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Research

Exercise programs may be effective in preventing a new episode of neck pain: a systematic review and meta-analysis

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KEY WORDS

Neck pain
Prevention
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Systematic review
Meta-analysis

ABSTRACT

Question: What is the effectiveness of interventions that aim to prevent a new episode of neck pain? **Design**: Systematic review and meta-analysis of randomised, controlled trials. **Participants**: People without neck pain at study entry. **Intervention**: Any intervention aiming to prevent a future episode of neck pain. **Outcome measures**: New episode of neck pain. **Results**: Five trials including a total of 3852 individuals met the inclusion criteria. The pooled results from two randomised, controlled trials (500 participants) found moderate-quality evidence that exercise reduces the risk of a new episode of neck pain (OR 0.32, 95% CI 0.12 to 0.86). One of the meta-analysed trials included some co-interventions with the exercise. There was low-quality evidence from three randomised, controlled trials (3352 participants) that ergonomic programs do not reduce the risk of a new neck pain episode (OR 1.00, 95% CI 0.74 to 1.35). **Conclusion**: This review found moderate-quality evidence supporting the effectiveness of an exercise program for reducing the risk of a new episode of neck pain. There is a need for high-quality randomised, controlled trials evaluating interventions to prevent new episodes of neck pain. **Registration**: PROSPERO CRD42017055174. **[de Campos TF, Maher CG, Steffens D, Fuller JT, Hancock MJ (2018) Exercise programs may be effective in preventing a new episode of neck pain: a systematic review. *Journal of Physiotherapy* XX: XX–XX]**

Introduction

Neck pain is one of the most significant health problems worldwide.[1] It has been ranked the fourth leading cause of years lived with disability, according to the Global Burden of Disease Study.[2] Mean lifetime prevalence is estimated to be 48.5% and is expected to increase due to the ageing population.[2,3] The natural course of an episode of neck pain is favourable;[4] however, recurrence rates are reported to be high,[5] which contributes to the high global social and economic burden. The Global Burden of Disease studies[1,2] and Task Forces[6] worldwide have called for prevention strategies for neck and back pain. Recent clinical practice guidelines for neck pain lack recommendations for prevention.[7] Consequently, a comprehensive, high-quality systematic review of the literature is required to examine the effectiveness of prevention strategies for neck pain.

A number of systematic reviews that examined the effectiveness of interventions for preventing neck pain have been published.[8–12] However, these systematic reviews have important limitations. Some were published > 10 years ago,[8,9] some did not publish a pre-specified study protocol,[10,12] some included non-randomised studies,[10–12] and some included studies recruiting symptomatic participants at study entry.[9,11] There has been no systematic review investigating strategies for prevention of neck pain including only randomised, controlled trials (randomised, controlled trials) and asymptomatic participants at baseline.

Therefore, the research question for this systematic review was:

What is the effectiveness of interventions that aim to prevent a new episode of neck pain?

Method

This systematic review adhered to the statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions (PRISMA).[13]

Identification and selection of studies

A comprehensive search of five electronic databases (MEDLINE via Ovid, EMBASE via Ovid, CINAHL, Physiotherapy Evidence Database (PEDro), and The Cochrane Central Register of Controlled Trials (CENTRAL) via The Cochrane Library) was conducted from the earliest records published to 27 April, 2018. A sensitive search strategy was used based on the recommendations of the Cochrane Back and Neck Group[14] for 'randomised controlled trials' and 'neck pain', combined with search terms for 'prevention'. The detailed search strategy for each database is presented in Appendix 1 (see eAddenda for Appendix 1). In addition, reference lists of relevant reviews and included randomised, controlled trials were manually searched for additional randomised, controlled trials, and citation tracking of all included trials was performed. Non-English language studies were

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Box 1. Inclusion criteria.

Design
- Randomised, controlled trials

Participants
- People not meeting the study's definition of an episode of neck pain at study entry

Intervention
- Any intervention aiming to prevent a new episode of neck pain

Outcome measures
- A new episode of neck pain
- A new episode of neck pain leading to care seeking, activity limitation or work loss
- Measures of pain or disability over the follow-up period

Comparisons
- The intervention group must be compared to no intervention/placebo or minimal intervention
- Studies investigating the additional benefit of a treatment (eg, exercise + education versus exercise alone)

included if an appropriate translation could be obtained; otherwise, they were noted but excluded from analyses.

Randomised, controlled trials assessing the effectiveness of prevention strategies for neck pain were included if they met the inclusion criteria listed in Box 1. A three-stage screening process was used to select relevant randomised, controlled trials for this review. In the first stage, one reviewer (TFC) screened all titles for eligibility and excluded clearly irrelevant studies. In the second stage, each study title and abstract was independently evaluated by two reviewers (TFC and DS or JTF). In the third stage, the full text for each potentially eligible study was retrieved and assessed against the eligibility criteria by two independent reviewers (TFC and DS or JTF). In cases of disagreement, a third reviewer (MJH or CGM) was consulted.

Assessment of characteristics of studies

Risk of bias

Risk of bias was assessed using the PEDro Scale[15,16] by downloading the available scores from the PEDro database. If a study had not been rated on the website, two experienced PEDro raters scored the study. The total score on the PEDro scale is the addition of 'yes' (criterion is clearly satisfied) responses for Items 2 to 11 (Item 1 is not used for calculation of the total PEDro scale score because it is more related to external validity) and range from 0 (high risk of bias) to 10 (low risk of bias). There is evidence that the PEDro scale total score has acceptably high reliability and validity[15,16] and Rasch analysis has confirmed that it can be used as a continuous scale.[17]

Participants

Randomised, controlled trials were included if the participants did not have neck pain at study entry or did not meet all of the study's criteria for an episode of neck pain at baseline. For example, if a small proportion of participants had mild neck pain at study entry but all were working, and the study outcome was a new episode of work absence due to neck pain, then the study would be considered eligible.

Intervention

To be eligible for inclusion, trials had to evaluate an intervention aiming to prevent a future episode of neck pain. The experimental group had to be compared to a group that received no intervention, sham intervention or minimal intervention. Randomised, controlled trials investigating multimodal interventions were also included.

Outcome measures

To be eligible for inclusion, trials had to report an outcome measure of a new episode of neck pain (eg, number of participants experiencing a new episode of neck pain, or number of participants taking sick leave due to a new episode of neck pain), or a measure of neck pain or disability over the follow-up period (pain or disability measures at a single point in time did not satisfy this criterion).

Data extraction and analysis

Data for each included trial were extracted by two independent reviewers (TFC and MJH or JTF) using a standardised data extraction form and discrepancies were resolved by discussion with a third author (CGM). Extracted data included the characteristics of the trial (eg, demographic characteristics of the participants, description of the interventions, duration of treatment, and description of the outcomes) and outcome data. Whenever possible, raw outcome data (number of participants having a new episode of neck pain and total number of participants) in both the intervention group and control group were extracted. Treatment effect estimates were calculated using methods recommended in the Cochrane Handbook for Systematic Review of Interventions.[18] Attempts were made to contact authors of included trials to clarify any relevant information or request additional data, when required.

The overall quality of evidence was assessed for each intervention contrast and rated as high, moderate, low, or very low, as recommended by the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system.[19] The GRADE classification was downgraded one level per study flaw, from high quality, if any of the following flaws were present: design limitation (more than a quarter of participants from studies with high risk of bias, PEDro score < 7); inconsistency of results (substantial heterogeneity, $I^2 > 50\%$); and imprecision (based on a threshold of < 400 participants for each pooled outcome, and also observation of the 95% CIs in cases of dichotomous outcomes). This review did not consider the indirectness criterion because the eligibility criteria ensured a specific population with relevant outcomes. In addition, the review did not assess publication bias due to insufficient study numbers. Two reviewers (TFC and MJH or DS or JTF) independently performed GRADE assessments for each treatment contrast.

Trials considered homogeneous were grouped into the same prevention strategy category. Odds ratios (ORs) and 95% CIs were calculated and a random-effects model was used to pool estimates using commercial meta-analysis software[a]. For randomised, controlled trials that did not report the sample size at the end of the follow-up period, the OR (95% CI) was calculated using the baseline sample size. Outcome data on short-term follow-up ($\leq$ 12 months) and long-term follow-up ($>$ 12 months) were assessed. Statistical heterogeneity was assessed visually and using the I^2 statistic.

Results

Flow of studies through the review

Overall, the comprehensive database search strategy identified 12 725 records. After screening articles by title and abstract, 114 potentially eligible studies were identified, and their full texts were retrieved. In total, five trials (3852 participants) met the inclusion criteria and were included in the review.[20–24] The included studies were three randomised, controlled trials[20,22,24] and two cluster-randomised, controlled trials.[21,23] An outline of the screening and reviewing process can be seen in Figure 1.

Characteristics of studies

Risk of bias

Risk of bias scores for four of the randomised, controlled trials[20,21,23,24] were found on the PEDro database website. The fifth

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