergonomic workplace interventions may include physical redesign changes at the workplace (i.e. ergonomic workstation modification), organizational system changes at the workplace (i.e. job rotation, production system changes) or individual worker changes (education, exercise, use of orthotics) [11]. The aim of ergonomic change is often prevention. Prevention strategies are defined as preventing the onset of symptoms (primary prevention) and reducing the recurrence rate of signs and symptoms (secondary prevention) [12].

How the Intervention Might Work

A number of these interventions may help people understand, independently self-manage, potentially limit the impact of injury on their neck pain and related disability or prevent potential injury.

Psychological treatments, psychosocial often multidisciplinary interventions and mind-body wellness approaches are designed to influence psychological process that underpin and contribute to pain, distress and disability. Interventions like cognitive behavioral therapy and neuroscience education potentially target cognitive-emotional sensitization (and descending facilitation) in patients with chronic neck pain. They aim to help individuals adjust to the reality of their chronic condition, adhere to a treatment regimen that will manage and reduce symptoms, and improve their quality of life despite their condition [13]. Some psychosocial interventions may target single elements such as stress or anxiety. Other psychoeducation provides information to better understand and cope with pain. Still other behavioral interventions may target compliance and adherence to a regimen through a program of self-monitoring and rewards. Cognitive interventions help individuals analyze their beliefs, thoughts and emotions as well as challenge irrational negative thoughts. Not unlike other chronic diseases, chronic neck pain can give rise to secondary co-morbid diagnoses requiring specific psychological treatments concurrently. Finally, various mind-body approaches like yoga breathing may reduce levels of anxiety, depression and stress and increase optimism [14].

Patient education is an iterative process: an educational diagnosis is made, a tailored education programme is established, group or individualised patient education is planned and provided, acquired skills are assessed, and the education programme is revised [15]. It is anticipated that through patient education strategies knowledge is transmitted, skills are acquired, and abilities are potentially maintained. Educational strategies for patients with neck pain may help patients achieve independence in care and self-management. However, in the context of neck pain, the optimal mode of delivery, and message to be delivered, is yet unknown. While education is a relatively low-cost intervention, in the absence of sound evidence of effectiveness even this is difficult to justify.

Orthosis maintain the neck in alignment or restrict movement minimizing symptom onset or recurrence. Similarly, ergonomic interventions may incorporate workplace physical redesign, organizational system changes or individual worker changes with the aim of reducing or preventing a worker’s signs and symptoms related to neck injury.

One overarching foundation to most of these interventions is that many are ‘change interventions’ [16]. Change interventions help people alter their maladaptive and unwanted behaviors and are especially useful in dealing with lifestyle modifications for disease or injury prevention and management [16]. Understanding the patient’s readiness to change, related barriers to change, and relapses may be important to not only improving patient satisfaction but also to producing and maintain health outcomes.

Why it is Important to Do this Overview (Review of Reviews)

The number of clinical trials on neck pain is continually increasing [12] and an ongoing collaborative, interdisciplinary and internationally represented effort at evidence synthesis is warranted. The purpose of this overview was to systematically review existing reviews and
establish evidence-based recommendations on psychological interventions, patient education strategies, orthosis use, ergonomic change, and prevention strategies for acute to chronic neck pain including WAD with and without cervicogenic headache or radiculopathy compared to primarily a control group at immediate post treatment to long-term follow-up. Our primary outcomes of interest were pain, function, disability, work related function, patient satisfaction, global perceived effect and quality of life. Our secondary outcomes include psychological measures such as depressive symptoms.

METHODS

The methodology of this overview is detailed in our International Collaboration on Neck (ICON) methods report [17].

Criteria for Considering Review for Inclusion

Selection criteria are noted in Table 1.

Search Methods for Identification of Reviews

Our systematic overview process used independent assessment by at least two members of our review team and included comprehensive search strategies including MEDLINE, EMBASE, CINAHL, ILC, CENTRAL and LILACS from January 2000 to August 2010. Note that two separate searches were performed - one for treatment and one for harms. The protocol for this review was not registered. Further, we undertook a grey literature search by identifying on going systematic reviews near completion such as Cochrane Reviews up to 2012, by contacting our expert panel and by systematically checking reference lists of primary studies to minimize the risk of missing relevant reviews and trials.

Selection of Reviews, Data Collection and Analysis

We utilized the following triage rules (set a priori) to guide decisions and group treatment reviewed:

1. Type of treatment was used to group reviews by treatment category
2. Within a treatment category we grouped review data with respect to comparator treatments.
3. We prioritized the highest quality reviews (low risk of bias) based on the rules below, per grouping.

a. If there were few reviews, we included them all due to the paucity of information.
b. If there were several reviews reporting on the same treatment and comparator, we selected the reviews with the lowest risk of bias [high Assessment of Multiple Systematic Reviews (AMSTAR) scores] for inclusion, according to the approach recommended by Whitlock [11] by considering the following:
   i. Year of publication. We selected the most current reviews when the data was similar across reviews and when the studies from the older review were also included in the most recent review. Further we ensured consistency among review conclusions before eliminating older reviews. Inconsistency and discordance were highlighted and reasons for these differences were discussed;
   ii. AMSTAR - risk of bias. We prioritized reviews with a low risk of bias for inclusion in our overview. Reviews that scored 8 or higher on the 11-point AMSTAR scale were considered at low risk of bias; 5 to 7 moderate risk of bias; and 4 or less a high risk of bias (See Table 2). These various reviews were further summarized in the summary of findings table with the goal of providing definitive summaries to inform clinical practice. Inconsistency and discordance were highlighted and discussed across reviews;
   iii. Effect size estimates: We selected the effect size as the primary summary measure. Within a grouping for treatment and comparator, we selected a review that represented the best estimate of the effect size (or a meta-analytic effect). In cases where there was a large discordance between reviews, we reported our re-analysis of the meta-analysis using the individual studies included in the reviews. Additional data on magnitude of effect such as number-needed-to-treat (NNT), standard mean difference (SMD) and weighted mean difference (WMD) were extracted when available. We further considered the clinical importance of the treatment effects using the following guiding principles: evidence on the minimal detectable change and the minimal clinically important difference for the outcome,

| PICOCSS | Criteria |
|---------|----------|
| Participant | Adult (≥ 18 years), acute to chronic neck pain with or without cervicogenic headache or radiculopathy or WAD |
| Intervention | Psychological, Psychosocial and Mind-body (Alternative) Interventions, Education strategies, Orthotic use, Ergonomic changes, and Prevention Strategies |
| Comparison | Control or comparison (i.e. standard care, another treatment) |
| Outcomes | Primary: pain, function, disability, work related, quality of life Secondary: global perceived effect and patient satisfaction, psychological outcomes |
| Study Design | Systematic reviews of randomized trials; narrative reviews were excluded |
| Study Timeframe | Immediate post-treatment (IP), short-term (ST: closest to 3 months); intermediate term (IT: closest to 6 months); long term (LT: closest to 1 year) |
with a change from baseline of $\geq 15\%$ representing the minimal clinical important difference when not otherwise determined, the magnitude of the treatment effect (represented by WMD, SMD, NNT, absolute benefit, treatment advantage), the evidence for a dose response gradient, and evidence on the duration of effect [18].

4) Strength of Evidence using the Grading of Recommendations Assessment, Development and

### Table 2. AMSTAR Rating of Systematic Reviews

| Author | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--------|---|---|---|---|---|---|---|---|---|----|----|
| Aas et al. 2011 [123]  | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| Boschi et al. 2010 [124]  | Y | N | Y | Y | N | Y | Y | Y | NA | N | N |
| Conlin et al. 2005 [125]  | Y | N | Y | N | N | Y | Y | Y | Y | N | N |
| Dresscher 2008 [126]  | Y | Y | Y | Y | N | Y | Y | Y | NA | N | N |
| Driessen 2010 [65]  | Y | Y | N | N | Y | Y | Y | Y | Y | N | N |
| Graham et al. 2006 [127]  | Y | Y | Y | Y | N | Y | Y | Y | Y | N | N |
| Gross et al. 2007 [128]  | Y | Y | Y | Y | N | Y | Y | Y | Y | N | N |
| Gross et al. 2012 [30]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Haines et al. 2009 [129]  | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N |
| Haraldsson et al. 2006 [130]  | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| Hurwitz et al. 2008 [12]  | Y | N | N | Y | N | Y | Y | Y | NA | N | N |
| Jordan et al. 2010 [131]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Kabisch 2008 [132]  | Y | N | Y | N | N | Y | Y | Y | Y | N | N |
| Karjalainen et al. 2003 [133]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Kay et al. 2005 [134]  | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N |
| Kay et al. 2012 [25]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Levat et al. 2010 [135]  | Y | Y | Y | N | N | Y | Y | Y | Y | N | N |
| Lee et al. 2009 [136]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Miller et al. 2010 [137]  | Y | Y | Y | Y | N | Y | Y | Y | Y | N | N |
| Nikolaidis et al. 2010 [138]  | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| Patel et al. 2012 [139]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Salt et al. 2011 [140]  | Y | Y | Y | Y | N | Y | Y | Y | Y | N | N |
| Santaguida et al. 2012 [45]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Shields 2006 [141]  | Y | Y | Y | Y | Y | Y | Y | Y | NA | N | N |
| Sihawong et al. 2011 [120]  | Y | Y | Y | Y | N | Y | Y | Y | NA | N | N |
| Teasel et al. 2010 [119]  | Y | N | Y | N | N | Y | Y | Y | NA | N | N |
| Teasel et al. 2010 [142]  | Y | N | Y | N | N | Y | Y | Y | NA | N | N |
| Verhagen et al. 2007 [121]  | Y | Y | N | N | Y | Y | Y | Y | NA | N | N |
| Verhagen et al. 2007 [122]  | Y | Y | Y | N | Y | Y | Y | Y | Y | N | N |
| Verhagen et al. 2007 [143]  | Y | Y | N | Y | Y | Y | Y | Y | NA | N | N |

Key: Y Yes; N No; NA not applicable; CA can’t assess; AMSTAR Questions:
1. Was an ‘a priori’ design provided? The research question and inclusion criteria should be established before the conduct of the review.
2. Was there duplicate study selection and data extraction? There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.
3. Was a comprehensive literature search performed? At least two electronic sources should be searched. The report must include years and databases used (e.g. Central, EMBASE, and MEDLINE). Key words and/or MeSH terms must be stated and where feasible.
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion? The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports.
5. Was a list of studies (included and excluded) provided? A list of included and excluded studies should be provided.
6. Were the characteristics of the included studies provided? In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the studies analyzed eg age, race, sex relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.
7. Was the scientific quality of the included studies assessed and documented? ‘A priori’ methods of assessment should be provided (e.g., for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled studies or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.
8. Was the scientific quality of the included studies used appropriately in formulating conclusions? The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.
9. Were the methods used to combine the findings of studies appropriate? For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e. Chi-squared test for homogeneity, 2). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e. is it sensible to combine?)
10. Was the likelihood of publication bias assessed? An assessment of publication bias should include a combination of graphical aids (e.g., funnel plot, other available tests) and/or statistical tests (e.g., Egger regression test).
11. Was the conflict of interest stated? Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.
Evaluation (GRADE) approach: We used the same prioritized representative systematic review to judge an overall GRADE for the strength of the body of evidence for each type of treatment. The selected reviews may have already reported a GRADE table. The GRADE approach on the quality of evidence from primary trials considers information on design [randomized controlled trials (RCT)], information on timing of outcomes (immediately post treatment to long term follow-up); risk of bias or equivalent methodological quality criteria reported in the review i.e. PEDro (Physiotherapy Evidence Database) [19,20]; imprecision (sample size); inconsistency; indirectness and reporting bias. We applied similar principles to evaluate those systematic reviews that did not undertake an evaluation of strength of evidence.

Data Extraction and Management

Data extraction was performed by one reviewer and checked by a second; disagreements were resolved by consensus. We systematically extracted data from selected systematic reviews and developed evidence tables. Factors extracted from the original reviews included the following: 1) descriptive features of the original review such as authors, publication year, source disorder, symptom duration, intervention, comparator (placebo, no care, usual care, other treatment), the search period, the original authors of primary studies; 2) methodological issues of original review such as search period, AMSTAR score, quality ranking system, evidence statement and a final strength of the body of evidence rating using the GRADE tool, and 3) data on benefits and risks, including the direction and magnitude of the effect of primary outcomes with duration of follow-up, reported harms, quality ranking system, evidence statement and final GRADE. Harm information was summarized qualitatively from both the treatment reviews that reported any adverse events and directly from the harms reviews.

Assessment of methodological quality

We used a systematic review methodological quality assessment tool (AMSTAR) [21].

Data Synthesis

Qualitative assessment using the GRADE approach [22, 23] and recommendation presentation was used. When the original review did not report using GRADE methodology, an assessment of the summary of finding estimate for GRADE was based on data extracted in the systematic review. Once reviews were deemed relevant and of low risk of bias, we reported trial findings by “quality of evidence” using the GRADE approach and by “treatment category” for the Summary of Findings Tables (Tables 3 and 4). Those intervention categories achieving moderate to high quality rating on GRADE were recorded in the recommendation table (Table 5). Associated primary outcome effect sizes and their related magnitude of effect [SMD, WMD, relative risk (RR)] were translated to clinically relevant terms (WMD, NNT) to aid knowledge users in judging their clinical importance.

RESULTS

We included 30 reviews on treatment (see Fig. 1 - Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)) [24] flow diagram representing 75 RCTs - 14 RCTs related to psychological interventions, 29 to ergonomic workplace interventions, 22 to orthotics, 22 to patient education, 6 to 1o prevention and 9 to 2o prevention; keep in mind that there was some overlap. We did not retrieve any reviews on harm for these interventions. The AMSTAR score ranged from 5 to 9 and the most common methodological limitation were: assessment of publication bias, stating conflict of interest and inclusion of a list of included and excluded studies [10, 17]. See Appendix 1 for the listing of the 24 excluded reviews and reasons for exclusion. We detailed trial findings by the quality of the evidence (GRADE level) and treatment category in the later sections. Tables 3 and 4 provides summary findings by treatment category. Table 5 summarizes the strong and moderate quality recommendations based on the GRADE approach and details the magnitude of the effect in terms of effect size. The primary studies included in our analyses investigated the following 1) psychological categories: psychological, psychosocial interventions and mind-body; 2) workplace interventions and prevention: physical environment change, individual worker change, ergonomic and mental health education; organizational change; 3) patient education categories: advice on activation, advice on rest, pain and stress coping skills education, workplace ergonomic education +pain and stress coping skills education self-management educational strategies; and 4) orthotics categories: specialized pillow, specialized pillow + therapy, rigid collar, soft collar, soft collar + home exercise + physiotherapy, collar + advice for self-mobilization, kinesio taping, oral splint.

FINAL EVIDENCE-BASED RECOMMENDATIONS (TABLE 5)

For acute whiplash associated disorder (WAD), our recommendation from moderate evidence suggests using an education video on advice to activate in emergency rooms for a small but clinically important pain reduction at long-term follow-up thus helping 1 in 23 WAD victims. Evidence of no benefit: We note moderate evidence against the use of a soft collar since it negatively influenced pain, function, quality-of-life and work ability in the long-term.

For chronic neck pain based on moderate GRADE evidence, we suggest a mind-body intervention -Dantian Qigong exercises- provided by a certified instructor may help to reduce pain and improve function in 1 of 4 to 6 participants in the short-term. For chronic myofascial pain in white collar workers, a small reduction of pain was noted after just 2 minutes of daily scapulothoracic endurance training over 10 weeks in 1 of 4 participants. Thus we would recommend this simple work station exercise approach for office workers. Evidence of no benefit: Again based on moderate GRADE evidence, we suggest that a number of interventions may not be useful for chronic neck pain reduction or improved function in the long-term:
Table 3. Summary of Findings by Quality of Evidence (GRADE) for Psychological Interventions

| Category | Treatments Details | vs Comparison | Quality of Evidence (GRADE*) |
|----------|--------------------|---------------|-------------------------------|
|          | Disorder Characteristic | Primary Authors | Moderate | Low | Very Low |
| **EVIDENCE of BENEFIT** | | | | |
| Psychosocial Intervention by PT | Multimodal (relaxation training, psychological support, exercise, manual therapy) delivered by PT for acute WAD | vs electrotherapy | IT pain NSD | LT RTW |
| | | Provinciali et al. 1996 [40]; VERHAGEN et al. 2007 [122]; HURWITZ et al. 2008 [12]; CONLIN et al. 2005 [125] | | |
| Psychosocial Intervention by practitioner NR | Values-based exposure and acceptance strategies delivered by practitioner NR for chronic WAD | | | |
| | | Wicksell et al. 2008 [39]; TEASELL et al. 2010 [142] | ST pain disability index | ST life satisfaction |
| | | | ST fear of movement |
| | | | post-traumatic stress |
| | | | symptoms psychological flexibility |
| | | | ST pain NSD |
| Psychosocial Body-Mind by certified instructor | Cognitive (mindfulness & emotional balance) during Dantian Qigong exercises + advice delivered by approved Qigong therapists, all being members of the German Qigong Society for chronic neck pain | vs that same advice | IP pain (M-A) | ST pain NSD |
| | | vonTrott 2009 [27]; Rendant et al. 2011 [28]; KAY et al. 2012 [25]; LEE et al. 2009 [136] | IP function (M-A) | ST function NSD |
| | | | IP QoL (M-A) | ST QoL NSD |
| | | | IP GPE NSD | ST GPE NSD |
| | | | | |
| Psychosocial Intervention by PT | Cognitive (coaching & motivational CBT) during Exercises + advice delivered by PT for chronic neck pain | vs that same advice | IP pain | LT pain NSD |
| | | Stewart et al. 2007 [38]; KAY et al. 2012 [25]; KABISCH 2008 [132]; TEASELL et al. 2010 [142] | IP function | LT function |
| | | | IP GPE | LT GPE NSD |
| | | | IP QoL | LT QoL NSD |
| **EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment)** | | | IT pain NSD | LT pain NSD |
| Psychological Intervention by Psychologist | CBT delivered by clinical psychologist for chronic neck and shoulder pain | vs CBT delivered by psychologist functioning as a coach to other health professionals | | LT disability NSD |
| | | Jensen 1995 [144]; KARJALAINEN et al. 2003 [133] | LT Sick leave | NSD |
| | | | IT Cost (favoured control) | |
| Psychological Intervention by PT | Integrated CBT + PT delivered by PT for chronic WAD | vs PT | ST pain NSD | ST disability NSD |
| | | Sonderhund & Lundberg 2001 [82]; CONLIN et al. 2005 [125]; HAINES et al. 2009 [129]; JORDAN et al. 2010 [131]; KABISCH 2008 [132]; TEASELL et al. 2010 [142]; VERHAGEN et al. 2007 [122] | ST ADL |
(Table 3) contd.....

| Category                      | Treatments Details                                                                 | vs Comparison Primary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) |
|-------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------|
|                               | Disorder Characteristic                                                              |                                                  |                              |
| Psychosocial Intervention     | Solution Finding:                                                                   | vs Usual Physiotherapy                           | LT QALY (Patient-specific quality-adjusted life years); brief intervention provided only slightly less health benefit on average |
| by PT                         | 1) Guidance to identify the problems correlated to their pain                       | Manca 2006 [55]; Klaber-Moffett et al. 2005 [56] |                              |
|                               | 2) Identification of solutions                                                       | BOSCHI et al. 2010 [124]                        |                              |
|                               | 3) goal setting based on CBT principles                                              |                                                  |                              |
|                               | 4) booklet or pamphlet delivered by PT for chronic non-specific neck pain            |                                                  |                              |
|                               | Behavioral Graded Activity Program delivered by a PT for chronic non-specific neck pain | vs conventional exercise                         | ST, IT, LT pain NSD          |
|                               |                                                                                     | Vonk et al. 2009 [83]                            | ST, IT, LT function NSD     |
|                               |                                                                                     | BOSCHI et al. 2010 [124]                        | ST, IT, LT main complaint NSD|
| Psychosocial Intervention by MD| Group 1: neck booklet with focus to allay unrealistic fears of patients, and to promote activity, despite pain delivered by occupational health physician for chronic neck pain | vs usual treatment                               | ST pain & disability NSD   |
|                               |                                                                                     | Derebery et al. 2009 [84]                       | IT pain & disability NSD    |
|                               | Intensive relaxation training (progressive relaxations, functional relaxation, autogenic training, systematic desensitization) delivered by PT for chronic non-specific neck pain | vs control                                      |                              |
|                               |                                                                                     | vs dynamic muscle training of neck and arms      |                              |
|                               |                                                                                     | Viljanen et al. 2003 [57]                       |                              |
|                               |                                                                                     | LEAVER 2010 [135]; KAY et al. 2012 [25]; VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] |                              |
| Psychosocial Intervention by PT| Stress management delivered by practitioner NR for mechanical neck disorder (duration NR) | vs non-intervention group                        | LT pain NSD                 |
|                               |                                                                                     | Homeij et al. 2001 [58]                         | LT function NSD             |
|                               |                                                                                     | HAINES et al. 2009 [129]                        |                              |
| Minor Body (Alternative)       | Gestalt therapy - 'philosophy of life' training by trained practitioner for chronic WAD | vs no treatment                                 | ST pain NSD                 |
|                               |                                                                                     | Venteugd et al. 2004 [85]                       | daily functioning NSD       |
|                               |                                                                                     | TEASELL et al. 2010 [142]                       | sick leave NSD              |

**Key:** GRADE*: study design, within study risk of bias, consistency of results, directness (generalizability), precision (sufficient data), reporting bias (publication, language, funding, other); ADL – activity of daily living; WAD – whiplash associated disorder; vs – versus; NR – not reported; NSD – no significant difference; PT – physiotherapy; ADL – activity of daily living; GPE – global perceived effect; QoL – quality of life; IP – immediate post treatment; ST – short term closest to 3 months, IT – intermediate term closest to 6 months, LT – long term closest to 1 year; ROM – range of motion; neg - negative findings or statistically not significant; pos - positive findings or statistically significant findings; M-A – meta-analysis; CBT - cognitive behavioral treatment; RTW – return to work; QALY – quality of life years
Table 4. Summary of Findings by GRADE (Quality of Evidence) for Ergonomic Workplace Interventions, Orthotics, Patient Education and Prevention

| Category | Treatments Details Disorder Characteristic | vs ComparisonPrimary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|-------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| EVIDENCE of BENEFIT | | | LT Pain |
| Workplace Intervention & Physical Environment Changes | Physical ergonomic intervention - ergonomic training + an arm board support for non-sick listed neck pain free working population - customer service operator | vs no ergonomic intervention Rempel et al. 2006 [41] DRIESSEN et al. 2010 [65] | Moderate |
| Workplace Intervention & Physical Environment Changes | Physical ergonomic intervention - Arm 1 - a chair with a cured seat and miscellaneous items Arm 2 - a chair with a flat seat and miscellaneous items for non-sick listed neck pain free working population - garment workers | vs miscellaneous items (no ergonomic intervention) Rempel et al. 2007 [42] DRIESSEN et al. 2010 [65] | Low |
| Workplace Intervention & Individual Worker Changes | 1a) 2 Minute Training (2-min): Progressive resistance training with elastic tubing. The participants performed shoulder abductions, also known as lateral raise, for effectively targeting several relevant neck/shoulder muscles; raising and lowering the arms in approximately 2 seconds; performed only a single set to failure. 5x/week for 10 weeks 1b) 12 Minute Training (12-min): performed 5 to 6 sets of 8 to 12 repetitions in a progressive manner 5x/week for 10 weeks for workers with acute, subacute and chronic myofascial neck pain in 2 white collar organizations 2) Exercise Group: Strength and endurance training; progression from low load non-postural exercise to endurance strength exercises to dynamic strengthening against resistance targeting the cervical/scapulothoracic region; individually tailored, completed 2x/day lasting 10-15 minutes, supervised weekly by PT; 6 weeks. for pilots with chronic neck pain and myofascial pain from 2 air force helicopter bases 3) Exercise + control (education): mobilization, stretching, strengthening, and relaxation exercises for computer operators with neck and upper extremity complaints | 1) vs control group (weekly email) Andersen et al. 2011 [31] KAY et al. 2012 [25]; GROSS et al. 2012 [30]; 2) vs control group Ang et al. 2009 [37] KAY et al. 2012 [25] 3) vs control (education) Omer et al. 2003 [36] VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] | Very Low |
| Workplace Intervention & Individual Worker Changes | 1) IP Pain for both 2-min and 12-min training | | |
(Table 4) contd.....

| Category | Treatments Details Disorder Characteristic | vs ComparisonPrimary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| Workplace Intervention & 2nd Prevention: Individual Worker Changes | 1a) Coordination Training: body awareness therapy  b) Strength exercises  c) Endurance training for chronic neck/shoulder complaints (nonspecific) in female workers where the work “contributed” to the disorder.  2a) Strength Exercises  b) Endurance training for chronic neck pain in female office workers, work related complaints | 1) vs control (discussion + stress management) Waling et al. 2000 [35] Waling et al. 2002 [34] VERHAGEN et al. 2007 [143] VERHAGEN et al. 2007 [121] 2) vs control (home stretching) Ylinen et al. 2003 [33] VERHAGEN et al. 2007 [143] VERHAGEN et al. 2007 [121] | 1a) ST Pain NSD LT Pain NSD 1b) ST Pain NSD LT Pain 1c) ST Pain NSD LT Pain 2a) ST Pain 2b) ST Pain |
| Orthotics: Collar | Semi-hard Collar for acute, subacute cervical radiculopathy | vs wait list Kuijper 2009 [43] SANTAGUIDA et al. 2012 [45] | ST Pain IT Pain NSD ST Function NSD IT Function NSD ST GPE |
| Orthotics: Kinesio Taping | Kinesio Taping of the neck (Kinesio Tex Tape, Kinesio Holing Corporation, Albuquerque, NM) for WAD | vs control Gonzalez-Iglesias 2009 [44] SANTAGUIDA et al. 2012 [45] | IP Pain ST Pain IP ROM NSD ST ROM NSD IP Disability NSD ST Disability NSD |
| Orthotics: Pillow | 1) Orthopaedic Pillow(s) + active control treatment (n=32)  2) Pillow use plus Exercise plus Active control treatment (n=33) Neck Support Pillows could be one of two designs [Shape of Sleep pillow (Manutex Products, Mississauga, ON, Canada) or the Sissel Design AB pillow (Sissel Design AB, Svedala, Sweden)]. The two types of pillows were randomly assigned equally in each arm. The pillows did not differ in shape but in the firmness of the foam. for acute to chronic neck pain | vs 3) standard (regular) pillow + active control (n=34): The Standard (regular) pillow is assumed to be used by this group. Active control treatment that included massage and thermal modality;  vs 4) Standard Pillow + Exercise + Active Control Treatment (n=29) Helewa et al. 2007 [49] | For 1 vs 3: ST Pain NSD ST Function NSD QoL NSD For 2 vs 4: ST Pain* ST Function QoL NSD |
| Orthotics: Pillow | Cervical Pillow  a) “The Orthopaedic Pillow”  b) A semi-customized Universal Pillow for chronic neck pain | vs generic pillow  1) Jochern 1997 [47], b) Erfanian 2004 [46] SHIELDS 2006 [141]; SANTAGUIDA 2012 [45]; GROSS 2007 [128] | a) ST Morning pain ST GPE NSD b) ST Morning Pain ST Function NSD |
| Orthotics: Pillow | Mediflow Water-based Pillow for chronic neck pain | vs Cervi-Garde roll pillow vs participants regular pillow Lavin et al. 1997 [48] SANTAGUIDA et al. 2012 [45]; SHIELDS et al. 2006 [141]; HURWITZ et al. 2008 [12] | ST Morning Pain ST Evening Pain ST QoL |
| Orthotics: Pillow | Curavario cervical pillow (Pala-Medic Co, Pleisweiler, Germany) + PT for chronic cervical radiculopathy | vs regular pillow + PT Bernateck et al. 2008 [50] SANTAGUIDA et al. 2012 [45] | ST Pain LT Pain |
| Orthotics: Oral Splint | Oral Splint For chronic neck pain and cervicogenic headache | vs control Karppinen et al. 1999 [51] GROSS et al. 2007 [128] | ST Pain NSD LT Pain |
| Category | Treatments Details | vs Comparison | Primary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|--------------------|--------------|-----------------------------------|-------------------------------------------------------------|
| EVIDENCE of BENEFIT | Educational Booklet about exercise for mechanical neck disorders | vs teaching exercises alone | Glossop et al. 1982 [52]; Gross et al. 2012 [30] | Moderate |
| Workplace Intervention: Mental Health Education | Advice on act as usual + 5 day prescription of NSAIDS + instructions for self-training exercises to be initiated immediately for acute WAD | vs immobilization group (12 days sick leave and collar use) + 5 day prescription of NSAIDS + instructions for self-training exercises to be initiated | Borchgrevink 1998 [53]; Teasell et al. 2010 [119] | Low |
| Workplace Intervention: Mental Health Education | Mobilization Advice (one 30 min session, included demonstration of neck exercises) for acute WAD | vs physiotherapy (multimodal therapy and active and passive repetitive movements) or rest (general advice to mobilize after 10 to 14 days of rest) | McKinney et al. 1989 [54; 78]; Teasell et al. 2010 [119]; Hurwitz 2008 [12] | Very Low |
| Workplace Intervention: Mental Health Education | 1) Relaxation Training included progressive relaxation, autogenic training, functional relaxation, and systematic desensitization. The intervention was instructed and trained by a PT for office workers with neck pain | vs minimal intervention | Viljanen et al., 2003 [57]; Leaver et al. 2010 [135]; Kay et al. 2012 [25]; Verhagen et al. 2007 [143]; Verhagen et al. 2007 [121] | Moderate |
| Workplace Intervention: Mental Health Education | 2) Stress Management Program in groups at the workplace—identify, reach goals/strategies for perceived stress (lack of social support, low work control/decision latitude, perceived high psychological workload). Meetings covered theory and practice; workplace and individual goal attainable within 6 months; immediate supervisors attended last 2 meetings for nursing aids and assistant nurses with neck pain working in home-care services | vs no intervention | Horneij et al. 2001 [58]; AAS et al. 2011 [123]; Hurwitz et al. 2008 [12] | Low |

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**EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment)**
### Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved)

| Category | Treatments Details | Disorder Characteristic vs Comparison | Primary Authors (REVIEW Reference) | Quality of Evidence |
|----------|--------------------|---------------------------------------|------------------------------------|--------------------|
|          |                    | Disorder Characteristic | Authors                         | Moderate | Low    | Very Low |
| EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment) | Workplace Intervention: Ergonomic Education | Mental Health Education and Physical Health Education, relaxation, breaks for computer workers with chronic neck pain; Weekly Email: physical exercise, advice to stay active in spite of pain, diet, smoking, alcohol use, stress management, workplace ergonomics for acute to chronic myofascial neck pain in 2 large white collar organizations; Health Counselling: workplace ergonomics, diet, health, relaxation and stress management for acute to chronic neck pain in 7 workplaces | 1) vs no intervention Bernaards et al. 2007 [59] AAS et al. 2011 [123] 2) vs 2 minute exercise Andersen et al. 2011 [31] 3) vs Arm 1 - general fitness training (bike) 3) vs Arm 2 - specific training group (high-intensity neck and shoulder exercises) Andersen et al. 2008 [60] KAY et al. 2012 [25]; GROSS et al. 2012 [30] | 1) IT Pain NSD LT Pain NSD 2) IP Pain favoured both 2 minute and 12 minute training | |
|          | Physical Environment Modifications | 1) Physical Ergonomic Interventions: a) ergonomic training on workplace adjustment for university workers; b) ergonomic training in kitchen workers; c) postural training & work station changes for computer workers; d) adjustment to desk/keyboard/mouse position/ forearm support for call centre workers in a non-sick listed neck pain free working population 2) Physical Ergonomic Changes a) alternative mouse, arm board and mouse for engineering staff b) participatory ergonomic training for kitchen workers c) ergonomic training + either arm board or trackball or both for customer service operators; in a non-sick listed neck pain free working population | 1) vs no intervention a) Brisson et al. 1999 [61] b) Haukka et al. 2008 [64] c) Gerr et al. 2005 [63] d) Cook et al. 2004 [62] DRIESSEN et al. 2010 [65]; AAS et al. 2011 [123] 2) vs control a) Conlon et al. 2008 [66] b) Haukka et al. 2008 [64] c) Rempel et al. 2006 [41] DRIESSEN et al. 2010 [65] | 1) ST neck Pain Prevalence (M-A) NSD 2) LT Pain Prevalence (M-A) NSD | |
|          | Physical Environment Change | a) Activity + Physical Environment Changes [ergonomic counselling (work task, work load, work hours, work station, work method) and work modification] for computer workers - job councillors, medical secretaries b) Physical Environment Changes - install new desktop with submerged VDU screen into the table top; computer screen tilted at two different angles for VDU user in national insurance service; c) Physical Environment Changes - downward tilted computer keyboard on a tray for office workers in worker with neck pain | 2) vs another workplace intervention a) Voerman 2007 [69] b) Fostervold 2006 [67] c) Hedge 1999 [68] DRIESSEN et al. 2010 [65] | 2a) NR - no between group data available b) LT Pain Prevalence NSD c) ST Pain Prevalence NSD between groups | |
| Category | Treatments Details Disorder Characteristic | vS ComparisonPrimary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|------------------------------------------|-----------------------------------------------|--------------------------------------------------|
|          | EVIDENCE of NO BENEFIT (vS control) or No DIFFERENCE (vS another treatment) | | |
| Workplace Intervention: Organizational Changes | Organizational Interventions: Breaks + Control: computer software program designed to stimulate regular work breaks (5 minute rest every 35 minutes and 7 second rest every 5 minutes of computer use) Both groups received ergonomic check, adjustment if needed, booklet with information on neck and upper limb disorders, and a risk test for computer workers from large office organizations with work related neck symptoms | vs control group van den Heuvel et al. 2003 [86]; AAS et al. 2011 [123]; DRIESSEN et al. 2010 [65]; HURWITZ et al. 2008 [12]; VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] | Moderate Low Very Low |
| Workplace Intervention and 1st Prevention: Individual Worker Change | Strengthening Exercise 3 times /week, 30 minutes duration, for 8 weeks for health workers | vs no intervention Hamberg-van Reenen et al. 2009 [87]; SIHAWONG et al. 2011 [120] | IP Discomfort NSD |
| Workplace Intervention and 2nd Prevention: Individual Worker Change | Upper Extremity Strengthening 1) Dynamic muscle training; dumbbells with weight 1 to 3kg; stretching followed each exercise 2) Feldenkrais Intervention Individualised (functional integration) teacher guides through movement sequences; Group (awareness through movement) verbally guided through exercises for neck-shoulder complaints; home exercises; 50 minutes per week; individually 4 times and in group (7 to 8 participants) 12 times; required 50% participation in both segments of program General Exercise 3) Group Gymnastics/exercise planned to train whole body; aerobic dynamic exercise; relaxation; stretching of muscles of the trunk and extremities and dynamic and coordination exercises; 45 minutes; 1 time per week for workers with neck pain from a printing company 4) General Fitness Training (bike) for subacute and chronic neck pain from 7 work places | vs no treatment Viljanen et al. 2003 [57] 2) Lundblad 1999 [70]; KAY et al. 2012 [25]; VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] 3) vs no treatment Takala et al. 1994 [71] KAY et al. 2012 [25]; VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] 4) vs health counselling Andersen et al. 2008 [145] KAY et al. 2012 [25] | 1) LT Pain NSD LT Disability NSD Sick Leave NSD 2) Pain NSD Disability NSD Sick Leave NSD 3) Pain NSD Tenderness NSD 4) IP Pain NSD ST Pain NSD |
(Table 4) contd.....

**EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment)**

| Category | Treatments Details Disorder Characteristic | v vs Comparison Primary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|------------------------------------------|-----------------------------------------------|--------------------------------------------------|
| Workplace Intervention, Ergonomic Education, Mental Health Education, Physical Environment Changes, and Organizational Changes | 1) Workplace Intervention - Three components: physical health education, relaxation, breaks, activity modification, and physical environmental modifications. The trainings program was for three groups: employees, employees and supervisors, supervisors for workers with chronic neck pain (prevalence of neck pain 68% at baseline) 2) Physical Health Education, relaxation, break and physical environmental modifications for computer / VDU workers with chronic neck pain 3) Mental Health Education and Physical Environment Modifications (Traditional Neck School plus compliance enhancement measures): psychological counselling, ergonomics, exercise, self-care, relaxation for chronic neck pain in medical secretaries | 1) vs no intervention Morken et al. 2002 [88] 2) vs no intervention Ketola 2002 [89] 3) vs no intervention Kamwendo 1991 [90] AAS et al. 2011 [123]; GROSS et al. 2012 [30]; VERHAGEN et al. 2007 [143]; VERHAGEN et al. 2007 [121] | Moderate Low Very Low |
| Orthotics: Collar | Soft Collar for acute WAD | vs passive control Gennis 1996 [91] SANTAGUIDA et al. 2012 [45]; GROSS et al. 2007 [128]; HURWITZ et al. 2008 [12] | ST Pain NSD |
| Orthotics: Collar | Soft Collar for acute WAD | vs education to act as usual Borchgrevink et al. 1998 [53] GROSS et al. 2007 [128]; HAINES et al. 2009 [129]; VERHAGEN 2007 [122]; TEASELL et al. 2010 [119]; HURWITZ et al. 2008 [12] | IP Pain VAS ST Pain VAS IT Pain VAS IP Sick Leave days ST Sick Leave days IT Sick Leave days IP GPE ST GPE IT GPE |
| Orthotics: Collar | Collar + Advice for self- mobilization exercise for acute WAD | vs control Crawford et al. 2004 [93] DRESCHER et al. 2008 [126]; VERHAGEN et al. 2007 [122] | ST Pain VAS IT Pain VAS LT Pain VAS ST Activities of daily living ST RTW IT RTW LT RTW |
| Orthotics: Collar | Soft Collar + Home exercise + Physiotherapy for acute WAD | vs manual therapy (intermittent traction)+ Home exercise + physiotherapy Pennie & Agambar 1990 [94] SANTAGUIDA et al. 2012 [45]; GRAHAM et al. 2006 [127]; VERHAGEN 2007 [122]; KAY et al. 2009 [134] | ST Pain VAS IT Pain VAS ST GPE IT GPE |
| Category | Treatments Details | Disorder Characteristic | vs Comparison | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|--------------------|-------------------------|--------------|------------------------------------------------------------|
| Orthotic Collar | Soft Collar for acute WAD with cervicogenic headache | vs general physiotherapy | Moderate | a) Giebel et al. 1997 [73]; b) Rosenfeld 2000 [74]; c) Vassiliou et al. 2006 [76]; d) Bonk 2000 [72]; e) Schnabel et al. 2004 [75]; KAY et al. 2005 [134]; MILLER 2010 [137]; VERHAGEN et al. 2007 [122]; DRESCHER et al. 2008 [126]; HARALDSSON 2006 [130]; TEASELL 2010 [119]; |
| Orthotic Collar | Soft Collar + Education + Self – mobilization for acute WAD | vs general physiotherapy | Low | a) McKinney et al. 1989 [54; 78]; b) Mealy et al. 1986 [79]; c) Kongsted et al. 2007 [102]; GROSS et al. 2007 [128]; VERHAGEN et al. 2007 [122]; KAY et al. 2005 [134]; MILLER et al. 2010 [137]; TEASELL et al. 2010 [119]; |
| Orthotic Collar | Semi-hard and Rigid Collar for cervical radiculopathy | vs active therapy | Very Low | a) Kuiper et al. 2009 [43]; b) Persson et al. 1997 [96]; c) Persson & Lilja 2001 [97]; HURWITZ et al. 2008 [12]; SALT et al. 2011 [140]; NIKOLAIDIS et al. 2010 [138]; MILLER et al. 2010 [137]; SANTAGUIDA et al. 2012 [45]; KAY et al. 2005 [134]; |
| Orthotic Collar | Rigid Collar for neck pain with radiculopathy or myelopathy | vs surgery | Low | a) Persson et al. 1997 [96]; b) Persson & Lilja 2001 [97]; HURWITZ et al. 2008 [12]; SALT et al. 2011 [140]; NIKOLAIDIS 2010 [138]; MILLER et al. 2010 [137]; SANTAGUIDA et al. 2012 [45]; KAY et al. 2005 [134]; |
| Orthotic Collar | Collar (2 days) + PT 2 day immobilization with a soft cervical collar within 24 h of a WAD injury. After 7 days, all patients started a standardized physiotherapy program for acute WAD | vs collar (7 days) + PT | Moderate | a&b) ST Pain favoured surgery; LT Pain NSD; ST Function NSD; LT GPE NSD; LT Disability NSD |

EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment):

Orthotics:

Collar

Soft Collar

GIEBEL et al. 1997 [73];

ROSENFELD 2000 [74];

VASSILIOU et al. 2006 [76];

BONK 2000 [72];

SCHNABEL et al. 2004 [75];

KAY et al. 2005 [134];

MILLER 2010 [137];

VERHAGEN et al. 2007 [122];

DRESCHER et al. 2008 [126];

HARALDSSON 2006 [130];

TEASELL 2010 [119];

Orthotics:

Collar

Soft Collar + Education + Self – mobilization for acute WAD

a) McKinney et al. 1989 [54; 78];

b) Mealy et al. 1986 [79];

c) Kongsted et al. 2007 [102];

GROSS et al. 2007 [128];

VERHAGEN et al. 2007 [122];

KAY et al. 2005 [134];

MILLER et al. 2010 [137];

TEASELL et al. 2010 [119];

Orthotics:

Collar

Semi-hard and Rigid Collar for cervical radiculopathy

a) Kuiper et al. 2009 [43];

b) Persson et al. 1997 [96];

c) Persson & Lilja 2001 [97];

HURWITZ et al. 2008 [12];

SALT et al. 2011 [140];

NIKOLAIDIS et al. 2010 [138];

MILLER et al. 2010 [137];

SANTAGUIDA et al. 2012 [45];

KAY et al. 2005 [134];

Orthotics:

Collar

Rigid Collar for neck pain with radiculopathy or myelopathy

a) Persson et al. 1997 [96];

b) Persson & Lilja 2001 [97];

HURWITZ et al. 2008 [12];

SALT et al. 2011 [140];

NIKOLAIDIS 2010 [138];

MILLER et al. 2010 [137];

SANTAGUIDA et al. 2012 [45];

KAY et al. 2005 [134];

Orthotics:

Collar

Collar (2 days) + PT 2 day immobilization with a soft cervical collar within 24 h of a WAD injury. After 7 days, all patients started a standardized physiotherapy program for acute WAD

a) Dehner et al. 2006 [92];

TEASELL et al. 2010 [119];
| Category                              | Treatments Details Disorder Characteristic                                                                 | $\text{vs}$ Comparison$\text{Primary Authors}$ ($\text{REVIEW Reference}$)                                                                 | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
|                                       | Advice focus on Activation for mechanical neck disorder                                                    | $\text{vs}$ another treatment Glossop et al. 1982 [52] HAINES et al. 2009 [129]                                               | ST Pain NSD                                                 |
| Patient Education: Advice on Activation | Advice focus on Activation - Neck School: instruction for exercise, relaxation, self-care for mechanical neck disorder | $\text{vs}$ no treatment Kumwendo et al. 1991 [90] GROSS et al. 2012 [30]; HAINES et al. 2009 [129]                          | ST Pain NSD IT Pain NSD IT Function NSD IT Knowledge NSD    |
| Patient Education: Advice on Activation | Educational Intervention (one lecture on neck pain and recommendations of exercise applied at home and work) for chronic neck pain | $\text{vs}$ multimodal treatment approach sessions of active treatment including exercise, relaxation training behavioral support to reduce fear of pain and anxiety or a home exercise group Taimela et al. 2000 [99] GROSS et al. 2012 [30] | ST Pain favour multimodal LT Pain NSD LT Function NSD LT Function favour multimodal |
| Patient Education: Advice on Activation | Advice focus on Activation for mechanical neck disorder                                                    | $\text{vs}$ home exercise Taimela et al. 2000 [99] HAINES et al. 2009 [129]                                                    | ST Pain NSD LT Pain NSD LT Function NSD LT Function NSD     |
| Patient Education: Advice on Activation | Brief Educational Intervention based on return to normal activity using the media of manual/book, video tape interview and role playing for subacute/chronic neck pain | $\text{vs}$ usual physiotherapy (electrotherapy, manual therapy, advice, home exercise) Klaber Moffet et al. 2005 [56] GROSS et al. 2012 [30]; HURWITZ et al. 2008 [12]; HAINES et al. 2009 [129] | IT Pain favour PT LT Pain favour PT IT Function favour PT LT Function favour PT IT Qol. NSD LT Qol. NSD |
| Patient Education: Advice on Activation | Physician-provided Advice and support to stay active for acute neck pain                                   | $\text{vs}$ naprapathy (mobilization, manipulation, massage, stretching) Skillgate et al. 2007 [100] HURWITZ et al. 2008 [12] | ST Pain favours naprapathy                                 |
| Patient Education: Advice on Activation | Whiplash Pamphlet (explanation, reassurance, importance of mobilization and continuation of normal activities) for acute WAD | $\text{vs}$ generic information sheet Ferrari et al. 2005 [101] GROSS et al. 2012 [30]; TEASELL et al. 2010 [119]; VERHAGEN et al. 2007 [122]; HURWITZ et al. 2008 [12]; HAINES et al. 2009 [129] | ST Pain NSD ST Function NSD ST GPE NSD ST Recovery NSD     |
| Category | Treatments Details | vs ComparisonPrimary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|-------------------|-----------------------------------------------|--------------------------------------------------|
| EVIDENCE of NO BENEFIT (vs control) or No DIFFERENCE (vs another treatment) | Advice to Act-as-usual (information about whiplash and rational for staying active, move as naturally as possible, stay active) for acute WAD | vs immobilization in a Philadelphia collar or active mobilization (manual therapy and exercise) Kongsted et al. 2007 [146] GROSS et al. 2012 [30]; TEASELL et al. 2010 [119]; HURWITZ et al. 2008 [12]; HAINES et al. 2009 [129] | LT Pain NSD LT Function NSD LT QoL NSD |
| Patient Education: Advice on Activation | Advice to Act-as-usual for acute WAD | vs immobilization (soft collar and 14 days sick leave) Borchgrevink et al. 1998 [53] GROSS et al. 2012 [30]; TEASELL et al. 2010 [119] | ST Pain NSD IT Pain NSD ST GPE NSD IT GPE NSD |
| Patient Education: Advice on Activation | 1 hour Educational Session advice given verbally (explanation fear of pain, acute pain expected, act as usual and a list of key points handed out) for acute WAD | vs educational pamphlet (explanation fear of pain, acute pain expected, act as usual) Kongsted et al. 2008 [103] GROSS et al. 2012 [30]; TEASELL et al. 2010 [119] | ST Pain NSD IT Pain NSD LT Pain NSD ST Disability NSD IT Disability NSD LT Disability NSD |
| Patient Education: Advice on Activation | Mobilization Advice (one 30 minute session, included demonstration of neck exercises) for acute WAD | vs physiotherapy (multimodal therapy and active and passive repetitive movements) or rest (general advice to mobilize after 10-14 days of rest) McKinney et al. 1989 [54; 78] MILLER et al. 2010 [137]; TEASELL et al. 2010 [119]; HURWITZ et al. 2008 [12] | ST Pain NSD |
| Patient Education: Advice on Activation | Early (within 96 hours) or Delayed (at 2 weeks) standard treatment (written material advising rest for first 2 weeks, followed by active movement 2 to 3 times daily and outlined benefits of soft collar) for acute WAD | early (within 96 hours) or delayed (at 2 weeks) active treatment (small range, small amplitude neck rotations 10 times every hour Rosenfeld 2000 [74] (ST) Rosenfeld 2003 [74] (LT) TEASELL et al. 2010 [119] | All outcomes favour active treatment IT Pain LT Pain |
| Patient Education: Self-management educational strategies | Self-care Booklet for chronic neck pain | vs massage and advice on stretching, body awareness, and increase in water intake Sherman et al. 2009 [104] GROSS et al. 2012 [30]; PATEL et al. 2012 [139] | ST Function NSD IT Function NSD LT Function NSD ST Pain favored massage IT Pain NSD LT Pain NSD IT QoL NSD LT QoL NSD |
| Patient Education: Self-management educational strategies | Education on aerobic exercise + stretching for chronic non-specific neck pain | vs specific neck strengthening exercise + dynamic exercise for trunk, Upper & Lower Extremity (1 set, 15 repitions) or specific neck endurance exercise + dynamic exercise for trunk, Upper & Lower Extremity (3 sets, 20 repitions) (5 sessions/week, 45 min) Ylinen et al. 2003 [33] SIHAWONG 2011 [120] | All outcomes favour neck strengthening exercise LT Pain LT Disability |
| Category | Treatments Details Disorder Characteristic | vs Comparison Primary Authors (REVIEW Reference) | Quality of Evidence (GRADE*) (no Strong GRADE was Retrieved) |
|----------|------------------------------------------|--------------------------------------------------|----------------------------------------------------------|
|          |                                          |                                                  | Moderate | Low | Very Low |
| EVIDENCE of NO BENEFIT (vs control) or NO DIFFERENCE (vs another treatment) | Education (health-promotion) for non-specific neck pain | vs 1) strengthening exercise; dynamic resistance for arm and shoulder (2 to 3 sets, 10 to 15 repetitions) + static neck exercise (hold 5 second) (3 times/week, required 20 min) vs 2) nonspecific exercise (motivated to increase their daily physical activity) Blangsted et al. 2008 [32] SIHAWONG 2011 [120] | LT duration of Pain favored 1 & 2 LT intensity of Pain favored 1 & 2 LT Work Ability NSD LT Sick Leave NSD LT Discomfort NSD |
| Patient Education: Self-management educational strategies | Education (anatomy + stretching) for non-specific neck pain | vs 1) self-stretching exercise for tight neck muscles and neck ROM exercises (hold 5 seconds, 10 times) vs 2) term-stretching exercise group I: exercise once a day (hold 5 seconds, 10 times) vs 3) term-stretching exercise group II: exercise twice a day in the morning and afternoon (hold 5 seconds, 10 times) (required 15 to 20 minutes for exercise) Tsauo et al. 2004 [105] SIHAWONG 2011 [120] | ST Pressure Pain Threshold favoured 2 & 3 |
| Patient Education: Self-management educational strategies | Self-management Program (education and information about exercise for chronic WAD) | vs multimodal PT program (low-load exercises, low-velocity mobilizing techniques, education and assurance) Jull et al. 2007 [106] MILLER et al. 2010 [137] TEASELL et al. 2010 [119] | ST Pain favoured PT |
| Patient Education: Self-management educational strategies | Instruction in home exercises for acute neck pain | vs supervised rehabilitation training Bunketorp et al. 2006 [107] HURWITZ et al. 2008 [12] | All outcomes favoured supervised rehab ST Pain ST Disability ST Sick Leave |
| Patient Education: Self-management educational strategies | Advice on neck care for acute neck pain | vs intensive neck exercise Chiu et al. 2005 [80] HURWITZ et al. 2008 [12] | All outcomes favoured exercise ST Pain LT Pain ST Disability LT Disability |

Key: GRADE*: study design, within study risk of bias, consistency of results, directness (generalizability), precision (sufficient data), reporting bias (publication, language, funding, other); WAD – whiplash associated disorder; PT – physiotherapy; VDU – video display unit; vs – versus; GPE – global perceived effect; QoL – quality of life; IP – immediate post-treatment; ST – short term closest to 3 months, IT – intermediate term closest to 6 months, LT – long term closest to 1 year; ROM – range of motion; VAS – visual analogue scale; RTW – return to work; min – minutes; NR – not reported; NSD - negative findings or statistically not significant; SD - positive findings or statistically significant different findings; * SMD -0.51 [95%CI: -1.05, 0.02] = positive trend; p - probability value.
Table 5. Evidence-Based Recommendations

| GRADE Symbol | GRADE* and Recommendation | Clinical Importance | Reported Adverse Effect or Side Effects |
|--------------|---------------------------|---------------------|----------------------------------------|
| Strong       | Evidence of Benefit:      |                     |                                        |
|              | (Strongly recommend use)  |                     |                                        |
|              | No recommendation         | NA                  | NA                                     |
| Moderate     | Evidence of Benefit:      |                     |                                        |
|              | (Suggested use)           |                     |                                        |
| ****         | **Patient Education:**    |                     |                                        |
|              | **Advice on Activation**  |                     |                                        |
|              | Educational video on advice on activation (1 trial [29], 405 participants) vs no treatment for acute WAD at ST, IT and LT follow-up | Magnitude of effect: ST MEDIUM LT SMALL | NR                                     |
|              |                           | ST Pain (0-5 scale) |                                        |
|              |                           | SMD: -0.67 (95%CI: -0.87 to -0.46) |                                        |
|              |                           | WMD: -1.00 (95%CI: -1.30 to -0.70) |                                        |
|              |                           | IT Pain             |                                        |
|              |                           | SMD: -0.38 (95%CI: -0.59 to -0.17) |                                        |
|              |                           | WMD: -1.00 (95%CI: -1.56 to -0.44) |                                        |
|              |                           | LT Pain             |                                        |
|              |                           | SMD: -0.44 (95%CI: -0.66 to -0.23) |                                        |
|              |                           | WMD: -1.00 (95%CI: -1.48 to -0.52) |                                        |
|              |                           | NNT 23              |                                        |
| ****         | **Mind-Body by certified instructor** |                         |                                        |
|              | Cognitive (mindfulness & emotional balance) during Dantian Qigong exercises + advice delivered by approved Qigong therapists, all being members of the German Qigong Society (M-A: 2 trials [27; 28], 191 participants) vs no treatment for chronic neck pain at IP and ST follow-up | Magnitude of effect: ST SMALL LT SMALL | NR                                     |
|              |                           | ST Pain (VAS 0-100) |                                        |
|              |                           | SMDp: -0.34 (95%CI: -0.67 to -0.01) |                                        |
|              |                           | WMDp: -14.90 (95%CI: -22.40 to -7.39) |                                        |
|              |                           | ST Function (NDI or NPDI 0-100) |                                        |
|              |                           | SMDp: -0.36 (95%CI: -0.68 to -0.03) |                                        |
|              |                           | WMDp: -10.38 (-17.11 to -3.64) |                                        |
|              |                           | Pain NNT 4 to 6     |                                        |
|              |                           | Function NNT 5 to 8 |                                        |
| ●            | **Workplace Intervention & 2° Prevention:** |                         |                                        |
|              | **Individual Worker Changes** |                     |                                        |
|              | 1 trial, 2 arms, 198 participants |                     |                                        |
|              | 1) 2-minute scapulothoracic endurance training program x 10 weeks (1 trial [31], 127 participants) vs control for (sub)acute/chronic myofascial neck pain immediately post treatment for workers from white collar organizations at IP follow-up | Magnitude of Effect: 2-minute IP SMALL 12-minute IP SMALL | No long lasting or major complications. Minor transient side effects: worsening of neck muscle tension, shoulder, upper arm or forearm/wrist joint pain during training; worsening of headache after training |
|              |                           | IP Pain (VAS 0 to 10) 2-minute |                                        |
|              |                           | SMD: -0.66 (95%CI: -1.02 to -0.30) |                                        |
|              |                           | WMD: -1.30 (95%CI: -1.98 to -0.62) |                                        |
|              |                           | IP Pain (VAS 0 to 10) 12-minute |                                        |
|              |                           | SMD: -0.59 (95%CI: -0.94 to -0.23) |                                        |
|              |                           | WMD: -1.30 (95%CI: -2.06 to -0.54) |                                        |
|              |                           | Pain NNT 4           |                                        |
| Strong       | Evidence of NO Benefit:   |                     |                                        |
|              | (Strongly recommend use)  |                     |                                        |
|              | No recommendation         | NA                  | NA                                     |
| Moderate     | Evidence of NO Benefit:   |                     |                                        |
|              | (Suggested not to use)    |                     |                                        |
| OOOO         | **Psychosocial Intervention by PT:** |                         |                                        |
|              | 1) Cognitive behavioral principles - Solution Finding (1 trail [56], 268 participants): Guidance to identify the problems correlated to their pain; Identification of solutions; goal setting based on CBT principles; booklet or pamphlet delivered by PT vs usual PT at LT follow-up | 1) LT QALY (Patient-specific quality-adjusted life years); brief intervention provided only slightly less health benefit on average | NR                                     |
(Table 5) contd.....

| GRADE Symbol | GRADE* and Recommendation | Clinical Importance Magnitude of Effect Duration of Effect | Reported Adverse Effect or Side Effects |
|---------------|----------------------------|-----------------------------------------------------------|----------------------------------------|
| ❧❑❑❑       | 2) Intensive relaxation training (1 trial [57], 258 participants) - progressive relaxations, functional relaxation, autogenic training, systematic desensitization- delivered by PT vs no control for chronic non-specific neck pain at LT follow-up | 2) LT Pain NSD LT Function NSD | NR |
| ❧❑❑❑         | Workplace Intervention: Mental Health Education Intensive relaxation training (1 trial [57], 258 participants) - progressive relaxations, functional relaxation, autogenic training, systematic desensitization- delivered by PT vs no control for chronic non-specific neck pain in office workers at LT follow-up | LT Pain NSD LT Function NSD | NR |
| ❧❑❑❑       | Workplace Intervention: Ergonomic Education & Mental Health Education 1) mental health education and physical health education, relaxation, breaks (1 trial [59], 2 arms, 466 participants) a) work style (1 trial, 210 participants analysed at LT) b) work style + physical activity (1 trial, 209 participants analysed at LT) vs no intervention | 1) IT Pain NSD LT Pain NSD | NR |
| ❧          | 2) Weekly Email (1 trial [31], 3 arms, 198 participants): physical exercise, advice to stay active in spite of pain, diet, smoking, alcohol use, stress-management, workplace ergonomics (n=64) vs 2-minute of exercise (n=63) vs 12-minutes of exercise (n=65) for acute to chronic myofascial neck pain in 2 large white collar organizations at IP follow-up | 2) IP Pain favoured the comparison treatments: 2-minute or 12-minute training groups | NR |
| ❧❑         | Workplace Intervention & 1st or 2nd Prevention: Physical Environment Changes Physical Ergonomic Interventions (M-A 4 trials [61-64], 1546 participants): a) ergonomic training on workplace adjustment for university workers; b) ergonomic training in kitchen workers; c) postural training & work station changes for computer workers; d) adjustment to desk/keyboard/mouse position/forearm support for call centre workers vs no intervention for non-sick listed neck pain free workers at ST follow-up | ST Neck Pain incidence/ prevalence: (M-A) NSD RRp: 0.93 (95%CI: 0.84 to 1.03) | NR |
| ❧❑❑❑       | Workplace Intervention & 2nd Prevention: Individual Worker Change Upper extremity stretching & strengthening endurance training (1 trial [57], 265 participants) vs no intervention for chronic neck pain at LT follow-up | IP Pain ST Pain LT Pain IP Disability ST Disability LT Disability LT Sick Leave | NR |
| ❧❑❑❑       | Orthotics: Collar 1) Soft Collar use in combination with Advice to self-mobilize: collar worn during waking hours for two weeks, after two weeks add active range of motion exercises (no M-A 5 trials [72-76], 637 participants) vs general PT for acute WAD neck pain at LT follow-up | 1) LT Pain NSD LT Function NSD LT QoL NSD LT Ability to Work NSD | No side effects reported |
| ❧❑          | 2) Soft collar use (no M-A 3 trials [77-79], 641 participants) vs general PT for acute neck pain with cervicogenic headache at ST and IT follow-up | 2) ST Pain favoured PT IT Pain favoured PT ST Disability favoured PT | NR |
1) psychosocial interventions by a physical therapy (PT) such as use of a) cognitive behavioral principles in solution finding or b) intensive relaxation training at an office work;

2) workplace interventions including ergonomic education and mental health education such as work style education, work style and physical activity increase or weekly emails over a short-term about exercise, advice to stay active, diet, smoking, alcohol use, stress-management and workplace ergonomics;

3) individual worker change such as upper extremity stretching and strengthening endurance training 3 times per week for 30 minutes; and

4) specific patient education using self-management educational strategies such as education on exercise or neck care. Other interventions are not recommended as they show moderate GRADE evidence of no benefit over the short-term including workplace interventions including physical environment change in non-sick listed workers specifically ergonomic training on workplace adjustment for university workers, ergonomic training for kitchen workers, postural training and work station changes in computer workers and adjustment to desk/keyboard/mouse position/forearm support in call centre workers.

EVIDENCE OF BENEFIT

Strong Evidence

We found no trials that met this standard.

Moderate Evidence

Mind-Body Interventions by Certified Instructor

For Dantian Qigong exercises when compared with a wait list control, two reviews [25; 26] and 1 meta-analysis [25] (2 trials, 191 participants, von Trott et al. 2009 [27], Rendant et al. 2011 [28]) found moderate GRADE evidence demonstrating small benefit for chronic neck pain reduction, moderate benefit on function and small benefit for quality of life post treatment but no benefit for global perceived effect immediate post treatment and at short-term follow-up. Kay and colleagues [25] noted one would need to treat 4 to 6 people to achieve this type of pain relief, 5 to 8 people to achieve this functional benefit, and 7 to 10 people for this improvement in quality of life. Qigong exercise includes a cognitive or affective element - mindfulness and emotional balance - thereby influencing the functional status of the psychological system as it is related to movement and was instructed by 5 approved Qigong therapists, all being members of the German Qigong Society.

Patient Education – Advice on Activation

For advice on activation (1 trial; 405 participants, Brison et al. 2005 [29]) using an educational video on reassurance, basic advice on posture, early return to daily activities, range of motion exercises, pain relief methods (ice, heat, analgesic) given in an Emergency Room, we found moderate evidence of a small benefit compared to no treatment for acute WAD for short-, intermediate-, and long-term pain [19]. For advice on activation (1 trial; 405 participants) favoured the use of specific strengthening exercises targeting the cervical and scapulothoracic regions for the individual worker. A reduction in the prevalence or intensity of pain was noted.

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### Table 5 contd....

| GRADE Symbol | GRADE* and Recommendation | Clinical Importance | Magnitude of Effect | Duration of Effect | Reported Adverse Effect or Side Effects |
|--------------|----------------------------|---------------------|---------------------|-------------------|----------------------------------------|
| ⬛⬜⬜⬜ | Patient Education: Self-management strategy 1) Education on aerobic exercise + stretching (1 trial [33], 180 participants) vs specific endurance and strengthening exercises for chronic non-specific neck pain at LT follow-up | 1) All outcomes favoured neck strengthening exercise LT Pain LT Disability | | | NR |
| ⬛⬜⬜⬜ | 2) Advice on neck care (1 trial [80], 218 participants) vs intensive neck exercises for acute neck pain for pain and disability at ST and LT follow-up | 2) All of the following outcomes favoured intensive exercise ST Pain LT Disability ST Disability LT Disability | | | NR |

GRADE*: study design, within study risk of bias, consistency of results, directness (generalizability), precision (sufficient data), reporting bias (publication, language, funding, other); open symbol= no benefit; closed symbol = beneficial; duration of effect noted by number of symbols: one = IP, two = ST, three = IT, 4 = LT; diamond (● or ○) = high GRADE; dot (● or ○) = moderate GRADE with solid symbol indicating benefit and open symbol indication no benefit

Clinical Important is determined by considering the following factors: minimal detectable change, minimal clinically important difference (≥ 15%), large magnitude of effect measured by weighted mean difference, number needed to treat, absolute benefit & treatment advantage, high dose response gradient, duration of the effect (IP – immediate post treatment, ST – short term for about 3 months, IT – intermediate term for about 6 months, LT – long term for about 1 year)

Key: WAD – whiplash associated disorder; IP – immediate post-treatment follow-up; ST – short term follow-up; IT – intermediate-term follow-up; LT – long-term follow-up; SMDg – pooled standard mean difference; WMDg – weighted mean difference; RRg – pooled relative risk; M-A – meta-analysis; NNT – number-needed-to-treat; 95% CI – 95% confidence interval, † no significant difference between groups for this outcome, GPE – global perceived effect; VAS – visual analogue scale; QALY – quality of life years; PT – physiotherapy; CBT – cognitive behavioral training; NR – not reported; NA – not applicable, vs – versus.
across different time points. Dosage diversity exists between programs. We note a small clinically meaningful benefit (moderate GRADE, 1 trial; 198 participants, Andersen et al. 2011 [31]) favouring both a 2-minute and 12-minute scapulothoracic endurance training program in reducing pain [WMD-2 minute -1.30 (95%CI: -1.98, -0.62) or WMD-12 minute -1.30 (95%CI: -2.06, -0.54)] in workers with acute/chronic myofascial neck pain from two large white collar organizations immediately post 10 weeks (5 times per week) of treatment [25]. A clinician would need to treat four workers to achieve this pain relief in one (NNT 4).

Specific strengthening exercises (dynamic resisted) targeting the neck, arm, and shoulder (moderate GRADE, 1 trial, 549 participants Blangsted et al. 2008 [32]) reduce the prevalence of neck pain and neck pain intensity in the long term when compared to a control of health promotion education in office workers. There was no difference observe in the workers ability to work or sick leave in this population. Two further trials (low GRADE) suggest strength or endurance training reduces worker’s neck pain compared to different controls at short (Ylinen et al. 2003 [33]) and at long-term (Waling 2000 [34, 35]) follow-up. Additionally, there is support for reduction of disability through the use of endurance muscle training in office workers at short-term follow-up (Ylinen et al. 2003 [33]). Two other trials (very low GRADE) support 1) strengthening, stretching and relaxation exercise in computer workers (Omer et al. 2003 [36]) or 2) progressive training from non-postural low load exercise to endurance strengthening to dynamic moderate resistance through full range of motion training tailored to the individual patient abilities for helicopter pilots with chronic myofascial neck pain (Ang et al. 2009 [37]).

**Low or Very Low Evidence**

**Psychosocial Interventions**

For exercise including coaching and motivational cognitive elements, we found evidence of benefit (low GRADE, 1 trial, 132 participants, Stewart et al. 2007 [38]) in pain, function, global perceived effect and quality of life.
post-treatment and for function at long term follow-up when compared with advice alone for chronic mechanical neck disorder. The cognitive behavioral therapy delivered by a physiotherapist included: setting goals of progressively increasing difficulty, shaping, encouraging self-monitoring of progress, and self-reinforcement.

Two trials of very low GRADE addressed two distinct psychosocial interventions. First, values-based exposure and acceptance strategies for chronic WAD were beneficial (very low GRADE, 1 trial, 21 participants, Wicksell et al. 2008 [39]) for short-term improvement in pain-disability index, life satisfaction; fear of movement, depression, post-traumatic stress symptoms, psychological flexibility but not pain intensity. The professional background of the practitioner applying this intervention was not reported. Second, a multimodal intervention including relaxation training, psychological support, exercise, and manual therapy (very low GRADE, 1 trial, 60 participants, Provinciali 1996 [40]) delivered by PT for acute WAD was beneficial for long-term return to work but not different in immediately post treatment pain intensity when compared to electrotherapy.

**Workplace Intervention & 1st Prevention - Physical Environment Change**

We note low GRADE evidence of benefit in preventing pain in workers using two physical ergonomic interventions - 1) ergonomic training plus an arm board support (1 trial, 83 participants, Kempe et al. 2006 [41]) in non-sick listed neck pain free workers in customer service had significant neck pain prevention compared to no ergonomic intervention in the long-term; and 2) The use of either a chair with a cured or flat seat pan (1 trial, 2 arms, 277 participants [42]) - resulted in lower neck pain intensity in non-sick listed neck pain free garment workers at short-term follow-up.

**Orthotics – Collar**

For semi-hard collars, we note low GRADE evidence of benefit (1 trial, 205 participants, Kuijper et al. 2009 [43]) in short-term pain reduction for cervical radiculopathy when compared to being on a wait list. However, there was no difference in pain at intermediate-term. There was also no difference in short-term and intermediate-term function, global perceived effect or working status between these groups.

**Orthotics – Kinesio Taping**

There is low GRADE evidence of benefit (1 trial, 41 participants, Gozalez-Iglesias et al. 2009 [44]) for the use of Kinesiotape when compared with a placebo control. The evidence indicates that Kinesiotape applied for 24 hours resulted in reduced immediate and short term pain when compared to the same tape applied with no tension for acute/subacute WAD. However, there was no difference in immediate and short-term range of motion and disability.

**Orthotics – Pillow**

There are significant differences in the types of pillows that impede comparisons across studies (very low GRADE, 5 trials, 383 analysed from 422 randomised participants [45]) evaluating specialised pillows in persons with acute and chronic neck pain. When a cervical pillow is compared to a generic or standard pillow, there is very low GRADE evidence of benefit (3 trials, 56 participants, Erfanian et al. 2004 [46] & Jochems et al. 1997 [47]) of morning pain relief favouring the cervical pillow for chronic neck pain but no difference in the evening or when evaluating global perceived effect. When comparing a Mediflow water-based pillow to a participant’s regular pillow (very low GRADE, 1 trial, 20 participants, Lavin 1997 [48]), evidence shows that a water based pillow resulted in reduced pain in the short-term. This trial also indicated that function, as measured by the Sickness Impact Profile was greatly improved when comparing the water based pillow to the roll pillow. Additionally, different specialised pillows - the Shape of Sleep pillow (Manutex Products, Mississauga, ON, Canada) or the Sissel Design AB pillow (Sissel Design AB, Svedala, Sweden) combined with exercise (low GRADE, 1 trial, 62 participants, Helewa et al. 2007 [49]) showed decrease pain and increase function when compared to exercise in persons with acute or chronic neck disorders. However, when these pillows were compared to regular pillows without the exercise interaction effect there was no difference in pain and function outcomes (Helewa et al. 2007). Finally, for chronic cervical brachialgia, using a specialized cervical pillow (very low GRADE, 1 trial, 149 participants, Bernateck et al. 2008 [50]) reduced pain recurrence significantly at short and long-term follow-up.

**Orthotics – Oral Splint**

For people with chronic neck pain and headache, occlusal adjustment plus physiotherapy (low GRADE, 1 trial, 40 participants, Karppinen et al. 1999 [51]) was significantly better in the long-term (12 and 60 months) then mock adjustment.

**Patient Education- Advice on Activation**

Advice on activation was given through various means in the studies included in this review. These included educational booklets (for mechanical neck disorder; Glossop et al. 1982 [52]), advice on acting as usual and instructions for self-training exercises to be initiated immediately (for acute WAD [53]) and mobilization advice (for acute WAD [54]). Advice on activation given through these modes showed low or very low evidence of benefit when compared to teaching exercises alone (for short-term pain and knowledge (Glossop et al. 1982 [52]), immobilization (for short- and intermediate-term pain, range of motion and cognitive symptoms [53] and physiotherapy or rest (for short-term pain and long-term presence of symptoms [54].

**EVIDENCE OF NO BENEFIT (VS CONTROL) OR NO DIFFERENCE (VS COMPARISON)**

**Strong Evidence**

We found no trials that met this standard.

**Moderate Evidence**

**Psychosocial Intervention by PT**

We found 1 trial (moderate GRADE, 268 participants, 2 publications, Manca et al. 2007 [55], Klaber-Moffet et al. 2005 [56]) on psychosocial intervention delivered by a PT based on cognitive–behavioral principles. It encouraged a return to normal daily activities as soon as possible through
self-management compared to usual physiotherapy. At long-term follow-up, there was a moderate effect size for neck pain and disability SMD 0.30 [0.06, 0.54]; Mean Difference 1.90 [0.39, 3.41] favoured the usual physiotherapy treatment over the brief intervention group. This brief intervention provided only slightly less health benefit on average in the long-term as measured by Patient-specific quality-adjusted life years at long-term follow-up.

For intensive relaxation training (progressive relaxations, functional relaxation, autogenic training, systematic desensitization) delivered by a physiotherapist for chronic non-specific neck pain, there was no difference (moderate GRADE, 1 trial, 258 participants, Viljanen et al. 2003 [57]) in neck/arm pain relief or improved function when compared to a control or exercise at long-term follow-up.

Workplace Intervention – Mental Health Education

For office workers with neck pain, relaxation training involving progressive relaxation, autogenic training, functional relaxation, systematic desensitization showed no significant difference in pain levels or disability over no treatment (moderate GRADE, 1 trial, 258 participants, Viljanen et al. 2003 [57]). Likewise, one further trial (stress management versus no intervention, low GRADE, 192 participants, Horneij et al. 2001 [58]) showed no significant difference for pain or sick leave at long-term follow-up.

Workplace Intervention – Ergonomic and Mental Health Education

For office and computer workers with neck pain, we note no difference between two-component work-place interventions (work style group) including stimulated workplace adjustment, improved body posture, breaks, and coping behaviors to high work demands over no intervention on pain severity at long-term follow-up (moderate GRADE, 1 trial, 2 arms - 210 and 209 participants, Bernaards et al. 2007 [59]). The second arm (work style + physical activity group) included an increase in moderate to heavy physical activities. Two further trials included work ergonomic education and stress coping stills (moderate GRADE, 1 trial 2 arms, 192 participants, Andersen et al. 2011 [31]; low GRADE, 1 trial - 2 arms, 42 participants, Andersen et al. 2008 [60]) compared to various exercise interventions and found either the 2 or 12 minute exercise was favoured (Andersen et al. 2011 [31]) or no difference when compared to general fitness or neck/shoulder exercise (Andersen et al. 2008 [60]).

Workplace Intervention & 1st or 2nd Prevention - Physical Environment Change

Four trials [61-64] (moderate GRADE, 1 meta-analysis [65], 1546 participants) suggests a number of physical environment interventions do not prevent neck pain in the short-term when compared to no intervention for non-sick listed neck pain free (university, kitchen, computer or call centre) workers while three other physical environment interventions (low GRADE, 1 meta-analysis [65], 3 trials [42, 64, 66], 295 participants) did not prevent neck pain in the long-term when compared to a control. Sick leave was also no different from a control [64]. For workers with neck pain, we note three further physical environment modifications (low GRADE, three trials Voerman et al. 2007, Fostervold et al. 2006, Hedge et al. 1999 [67-69], 137 participants) suggesting no evidence of benefit in the long-term for computer or office workers with chronic neck pain when compared to another workplace intervention. We refer the reader to Table 4 for descriptions of the modifications.

Workplace intervention & 2nd Prevention – Individual Worker Change

We suggest two categories of exercise 1) upper extremity stretching and strengthening or 2) general exercise may not reduce pain intensity or pain prevalence in workers. Upper extremity stretching and endurance training (moderate GRADE, one trial, 265 participants, Viljanen et al. 2003 [57]) for chronic neck pain and function at immediate post treatment, short- and long-term follow-up and a teacher guided combined exercise approach (Feldenkrais Intervention, low GRADE, one trial, 38 participants Lundblad 1999 [70]) of stabilization of the low back and pelvis, posture awareness, ergonomic training, and strength, coordination, endurance, flexibility/smoothness and rhythm exercises when compared to no intervention or a wait list control for pain reduction with in chronic neck pain at short-term follow-up showed no evidence of benefit. General fitness training (i.e. biking) (low GRADE, 1 trial, 30 participants, Andersen et al. 2008 [60]) or group exercise that combined extensibility and coordination exercises with cardiovascular training (low GRADE one trial, 44 participants, Takala et al. 1994 [71]) for pain reduction immediately post treatment in patients with neck pain of unspecified duration did was no differ from a control group.

Orthotics – Collar

When a soft collar is used following acute WAD and is compared to general physiotherapy, the research showed moderate evidence of no benefit (5 trials, 637 participants, Giebel et al. 1997, Rosenfeld 2000, Schnabel et al. 2004, Vassiliou et al. 2006, Bonk et al. 2000 [72-76]). These trials concluded that there was a greater reduction of pain and increased global effect at short- and intermediate-term follow-up but not at long-term follow-up with physiotherapy treatment versus continuous use of a collar. Similarly, there is moderate evidence of no benefit (3 trials, 641 participants, McKinney 1989, Mealy et al. 1986, Kongsted et al. 2007 [77-79]) when comparing the use of a soft collar in combination with education to self-mobilize when compared to general physiotherapy [77-79]. Following an acute WAD, the evidence shows that general physiotherapy is better at reducing short-term pain, and increasing short-term cervical ROM than the combined use of a collar and education to self-mobilize [78, 79]. However, there is no significant difference when comparing the effects of these two interventions on long-term pain or function [77].

Patient Education – Self Management Educational Strategy

For a self – management educational strategy (moderate GRADE, 1 trial; 180 participants Ylinen et. al. 2003 [33]), utilizing education on aerobic exercise plus stretching compared to specific neck, trunk, lower and upper extremity exercises or specific neck endurance and strengthening exercises was not beneficial for chronic non-specific neck pain and disability at long-term follow-up. Additionally, we
note moderate evidence of no benefit (1 trial, 218 participants, Chiu et al. 2005 [80]) for a self-management strategy on neck care versus intensive neck exercises for acute neck pain and disability at short- and long-term follow-up.

**Low or Very Low Evidence**

**Psychological Intervention by Clinical Psychologist**

Cognitive-behavioral therapy delivered by clinical psychologist for chronic neck and shoulder pain was not different from cognitive-behavioral therapy delivered by psychologist functioning as a coach to other health professionals (low GRADE, 1 trial, 70 participants, Jensen 2005 [81]) for intermediate-term pain relief or disability and long-term pain relief or sick leave. By the intermediate-term, the costs of delivering the intervention favour the coached health professionals.

**Psychosocial Intervention by PT**

Two trials assessed two different psychosocial interventions conducted by a physiotherapist. For cognitive behavioral components integrated with PT delivered by a physiotherapist in chronic WAD, there was no benefit (low GRADE, 1 trial, 33 participants, Soderlund 2001 [82]) over PT alone for pain relief, disability and activity of daily living at short-term follow-up. There were four phases to the cognitive-behavioral therapy: Learning of basic physical and psychological skills, application and generalisation of basic skills in everyday activities derived from functional behavioral analysis and a maintenance phase. One further trial (low GRADE, 1 trial, 139 participants, Vonk 2009 [83]) assessing a Behavior Graded Activity Program showed no difference in pain relief, function, global perceived effect and self-efficacy from a conventional exercise program at short-, intermediate- and long-term follow-up but required less treatment. Finally, the Neck Book provided by a physician from an occupational healthcare network intended to allay unrealistic fears of patient and promote activity despite pain (Very low GRADE, 1 trial, 181 analysed/552 randomized participants, Derebery 2009 [84]) noted a great loss to follow-up (n=181 randomized/552 analysed) and make conclusions difficult but demonstrated poor short-term and intermediate-term benefits in pain/disability. One further trial of very low GRADE noted stress management (169 randomized/282 analysed participants, Hornej et al. 2001 [58]) for mechanical neck disorder (duration NR) was not beneficial when compared to a non-intervention group for pain relief at long-term follow-up. The profession of the practitioner delivering the intervention was not reported.

**Mind-Body (Alternative) Interventions by Certified Instructor**

For an alternative mind-body approach – Gestalt therapy ‘philosophy of life’ training, we found evidence of no benefit (very low GRADE, 1 trial, 87 participants, Venteogodt 2004 [85]) when compared to no treatment for pain, daily functioning, sick leave and global quality of life at short-term follow-up.

**Workplace Intervention – Organizational Change**

For computer workers from large office organizations with work related neck symptoms, computer stimulated breaks showed no evidence (low GRADE, 1 trial, 219 analysed/268 randomized participants, van den Heuvel 2003 [86]) of altering pain intensity/frequency or sick leave but did alter productivity and perceived recovery from complaints.

**Workplace Intervention or 2º Prevention – Individual Worker Change**

For healthy pain free workers, doing strengthening exercise (very low grade, 1 trial, 19 participants, Hammer-van Reenen et al. 2009 [87]) did not protect against new onset musculoskeletal discomfort in the short-term.

**Workplace Intervention – Ergonomic Education, Mental Health Education, Physical Environment Change, and Organizational Change**

Three trials suggest no significant change in pain prevalence [88], pain intensity [89, 90] or sick leave [90] when various combinations of four component workplace interventions were compared to no intervention at intermediate-term (low GRADE, 1 trial, 2 arms – 54, 57 participants; Ketola 2002 [89]; very low GRADE, 1 trial, 76 participants, Kamwendo et al. 1991 [90]) or long-term follow-up (low GRADE, 1 trial, 3 arms - 601, 599, 629 participants; Morken et al. 2002 [88]).

**Orthotics - Collars**

There is very low GRADE evidence of no difference (1 trial, 196 participants, Gennis 1996 [91]) when comparing the use of a soft collar following an acute WAD versus rest for short term pain relief or global perceived effect. The research also showed low GRADE evidence of no difference (1 trial, 211 participants, Borchgrevink et al. 1998 [53]) when comparing the use of a collar versus advice to “act as usual” for immediate, short-term or intermediate-term pain relief, global perceived effect, improving ROM, or time on sick leave. Also there was no difference in pain at the short- and intermediate-term follow-up if a collar was worn 2 days versus 7 days (1 trials, 70 participants, Dehner et al., 2006 [92]).

Following an acute WAD, there is very low evidence of no benefit (1 trial, 108 participants, Crawford et al. 2004 [93]) when combining the used the combined the use of a collar for 3 weeks followed by a self-mobilization exercise regime versus a control group. This trial found that there was no benefit of collar use on pain, ROM, activities of daily living or return to working in the short-term, intermediate-term or long-term. Advice to self-mobilize was administered by providing participants with advice sheets. Furthermore, there is very low evidence of no difference (1 trial, 135 participants, Pennie 1990 [94]) when comparing the initial use of a soft collar followed by home exercises and late physiotherapy when compared to manual therapy for the treatment of acute WAD. Collar in combination of exercise and physiotherapy showed no difference in reduction of pain and global perceived effect in a short-term and intermediate-term follow-up.

When compared to active physiotherapy, there is low level evidence of no difference (2 trials; one with a 2 year follow-up, 286 participants, Kuijper et al. 2009, Persson et al. 1997 & Persson et al. 2001 [95-97]) for semi-hard and rigid collar use in those with cervical radiculopathy [95-97].
Evidence shows that there is no difference between these two treatments when comparing short-term intermediate-term and long-term pain, function, global perceived effect and long-term disability [95-97].

When compared to surgery, there is also low level evidence of no difference (2 trials; one with a 2 year follow-up, 149 participants, Kadanka et al. 2000, Persson et al. 1997, Persson et al. 2001 [96-98]) for semi-hard and rigid collar use in those with cervical radiculopathy. The evidence shows that there is no significant difference in short- and long-term pain, global perceived effect, and disability as well as intermediate- and long-term function.

**Patient Education - Advice on Activation**

Low GRADE evidence of no benefit was shown for the following 11 educational interventions:

1. Advice on activation versus another treatment [52] or home exercise [99] for mechanical neck pain at short-term [52, 99] and long-term follow-up and function [99];
2. Neck school which included instruction for exercise, relaxation and self-care versus no treatment for mechanical neck pain and function at short- and intermediate-term follow-up and knowledge [100];
3. Lecture on neck pain and recommendations on exercises versus multimodal treatment of exercise and relaxation training or home exercise for chronic neck pain for short- and long-term pain and function [99];
4. Education or control booklet versus no treatment for acute or subacute neck pain for short-term pain and intermediate-term pain and disability [84];
5. Education on return to normal activity using media, manual/book, video tape interview and role playing versus physiotherapy for subacute or chronic neck pain for intermediate- and long-term pain, function and quality of life [56];
6. Physician advice versus naprapathy for acute neck pain for short-term pain [100];
7. Whiplash pamphlet versus generic information sheet for acute WAD for short-term pain, function, recovery and global perceived effect [101];
8. Advice to act-as-usual and education on WAD versus immobilization in a collar [53, 102] or manual therapy and exercise [102] for acute WAD for short- and intermediate-term pain and global perceived effect [53] and long-term pain, function and quality of life [102];
9. One hour verbal advice plus a hand-out of key points versus an educational pamphlet for acute WAD for short- and intermediate-term pain and disability [103];
10. Mobilization advice versus rest for acute WAD for short-term pain and ROM [78];
11. Early or delayed standard treatment which included written material advising for rest followed by active movement versus early or delayed active treatment for acute WAD for intermediate- and long-term pain and ROM [74].

**Patient Education - Pain and Stress-Coping Skills Education**

We note low GRADE evidence of no benefit for pain and stress-coping skills education from the following 2 trials: 1) education on psychological skills plus physiotherapy versus physiotherapy for subacute WAD for short and intermediate term pain and disability [82]; and 2) education on stress management versus individual training programme or no intervention for mechanical neck pain and disability at short- and long-term follow-up [58].

**Patient Education - Work place Ergonomic Education and Pain and Stress-Coping Skills Education**

Also, low GRADE evidence from 2 trials suggests workplace education on pain and stress-coping skills was not favoured. First, health counselling versus specific training or general fitness training for chronic neck pain at short-term follow-up [60]; Second, education on physical exercise, advice to stay active, diet, smoking, alcohol use, stress management and workplace ergonomics versus 2 minute or 12 minute exercise program for chronic neck pain at short-term follow-up [31].

**Patient Education - Self-Management Educational Strategies**

We also note that a variety of educational self-management strategies appear not beneficial (Low GRADE, 5 trials) as follows. 1) Self-care booklet versus massage plus advice on stretching, body awareness and water intake for chronic neck pain, function and quality of life at short-, intermediate- and long-term follow-up [104]; 2) Health promotion versus strengthening arm and shoulder exercises plus static neck exercises or non-specific exercises for neck pain, work ability, sick leave and discomfort at long term follow-up [32]; 3) Anatomy and stretching education versus self-stretching plus neck ROM exercises for non-specific neck pain and pressure pain threshold at short-term follow-up [105]; 4) Self-management program which included education on exercise versus multimodal physiotherapy for chronic pain from WAD at short-term follow-up [106]; 5) Instruction in home exercises versus supervised training rehabilitation for acute neck pain, disability and sick leave at short-term follow-up [107].

**Adverse Events**

Side effects were consistently not reported in primary trials. For orthotics, two trials reported side effects. Lavin et al. 1997 noted 12 of 19 patients reported difficulty using the roll pillow. Jochem et al. 1997 noted the following transient side effects with the use of the “orthopaedic pillow” [(migraine (n=1), throat pain (n=1)) and roll pillow [migraine (n=1), headache (n=2), transient pain outer ear (n=2), pain in fingers (n=1), flu like symptoms (n=1)]. For workplace interventions, Andersen and colleagues 2011 note exercises groups also had transient side effects including worsening of neck muscle tension, pain upper arm during training, pain in forearm wrist, and worse headache after training. For educational or psychological interventions, side effects or harm were not addressed.
We did not find a systematic review on harms for any intervention category explored in our overview.

**DISCUSSION**

**Summary of Main Results**

There continues to be a lack of high-quality evidence to inform recommendations on the use of psychological interventions, orthotic- collar, pillows, kinesio taping, or oral splint use, patient educational strategies, ergonomic workplace interventions and prevention for neck pain. We found 5 trials meeting the moderate quality evidence threshold and reporting evidence of benefit. For psychological interventions specific to chronic neck pain, there is one mind-body interventions (Dantian Qigong exercise) that assists 1 in 4 to 6 participants a small amount in pain reduction and 1 in 5 to 8 participants in function in the short-term when compared to a wait list control. Of 19 trials on patient education strategies, there is one that supports the use of an educational video given in an Emergency Room for acute WAD and helps 1 in 23 participants reduce pain a small amount in both the short- and long-term. For secondary prevention of acute to chronic myofascial neck pain in white collar workers, small daily amounts (2 or 12 minutes) of progressive resistance training with elastic tubing over 10 weeks reduced pain a small amount in 1 or 4 participant immediately post this treatment period. There is a lack of moderate or strong evidence in other treatment categories upon which to make recommendations. There is emerging and promising evidence from many small low GRADE trials that need verification. In these trials, it is the imprecision (sample size) and indirectness rather than low risk of bias assessment that limits us from making recommendations.

There was more data on moderate evidence of no benefit at short- and long-term follow-up: 2 psychosocial interventions delivered by a PT; 4 workplace interventions; 2 soft collar interventions and 2 self-management educational strategies. Psychosocial interventions by PTs not effective in long-term chronic neck pain management were solution finding using cognitive behavioral principles or intensive relaxation training. Workplace interventions that were ineffective in the long-term pain prevalence were mental health education (intensive relaxation training ), ergonomic education plus mental health education (work style or work style plus physical activity training; weekly email on this topic), individual worker change (upper extremity stretching and strengthening endurance training - 3 time per week for 8 weeks) and physical environment changes (ergonomic training plus workplace adjustment in university workers, kitchen workers, computer workers, support call center workers at short-term follow-up). The use of a soft collar or soft collar plus advice was consistently inferior to usual physiotherapy care at long- and intermediate term follow-up respectively. Finally, self-management educational strategies were less effective compared to exercise for reducing pain and disability in the long term.

Lastly, the trials we found rarely report adverse event data. There were no reviews reporting adverse events in this category of treatments. This is consistent with a review of cognitive behavioral therapy for low back pain patients reported that side effects and adverse events related to this intervention are unknown [108]. Interestingly a prospective study with a two year follow-up of the effect of CBT on patients with chronic low back pain suggested that CBT may indirectly decrease adverse events since participants decreased antidepressant drug use [109].

**Overall Completeness and Applicability of Results**

We came to realize through our reviewing process that expanding on three facets of our search method could lead to broader overall completeness and applicability of results from our overview. First, for MVA WAD prevention the inclusion of biomechanical studies and cohort trials might better inform overview results. For example, one recent review found a reduction of MVA related WAD claims and subjective complaints of 21 to 49% when energy-absorbing seats aimed at decreasing occupant loads and accelerations were used. Additionally, this same review showed the use of active head restraints that provide early head support to minimize head and neck motions showed evidence of reducing WAD claims and subjective complaints between 43 to 75%. Epidemiological outcomes were changed drastically for WAD prevention [110]. Another example is neck injury rate from use of helmet in biking accidents gleaned only from cohort trials [111, 112]. Clearly, studies addressing anti-whiplash systems may reduce WAD injury through improved prevention strategies especially if they are adapted by industry, the government and the clinic setting. Missing key messages like this is a limitation of this review’s search strategy.

Second, we found an absence of psychological interventions performed by a psychologist. A broader search strategy that is not limited to neck pain would enhance our understanding of the treatment for depression or post-traumatic stress by a clinical psychologist and may be applied to those with comorbid conditions of depression and neck pain [113]. Third, are therapeutic educational strategies dependent on the specific disorder or other educational dimensions? The inclusion of educational strategies for chronic musculoskeletal pain may inform us about a greater breadth of educational options not specifically studied in randomized trials for neck pain. Should we be evaluating education for chronic diseases? For example, we excluded a systematic review informing us about the compelling effect of a neuroscience educational strategy addressing a patients understanding of neurophysiological or the neurobiology effects of pain on chronic musculoskeletal pain [112].

Overall in this overview, there was incomplete and limited data. Our overview therefore has limited impact on informing or guiding clinical practice or recommendations. While many of the interventions discussed under moderate GRADE in this overview have a small magnitude of effect but lasting effect on the neck pain and to a lesser extent on function, there are many interventions (low GRADE) that require a second larger trial conducted in an independent setting to impact on our confidence in the estimate of effect. Future research needs a clear navigational strategy mapped out so we may be able to address the effects of some of these promising interventions and decrease the use of limited resources on imprudent trials.

Reporting ‘adherence to the intervention’ was poorly or not at all monitored in most trials. Since the results in
different studies might be influenced by the therapists’ and patients’ adherence to treatment regime, the adherence should be better investigated in future studies to be able to analyse adherence as a covariate in effect analyses. In addition, the validity of the therapists’ skills in delivering e.g. psychological or cognitive behavioral interventions should be measured and reported in future studies. These measures would strengthen the clinical applicability and interpretability of the study’s results.

We agree with Andersen et al. [114] and Leyshou and colleagues [115] that the outcomes - productivity (cost) and safety - need to be consistently evaluated. Ergonomic interventions at the work place may alter productivity even when patient comfort (pain and function) may not change. On the one hand, if an intervention is cheap, easy to apply, easy to comply with and safe, we may consider treating even if a small difference is achieved for the short-term. For example there is evidence for some interventions that some types of specialized pillows act to provide relief from morning pain [31-32, 47, 116]. Though this effect is not a long-term effect, it may be clinically meaningful to the patient. On the other hand, if the treatment is expensive and carries further risks, we may not choose to treat.

Finally, in order to use the interventions discussed in this paper effectively with patient populations, clinicians need to determine the patient’s readiness to change and choosing the appropriate treatment interventions accordingly. We note, two trials [82]; Ferrari 2005 [101] from one review [30] on educational interventions for WAD consider readiness to change in their trials intervention. The rationale for choosing the optimal treatment for a specific patient must involve consideration of the mechanism of action of the treatment, the patient’s readiness to change and how these match with the clinical indications for treatment, as well as evidence that therapeutic objectives can be achieved. By determining the patient’s readiness to change, based on the transtheoretical model, we may be able to identify which patients are best suited to an intervention and thus better translate the evidence to the individual patient. The Stages of Change Model – pre-contemplation, contemplation, preparation, action, maintenance and relapse [16] - can help us understand success and failure rates in aiding patients with achieving change and the role of clinicians in improving patient outcomes. The physical and psychological impairments associated with the neck disorder need to be specifically targeted; consider the patient’s (and their environment’s) readiness to change; and incorporate plausible implementation strategies. Patient education, orthosis use, ergonomic change, and prevention interventions may need to be underpinned by sound adult learning principles, application of stages of change model to a practice setting, and cognitive behavioral theory. Therefore, to establish optimal treatment for a specific patient it is clear that we need conceptually sound and theory driven research in this area.

Quality of the Evidence

Two perspectives - AMSTAR rating of reviews assisted in triaging the evidence and GRADE was either extracted (most often from Cervical Overview Group (COG) or Cochrane reviews where a relatively consistent GRADE application process was used) or assessed by going back to the original articles to establish the quality of the body of evidence. For low GRADE evidence, further research is very likely to have a significant impact on our confidence in the estimate of effect and may change the estimate while with very low GRADE evidence we remain extremely uncertain about the estimate.

Potential Bias in Review Process

We had several strengths regarding our approach to summarizing this literature. We used a comprehensive, librarian-assisted search and multiple databases. We accessed grey literature through early submitted data for Cochrane Reviews. But we did not use new primary trials published since review updates. For example, one large (n =3851) trial (the MINT trial – Managing Injury of the Neck Trial) [117] may have an important impact on the direction of education recommendations. Two independent reviewers determined article relevance, assessed the AMSTAR methodological and verified data extraction. Our review used unique methodology, unlike Andersen [114] and colleagues’ overview methodology where overlap of original publications is detailed followed by reporting of the aim and main conclusion for each intervention, we created summary of finding tables categorized by the quality of the body of evidence (GRADE). We returned to the description of the original papers, the related GRADE statement and their reported data to be able to extract evidence on the magnitude, NNT, and duration of the effect with related side effects / harm. Consensus was used both by the internal data abstraction team and an interdisciplinary external panel consensus to validate the GRADE of evidence and recommendations. Thus, one potential source of bias is that there are several individuals on this ICON Review panel that were authors of the review papers discussed in this paper. However, these specific authors did not participate in the selection of papers or data extraction. The potential of this particular bias was reduced by using a stringent protocol for this review (as documented in the methods section).

Agreement and Disagreement with Other Studies or Reviews

The main findings in this paper were consistent with those found in previous reviews. In a 2010 overview, psychosocial interventions, patient education, orthotic use, ergonomic change and prevention strategies received minimal clinical directives [12, 118]. Psychological interventions were briefly mentioned. Our overview has expanded on previous reviews findings but continues to find a dearth of information on psychological interventions by psychologists. One would need to expand this review’s scope for a complete understanding on psychological interventions. For acute WAD evidence on use of an educational video on activation in the emergency department and avoidance of collar use has been well documented in the past; we have not added new information and are in agreement with others [12, 119]. For work interventions targeting the individual worker such as strengthening, the addition of new evidence (Kay et al.) has shifted the evidence from conflicting [120] or limited [121] to moderate GRADE evidence that strengthening of the cervical and scapulothoracic region aides in either preventing or reducing
the recurrence of neck and shoulder pain for workers in both the short and long term. We are in agreement with Andersen (2011) [31] and Driessen 2010 [65] that no strong evidence exists for workplace interventions and that there is low-quality evidence in support of a physical ergonomic intervention (arm board support) to reduce neck pain in the long-term. For chronic neck pain or WAD, there is limited evidence emerging in favor but more against the use of psychosocial interventions. Systematically planning the future research agendas for Neck Care is needed to avoid exploring ineffective treatment pathways. We agree that targeted research of high quality is needed in workplace interventions for chronic neck pain and WAD (Verhagen 2007 [122], Andersen 2011 [31]). Prevention strategies from biomechanical studies and cohort trials that showed evidence of benefit included energy absorbing seats and active head rests [24] need to be included in future overview updates.

CONCLUSION

In summary, due to the moderate GRADE evidence available in this domain of research clinical recommendations remain limited at this point. One mind-body intervention strategy, one educational strategy, one workplace intervention on individual worker change showed moderate evidence of benefit for reducing pain and reducing disability. A greater body of evidence has emerged on what may not be effective interventions including the following categories: workplace interventions/prevention strategies including specific physical environment changes and individual worker changes, use of soft collar for WAD and a number of self-management strategies. It is necessary to direct future research towards prevention strategies in order to reduce the burden of neck injuries on the healthcare system; to consider economic outcomes such as productivity and safety; and have a focused research agenda developed by experts in the field.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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The ICON authors that provided direction of the project and reviewed the findings/manuscript includes (in alphabetical order): Gert Bronfort, Norm Buckley, Lisa Carlesso, Linda Carroll, Pierre Côté, Jeanette Ezzo, Paulo Ferreira, Tim Flynn, Charlie Goldsmith, Anita Gross, Ted Haines, Jan Hartzvigen, Wayne Hing, Gwendolene Jull, Faith Kaplan, Ron Kaplan, Helge Kasch, Justin Kenardy, Per Kjer, Janet Lowcock, Joy MacDermid, Jordan Miller, Margareta Nordin, Paul Pelosi, Jan Pool, Duncan Reid, Sidney Rubinstein, P. Lina Santaguida, Anne Söderlund, Natalie Spearing, Michele Sterling, Grace Szeto, Robert Teassell, Arianne Verhagen, David M. Walton, Marc White.

APPENDIX 1

Excluded Studies with Reason for Exclusion in Square Brackets

Excluded Studies

Brosseau L, Wells G, Tugwell P, et al. Ottawa panel evidence-based clinical practice guidelines on massage therapy for neck pain. 2012. (submitted for publication). [INTERVENTION]

Conlin A, Bhogal S, Sequeira K, Teasell R. Treatment of whiplash-associated disorders – Part II: Medical and surgical intervention. Pain Res Manage 2005; 10(1): 33-40. [INTERVENTION]

Crawford J, Laioe E. Conservative treatment of work-related upper limb disorders – a review. Occupational Medicine 2007; 57: 4-17. [POPULATION]

Cassidy J, Cote P. Is it time for a population health approach to neck pain? J Manipulative Physiol Ther 2008; 31: 442-46. [INTERVENTION]

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 2008; 33(S4): S153-S169. [INTERVENTION]

Furlan A, Yazdi F, Tsertsvadze A, et al. Complementary and alternative therapies for back pain II. Evidence report/technology assessment no. 194. (Prepared by the university of Ottawa evidence-based practice center under contract no. 290-2007-10059-I (EPCIII). AHRQ Publication no. 10(11)-E007. Rockville, MD: Agency for healthcare research and quality. October 2010. [INTERVENTION]

Gross A, Miller J, D’Sylva J, Burnie SJ, Goldsmith CH, Graham N, Haines T, Bronfort G, Hoving JL. Manipulation or Mobilisation for Neck Pain. Cochrane Database of Syst Rev 2010; 1(1): CD004249. DOI: 10.1002/14651858.CD004249.pub3. [INTERVENTION]

Kroeling P, Gross AR, Graham N, et al. Electrotherapy for neck disorders with and without radiculopathy: a Cochrane systematic review update. Cochrane Database of Syst Rev 2012 (submitted) [INTERVENTION]

Kroeling P, Gross AR, Goldsmith CH, Burnie SJ, Haines T, Graham N, Brant A. Electrotherapy for neck pain. Cochrane Database Syst Rev. 2009 Oct 7; (4): CD004251. [INTERVENTION]

Gross AR, Graham N, et al. Electrotherapy for neck disorders with and without radiculopathy: a Cochrane systematic review update. Cochrane Database of Syst Rev 2012 (submitted) [INTERVENTION]

Langevin P, Lowcock J, Weber J, et al. Botulinum Toxin Intramuscular Injections for Neck Pain: A Systematic Review and Metaanalysis. J Rheumatol 2011; 38(2): 203-14. [INTERVENTION]

Lee M, Choi T, Kim J, Choi S. Using guasha to treat musculoskeletal pain: a systematic review of controlled clinical trials. Chinese Medicine 2010; 5: 5. [INTERVENTION]
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