CRD summary
The authors recommended mobilisation for treating pain and compromised range of motion in patients with acute whiplash-related disorders, but recommended further research into other treatments. Limitations in the review methods and questionable methods of meta-analysis mean some results should be treated with caution. It should be noted that the overall recommendation is based on only 2 trials.

Authors' objectives
To review the literature on noninvasive interventions for whiplash-associated disorder (WAD).

Searching
MEDLINE, CINAHL, and the Cochrane CENTRAL Register were searched from 1993 to 2003; the search terms were reported. Only studies published in the English language were included. Abstracts were excluded.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), cohort and case-control studies, and case-series were eligible for inclusion. Case reports were excluded. Only RCTs were eligible for inclusion in the meta-analysis.

Specific interventions included in the review
Studies of a clearly defined treatment protocol were eligible for inclusion. The identified interventions were categorised into three groups (noninvasive, medical and surgical), but only studies evaluating noninvasive interventions were included in this review; the results for medical and surgical interventions were reported elsewhere (see Other Publications of Related Interest). Noninvasive interventions were categorised as: physiotherapy exercise alone; multimodal treatment including physiotherapy; patient mobilisation; strength training; pulsed magnetic field treatment; and chiropractic manipulation.

Participants included in the review
Studies of adults older than 18 years with a WAD resulting from a motor vehicle collision were eligible for inclusion. WAD was classed as acute for an injury of less than 3 months' duration and chronic for an injury of more than 3 months' duration.

Outcomes assessed in the review
Outcomes were not specified as part of the inclusion criteria. The review assessed pain intensity and disability, cervical range of motion, head posture, global functioning, kinaesthetic sensibility, coping strategies, self-efficacy, treatment efficiency and delay in returning to work. The included studies measured these outcomes using a variety of measures. Measures of pain included visual analogue scales (VAS) of 10 or 100, the Pain Disability Index, the McGill Pain Questionnaire and subjective reports. Physical measures included cervical range of motion (flexion, extension, left and right lateral flexion and rotation). Function or coping measures included the Self-Efficacy Score, Vernon-Mior Score, sick-leave profile, self-reported psychological distress and self-reported ability to complete activities of daily living.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The validity of the RCTs was assessed using the PEDro scale, which assesses the following: random allocation;
allocation concealment; baseline comparability of the groups; blinding of the patient, treatment provider and outcome assessor; one outcome measured in at least 85% of the patients; intention-to-treat analysis; between-group statistical analysis for at least one outcome; point measures and variance estimates reported for at least one outcome. The maximum possible score was 10 points.

Two reviewers independently assessed the validity of the RCTs. Any disagreements were resolved by discussion until consensus was reached.

Data extraction
One reviewer extracted the data. The results for each study were presented as treatment differences or changes from baseline, along with the level of statistical significance.

Methods of synthesis
How were the studies combined?
The studies were grouped by study design. Where at least 2 RCTs reported a common type of outcome measure, they were pooled in a meta-analysis using a fixed-effect model in the presence of statistical homogeneity (chi-squared test p>0.05), weighted by the inverse variance. The weighted mean difference (WMD) was calculated for continuous outcomes and the pooled relative risk or odds ratio (OR) for dichotomous outcomes. The results from RCTs and other study designs were also presented narratively.

How were differences between studies investigated?
Statistical heterogeneity was assessed using a chi-squared test and the I-squared value.

Results of the review
Eight RCTs (n=666) and 10 observational studies (n=511) were included.

RCTs.
The median quality score was 5 (range: 3 to 6). Most of the trials satisfied the criteria of random allocation, baseline comparability and between-group statistical comparisons. None of the RCTs analysed data on an intention-to-treat basis.

Exercise (3 trials): one RCT reported significantly less pain in the exercise group compared with standard treatment, but no difference in cervical range of motion. One RCT reported no significant difference between treatments for pain, physical measures or function. The third RCT did not compare the treatments statistically.

Multimodal interventions with exercise (2 trials): one RCT reported better performance of activities of daily living after 3 months in the intervention group compared with usual primary care physiotherapy, but reported no difference in other outcomes. The other RCT reported greater improvement in pain, self-assessed outcome and speed of return to work in the intervention group compared with control, but reported no difference in neck mobility.

Mobilisation (2 trials): one RCT reported significantly less pain and improved range of motion at 3 weeks in the intervention group compared with soft collar. The other RCT reported a significant improvement in pain intensity, neck stiffness, memory and concentration in the intervention group compared with an 'act-as-usual' control.

Pulsed magnetic field (1 trial): the RCT reported significantly less pain and improved range of motion in the intervention group compared with control.

Five trials (n=850) were included in the meta-analysis. This found no difference between active treatment and control with respect to the degree of pain, as measured by a variety of pain scales (WMD -1.10, 95% confidence interval, CI: -1.18, -1.02). There was considerable heterogeneity (I-squared 98.9%). For the presence of neck, head, shoulder or arm pain (1 trial), mobilisation was superior to soft collar use (OR 0.13, 95% CI: 0.01, 0.52). Patients receiving noninvasive interventions experienced significantly greater improvement in cervical range of motion compared with
control (WMD 4.70, 95% CI: 4.34, 5.07). There was also considerable heterogeneity for this outcome (I-squared 92.8%). There were no significant differences between the groups for other physical outcome measures or functional measures.

The results of the observational studies were also reported in the paper.

**Authors’ conclusions**
Mobilisation appears to be the most effective noninvasive intervention for the treatment of pain and compromised cervical range of motion in patients with acute WAD. Exercise alone does not improve range of motion. Pulsed electromagnetic field treatment can improve pain and range of motion. There is conflicting evidence regarding multimodal intervention with exercise and only limited evidence from observational studies to support chiropractic manipulation.

**CRD commentary**
This review had a clearly stated but broad research question. The search was limited and failed to include sources of unpublished studies; it was also restricted to articles in English, thus some relevant studies might have been missed. It was unclear whether the study selection process was performed in duplicate and whether another reviewer checked the data extraction; this might have introduced errors into the process. However, two reviewers independently assessed the quality of the RCTs using an appropriate checklist; the quality of the observational studies was not assessed.

The presentation of the observational study results and RCTs in a narrative synthesis was appropriate. However, the pooling of the RCTs is questionable: the authors have pooled multiple outcomes from the same trial and used a fixed-effect model in the presence of strong heterogeneity, even though they stated they would only use such models in the absence of heterogeneity. The pooled results should be treated with caution. Although there is some evidence of pain reduction, the recommendation regarding mobilisation seems strong given that it is based on only 2 trials.

**Implications of the review for practice and research**
Practice: The authors recommended the use of mobilisation for patients with acute WAD.

Research: The authors stated that further research is needed to evaluate exercise, manipulation and pulsed electromagnetic field treatment for patients with WAD.

**Bibliographic details**

**PubMedID**
15782244

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
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**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.