Conservative management of mechanical neck pain: systematic overview and meta-analysis

Peter D Aker, Anita R Gross, Charles H Goldsmith, Paul Peloso

Abstract

Objective—To review the efficacy of conservative management of mechanical neck disorders.

Methods—Published and unpublished reports were identified through computerised and manual searches of bibliographical databases, reference lists from primary articles, and letters to authors, agencies, foundations, and content experts. Selection criteria were applied to blinded articles, and selected articles were scored for methodological quality. Effect sizes were calculated from raw pain scores and combined by using meta-analytic techniques when appropriate.

Results—Twenty four randomised clinical trials met the selection criteria and were categorised by type of intervention: nine used manual treatments; 12 physical medicine methods; four drug treatment; and three education of patients (four trials investigated more than one form of intervention). The intervention strategies were summarised separately. Pooling of studies was considered only within each category. Five of the nine trials that used manual treatment in combination with other treatments were combined. One to four weeks after treatment the pooled effect size was -0.6 (95% confidence interval -0.9 to -0.4), equivalent to an improvement of 16 (6.9 to 23.1) points on a 100 point scale. Sensitivity analyses on study quality, chronicity, and data imputation did not alter this estimate. For other interventions, studies could not be combined to arrive at pooled estimates of effect.

Conclusions—There is little information available from clinical trials to support many of the treatments for mechanical neck pain. In general, conservative interventions have not been studied in enough detail to assess efficacy or effectiveness adequately.

Introduction

Neck pain is a common complaint, with a point prevalence of nearly 13%^{1,2} and lifetime prevalence of nearly 50%.^{3,5} In some industries neck related disorders account for as many days of absenteeism as low back pain.⁶ Many treatments are available to patients and accepted as standard forms of practice, including such common conservative strategies as medication, physical medicine methods, manual treatments, and education of patients.^{7,8} There is little evidence, however, for their accepted use. To determine the efficacy of the various conservative treatment strategies for mechanical neck pain our multidisciplinary team undertook this systematic overview. This article summarises a more detailed report published on line.⁹

Methods

STUDY IDENTIFICATION

Computerised bibliographical databases (MEDLARS, EMBASE, CINAHL, and CHIROLARS) and indexes of conference proceedings (NTIS and CPI) were searched without language restrictions from 1985 to December 1993. To reduce the likelihood of missing information published before this time, references lists of all retrieved articles were reviewed independently by two investigators

to identify additional relevant citations. Letters were sent to first authors, relevant agencies and foundations, drug companies, and content experts to help to identify further published, unpublished, or current research.

STUDY SELECTION

The titles of citation printouts were reviewed by two investigators independently. All citations identified by either investigator as being potentially related to our topic were retrieved. The methods sections from these articles were reviewed by two investigators who had no access to the abstract, results, discussion, and conclusion sections. Authors of articles published in abstract form alone were contacted for full manuscripts and datasets. Randomised controlled trials included adults with mechanical neck disorders treated with conservative treatments and reported pain outcomes. For the purposes of this review conservative treatments were defined as any non-invasive, non-surgical form of treatment including drugs, manual treatments, education of patients, and physical medicine methods.⁸ Mechanical neck disorders included conditions causing neck pain with or without referral into the shoulder and upper arm.¹⁰ Studies investigating neck disorders with neurological deficit, headache without associated neck pain, or neck pain caused by other pathologies such as inflammatory disease, neurological disease, fracture, dislocation, neoplasm, or infection were excluded.

ASSESSMENT OF VALIDITY

Three investigators independently assessed each selected study for methodological quality in five key validity criteria and assigned an overall score from 1 to 5. Lower scores (1 and 2) were assigned to weaker studies and higher scores (4 and 5) to stronger studies. The criteria and their scoring are outlined in detail elsewhere.⁹

DATA ANALYSIS

Raw data on pain scores were extracted from the full manuscripts and were transformed to a 100 point scale. The effect size for each study was calculated as the mean difference between treatment and control groups divided by the pooled standard deviation. A fixed effects model¹¹ was used to pool effect sizes with Metanal software.¹² In studies where data were not available in a form to calculate an effect size the inverse χ^2 method (Fisher's method) was used to combine P values.¹¹ When data could not be extracted and were not available from authors, values were imputed if possible.⁹

Studies were assigned into treatment categories and assessed for similarity before calculation of a pooled effect measure. To be considered eligible for pooling, trials must have studied subjects with similar disorders treated with similar interventions. If combining was sensible homogeneity of the estimates was formally tested with the Breslow-Day test.¹³ When data were not heterogeneous a pooled effect size (with 95% confidence intervals) was estimated and the magnitude assessed.

Results

STUDY IDENTIFICATION AND SELECTION

The computerised search strategies located 917 citations. Sixty eight responses were received from over 200 letters sent out. In total, 200 citations were identified as

Division of Graduate Studies and Research, Canadian Memorial Chiropractic College, Toronto, Ontario, Canada
Peter D Aker, *associate professor*

Chedoke-McMaster Hospitals and School of Rehabilitation Sciences, McMaster University, Hamilton, Ontario, Canada
Anita R Gross, *assistant professor*

Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario
Charles H Goldsmith, *professor*

Department of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada
Paul Peloso, *assistant professor*

Correspondence to:
Dr C H Goldsmith, Centre for Evaluation of Medicines, St Joseph's Hospital, 50 Charlton Avenue East, Hamilton, Ontario L8N 4A6, Canada.

BMJ 1996;313:1291-6

Table 1—Trials that used manual treatment for neck pain

Reference	Sample size	Treatment (active v control)	Validity score*					Overall score out of 5	Reported result	Effect size† (95% confidence interval)
			A	B	C	D	E			
Cassidy <i>et al</i> ¹⁸	100	Manipulation v mobilisation (one treatment)	4	2	4	6	2	5	P = 0.16	−0.01 (−0.4 to 0.4)
Vernon <i>et al</i> ⁴³	9	Manipulation v mobilisation (one treatment)	4	1	4	5	2	3	P<0.0001	Unable to abstract

*A = design (maximum = 4); B = population (maximum = 2); C = intervention (maximum = 6); D = outcomes (maximum = 6); E = follow up (maximum = 2).

†Negative value indicates reduction in pain.

Table 2—Trials of manual treatment combined with drug treatment, education, or physical medicine methods for treatment of neck pain

Reference	Sample size	Treatment (active v control) and length of treatment (weeks)	Validity score*					Overall score out of 5	Reported result	Effect size† (95% confidence interval)
			A	B	C	D	E			
Koes <i>et al</i> ²⁵	25	Manual (manipulation, mobilisation, exercise, heat, ice, analgesic) v placebo:	4	1	2	4	2	4	P>0.7	
		3								−0.3 (−1.1 to 0.5)
		6								−0.3 (−1.1 to 0.5)
	32	9 plus 3 follow up								0.1 (−0.7 to 0.9)
		Physical (massage, exercise, heat, ultrasound, short wave diathermy) v placebo:							P>0.7	
		3								−0.1 (−0.9 to 0.6)
Brodin ¹⁷	63	6	4	1	2	2	1	3	P<0.05	−0.2 (−0.9 to 0.6)
		9 plus 3 follow up								0.8 (0.1 to 1.5)
		Manual v physician general practice (analgesics, anti-inflammatory, education (rest, exercise, posture)) for:							P>0.7	
	26	3								−0.6 (−1.3 to 0.2)
		6								−0.5 (−1.3 to 0.3)
		9 plus 3 follow up								−0.5 (−1.3 to 0.3)
Mealy <i>et al</i> ³⁵	61	Mobilisation, education, analgesic v waiting list control	4	1	2	2	1	3	P<0.05	Unable to abstract
		Mobilisation, education, analgesic v massage, electrotherapy, traction, analgesic for								Unable to abstract
Nordemar <i>et al</i> ³⁶	30	3 plus 1 follow up	4	1	2	2	2	3	P<0.001	−0.8 (−1.3 to −0.2)
		8								−0.8 (−1.1 to −0.5)
Jensen <i>et al</i> ²³	19	Mobilisation, collar, rest, education, analgesic v collar, rest, education, analgesic for	4	1	2	2	1	3	Not reported	−0.5 (−1.3 to 0.4)
		2 plus 6 follow up								
McKinney <i>et al</i> ³³	104	Mobilisation, analgesic v ice, analgesic:	4	1	2	2	1	3	P<0.05	−0.7 (−1.6 to 0.2)
		1								−0.7 (−1.6 to 0.3)
Sloop <i>et al</i> ³⁹	39	1 plus 7 follow up	4	0	3	2	2	2	P<0.01	−0.6 (−1.0 to −0.2)
		Mobilisation, heat, cold, short wave diathermy, hydrotherapy, traction, education, analgesic, collar v rest, education, analgesic, collar:								−0.4 (−0.8 to 0.0)
		4							P = 0.20	Unable to abstract
		6 plus 2 follow up								
		1 treatment plus 3 weeks' follow up								

*†See footnote to table 1.

being potentially related to mechanical neck disorders. Of these, 169 were excluded during the selection process: 127 did not study adults with mechanical neck disorders, 27 were not randomised controlled trials, 25 did not use conservative management strategies, and 20 did not report on pain outcomes (some studies were excluded for more than one reason). Twenty four randomised controlled trials identified from 31 publications met our selection criteria.¹⁴⁻⁴⁴

DATA SYNTHESIS

Manual treatments

Nine randomised controlled trials that used various types of manual treatments (including manipulation, mobilisation, and massage) met our eligibility criteria.^{17 18 23 25 33 35 36 39 43} Validity scores varied from strong to weak; criterion scores are reported in the summary tables.

Manual treatment alone—Two trials studied the use of manual treatments alone (that is, not in combination with any other form of treatment) compared with other treatments (table 1).^{18 43} Both compared manipulation with mobilisation, one rated as methodologically strong¹⁸ and the other moderate.⁴³ Cassidy *et al* showed

no significant difference between treatments.¹⁸ Vernon *et al* reported a significant improvement in the manipulation group.⁴³

Manual treatment in combination with other treatments—Seven studies compared manual treatment in combination with other forms of treatment with another intervention (table 2).^{17 23 25 33 35 36 39} Nordemar *et al*³⁶ and Sloop *et al*³⁹ were included in this section because of potential interaction effects between the manual treatments and control treatments. In all seven studies manual treatments in combination with other treatments were compared with a control and considered eligible to pool. Brodin¹⁷ and Sloop *et al*³⁹ were excluded from the pooled analysis because we were unable to obtain data to calculate effect sizes; the remaining five studies were combined. Control groups were relatively similar, consisting of rest, education, and use of analgesics with or without the use of exercise, cold packs, or cervical collars. The case mix included acute whiplash,^{33 35} acute³⁶ or subacute and chronic mechanical disorders,²⁵ and chronic cervical headache.²³ All conform to the definition of a mechanical neck disorder and hence were considered to be clinically similar. As the duration of complaint (from acute to chronic) and the methodological quality varied

Table 3—Trials of physical medicine methods for treatment of neck pain

Reference	Sample size	Treatment (active v control) and length of treatment (weeks)	Validity score*					Overall score out of 5	Reported result	Effect size† (95% confidence interval)
			A	B	C	D	E			
Controlled trials‡										
Spray and stretch: Snow <i>et al</i> ⁴⁰	34	Spray and stretch v placebo for 5 treatments	4	2	5	6	2	5	P>0.05	0.1 (–0.6 to 0.8)
	40	Spray and stretch v control for 5 treatments								–0.3 (–0.9 to 0.3)
Laser therapy: Thorsen <i>et al</i> ⁴² Waylonis <i>et al</i> ⁴⁴	47	Laser v placebo for 2 weeks	4	1	6	0	2	4	P = 0.021	–1.9 (–3.8 to 0.1)
	55	Laser v placebo for 5 treatments and 6 weeks follow up	4	1	3	0	1	3	F = 1.598	Unable to abstract
Electromagnetic therapy: Foley-Nolan <i>et al</i> ²¹	40	Pulsed electromagnetic therapy, collar, education (advice), exercise, analgesic, anti-inflammatory v placebo, collar, education (advice), exercise, analgesic, anti-inflammatory for 2 4 12	4	1	6	2	2	4		Unable to abstract
									P<0.05 P<0.05 P>0.05)	
	Foley-Nolan <i>et al</i> ²⁰	20	Pulsed electromagnetic therapy, collar, analgesic, anti-inflammatory v placebo, collar, analgesic, anti-inflammatory for 3 6	4	1	5	2	2	4	
Infrared light therapy: Lewith <i>et al</i> ³¹	25	Infrared v placebo for 2 weeks	4	2	3	2	2	4	P = 0.07	Unable to abstract
Acupuncture: Petrie <i>et al</i> ³⁸	13	Acupuncture v placebo for 4 weeks	4	2	3	0	2	3	P<0.01	Unable to abstract
Traction and exercise: Goldie <i>et al</i> ²²	73	Traction, analgesic, muscle relaxant, posture v exercise, analgesic, muscle, relaxant, posture v analgesic, muscle relaxant, posture for 3 plus 6 follow up	3	1	2	3	2	3	Not reported	Unable to abstract
Transcutaneous electrical nerve stimulation (TENS): Nordemar <i>et al</i> ³⁶	30	TENS, collar, rest, education, analgesic v collar, rest, education, analgesic for 2 plus 6 follow up	4	1	2	2	2	3	Not reported	–0.5 (–1.9 to 0.4)
Comparison trials§										
Levoska <i>et al</i> ³⁰	44	Active exercise v heat, massage, passive exercise for 5 treatments 5 treatment plus 4 weeks' follow up 5 treatment plus 1 year follow up	4	2	4	2	2	4	P = 0.05 P<0.01 P<0.01	Unable to abstract
Loy ³²	53	Electroacupuncture v traction, short wave diathermy for 3 6	3	1	1	1	1	2	Not reported Not reported Not reported	Unable to abstract
Pennie <i>et al</i> ³⁷	128	Traction, exercise, education v collar, exercise: 6 8 8 plus 5 months' follow up	3	1	1	0	1	2	Not reported Not reported Not reported Not reported	Unable to abstract

*†See footnote to table 1.

‡Controlled trial: the control group is treated similarly in all respects as the active treatment group, except that they do not receive the intervention of interest.

§Comparison trial: the treatments groups are exposed to different interventions.

between studies, sensitivity analysis was conducted. All outcomes were compared at similar end points—between one and four weeks of treatment. Specifically, the comparisons made were between the effect size for pain scores in Koes *et al*²⁵ at three weeks of treatment, Mealy *et al*²⁵ at four weeks of treatment, Nordemar *et al*³⁶ at one week of treatment, Jensen *et al*²³ at one week of treatment, and McKinney *et al*³³ at four weeks of treatment. There was no evidence of heterogeneity between studies (Breslow-Day test with 4 df, $P = 0.976$), and the studies were combined to yield a pooled effect size of –0.6 (95% confidence interval –0.9 to –0.4) (fig 1). This pooled effect size is equivalent to a change of 16.2 points on a 100 point scale (6.9 to 23.1), which does not alter significantly when the study of lower methodological quality³³ is dropped (–0.7; –1.0 to –0.3) or when those studies for which standard deviation was imputed^{25 33} were withdrawn (–0.5; –1.0 to 0.0). Similar point estimates of effect size were found for those trials that assessed acute (–0.63; –0.93 to 0.32) and subacute or chronic (–0.45; –1.05 to 0.15) patient groups. The

small number of studies used in these subgroup analyses would be unlikely to have sufficient power for meaningful results.

Physical medicine methods

Twelve randomised controlled trials that used physical medicine methods (including spray and stretch, laser, electromagnetic treatment, infrared, acupuncture, traction, exercise, and transcutaneous electrical nerve stimulation (TENS)) met our eligibility criteria.^{20-22 30-32 36-38 40-44} Validity scores varied from strong to weak. Table 3 summarises the abstracted results. Because we were unable to calculate an effect size in nine of the 12 studies and because many of the studies with negative results probably lacked statistical power, we could not come to conclusive recommendations for these treatments.

Treatments with positive results—In two strong quality randomised controlled trials the use of pulsed electromagnetic therapy (PEMT) produced a signifi-

Table 4—Results of trials that used physical medicine methods with non-parametric data

Method	Source	P value	Transformed P value (-2log P _i)	Combined P value (two tailed)
Laser therapy	Thorsen ⁴²	0.49	1.43	0.6287
	Waylonis ⁴⁴	0.56	1.16	
Electromagnetic therapy	Foley-Nolan ²¹ for 4 weeks	0.05	5.99	0.0089
	Foley-Nolan ²⁰ for 3 weeks	0.02	7.82	

cant reduction in pain compared with placebo PEMT.^{20, 21} Both studies used additional control treatments: one consisting of the use of a soft collar in combination with analgesic and anti-inflammatory drugs²⁰ and the other the use of a soft collar in combination with education (advice), exercise, and analgesic and anti-inflammatory drugs.²¹ A combination of P values across these two studies produced an overall estimate of a positive effect of PEMT (P 0.0089; table 4). Two randomised controlled trials investigated acupuncture: one was a study of moderate quality that compared acupuncture with a placebo,³⁸ and the other was a study of weak quality that compared acupuncture with a combination of traction and short wave diathermy.³² Both studies reported that the acupuncture group achieved better pain relief than the placebo group.

Treatments with mixed results—Two randomised controlled trials have been reported on the use of exercise; one with negative and the other with positive results.^{22, 30} Goldie *et al* compared exercise in combination with drug treatment and advice to a control group in a study of moderate quality and reported no significant difference.²² Levoska *et al* compared active exercises with a combination of stretching, heat, and massage in a methodologically strong study and reported a significant difference (P≤0.01) favouring active exercise.³⁰

Treatments with negative results—One methodologically strong randomised controlled trial compared spray and stretch (vapocoolant spray followed by passive stretching) with a placebo and found no significant difference between groups.⁴⁰ Two trials, one methodologically strong⁴² and the other moderate,⁴⁴ compared laser therapy with a placebo. Both report no significant difference between groups. P values from these studies were combined to give an overall estimate of effect of P = 0.6287 (table 4), indicating laser did not reduce pain. One randomised controlled trial of strong

methodological quality compared infrared light therapy with a placebo.²¹ No significant reductions in pain were reported. Three randomised controlled trials investigated the use of traction.^{22, 32, 37} In a moderate quality study, Goldie *et al* compared traction with a control treatment of analgesics, muscle relaxants, and postural advice.²² They reported the difference between groups to be small and not significant, but no statistical analysis was reported. Pennie and Agambar, in a study of weak quality, compared traction, exercise, and patient education with collar and exercise.³⁷ No significant difference between groups was reported, and no statistical analysis was described. A methodologically weak study by Loy compared traction and shortwave diathermy with electroacupuncture.³² Electroacupuncture was reported to improve symptoms significantly better than traction and diathermy, but no details of the analysis were reported. The one randomised controlled trial of moderate quality that compared TENS with a combination of collar, rest, education, and analgesics had an effect size of -0.5 (-1.9 to 0.4). We can be 95% certain that there was no difference between these treatments.³⁶

Fig 1—Pooled effect size of pain reduction for five similar trials that used manual treatment in combination with either drug treatment, education, or physical medicine methods at one to four weeks of treatment

Table 5—Trials of drug treatment for neck pain

Reference	Sample size	Treatment (active v control) and length of treatment (weeks)	Validity score*					Overall score out of 5	Reported result	Effect size† (95% confidence interval)
			A	B	C	D	E			
Analgesic, anti-inflammatory, education										
Koes <i>et al</i> ²⁵	25	General practitioner (analgesic, anti-inflammatory, education (rest, exercise, posture)) v placebo for:	4	1	2	4	2	4		
		3							P>0.7	0.2 (–0.6 to 1.0)
		6							P>0.7	0.4 (–0.4 to 1.2)
		9 plus 3 follow up							P>0.7	0.6 (–0.2 to 1.4)
Muscle relaxant										
Basmajian <i>et al</i> ¹⁴	105	Cyclobenzaprine v placebo, diazepam v placebo for 2 weeks	4	2	4	0	2	4	P<0.01	Unable to abstract
Bercel <i>et al</i> ¹⁵	54	Cyclobenzaprine v placebo for:	4	1	3	2	2	3	P<0.05	Unable to abstract
		2 plus 1 follow up							P<0.05	
Anti-inflammatory										
Coletta <i>et al</i> ¹⁹	12	Topical anti-inflammatory, TENS v TENS for:	4	0	2	0	2	2		
		5							P<0.02	Unable to abstract
		10							P<0.02	
		20							P<0.05	

*†See footnote to table 1.

Table 6—Trials of patient education for treatment of neck pain

Reference	Sample size	Treatment (active v control) and length (weeks) and time of treatment	Validity score*					Overall score out of 5	Reported result	Effect size† (95% confidence interval)
			A	B	C	D	E			
Controlled trials‡										
Koes <i>et al</i> ²⁵	25	General practitioner (education (rest, exercise, posture), analgesic, anti-inflammatory) v placebo for: 3 6 9 plus 3 follow up	4	1	2	4	2	4	P>0.7	0.2 (–0.6 to 1.0) 0.4 (–0.4 to 1.2) 0.6 (–0.2 to 1.4)
Kamwendo <i>et al</i> ²⁴		Education (neck school, posture), exercise v control (no treatment) for:	4	2	2	0	2	3	Not reported	
	47	4, morning								0.1 (–0.5 to 0.7)
	47	4, noon								0.1 (–0.5 to 0.7)
	46	4, afternoon								0.1 (–0.5 to 0.7)
	40	4, afterwork								0.2 (–0.5 to 0.8)
	47	6 months' follow up, morning								–0.2 (–0.8 to 0.3)
	47	6 months' follow up, noon								–0.2 (–0.7 to 0.4)
	47	6 months' follow up, afternoon								0.0 (–0.6 to 0.6)
	39	6 months' follow up afterwork								–0.8 (–1.4 to –0.1)
		Education (neck school, ergonomics, posture), psychological counselling, exercise v no treatment control for:							Not reported	
	47	4, morning								–0.4 (–0.9 to 0.2)
	47	4, noon								–0.1 (–0.7 to 0.5)
	47	4, afternoon								0.0 (–0.6 to 0.6)
	39	4, afterwork								0.2 (–0.4 to 0.8)
	46	6 months follow up, morning								–0.3 (–0.9 to 0.3)
	46	6 months' follow up, noon								–0.1 (–0.7 to 0.5)
	46	6 months' follow up, afternoon								0.1 (–0.5 to 0.6)
	39	6 months' follow up, afterwork								0.0 (–0.6 to 0.7)
Comparison trials§										
McKinney <i>et al</i> ³³	99	Education (posture, relaxation, exercise), analgesics, collar v education (advice, rest), analgesics, collar for: 4 6 plus 2 follow up	4	1	1	2	0	2	P<0.01 P<0.01	–0.6 (–1.0 to –0.2) –0.4 (–0.8 to 0.1)

*†See footnote to table 1.

‡Controlled trial: control group is treated similarly in all respects as active treatment group except they do not receive intervention of interest.

§Comparison trial: treatments groups are exposed to different interventions.

Drug treatments

Four randomised controlled trials that used drug treatments met our eligibility criteria, with validity scores varying from strong to weak.^{14-15 19 25} Table 5 summarises the abstracted results.

Two placebo controlled trials, one of moderate methodological quality¹⁵ and the other strong,¹⁴ investigated muscle relaxants with algometry or muscle spasm symptom scores as outcomes. Direct pain score data could not be abstracted from either study. Both reported significant improvement in patients with both neck or low back disorders. One methodologically weak randomised controlled trial compared a topical anti-inflammatory applied with TENS with TENS alone and reported significant pain reduction with the combined treatment.¹⁹ We could not calculate the magnitude of this effect. One strong randomised controlled trial tested a combination of anti-inflammatories, analgesics, and patient education compared with a placebo of detuned electrotherapy²⁵ and showed no significant difference between treatments, but the small sample size used in this subgroup analysis probably does not have sufficient power to state conclusively that no difference exists.

Patient education

Three randomised controlled trials that used patient education (including ergonomic advice, neck school, postural advice, and strategies for the management of pain) met our inclusion criteria, with validity scores varying from weak to strong.^{24 25 34} Table 6 summarises the abstracted results.

In Kamwendo *et al* traditional neck school and neck school combined with ergonomic advice were each compared with a no treatment control in a moderate quality study.²⁴ Data provided by the authors allowed us

to calculate an effect size, which showed no significant difference between groups. Two randomised controlled trials investigated forms of patient advice. Koes *et al*, in a methodologically strong study, compared a combination of anti-inflammatories, analgesics, and patient education with a placebo and found no significant difference between groups.²⁵ McKinney *et al* compared two forms of education (advice) in a methodologically weak study.³⁴ At four weeks of treatment, education combined with posture, relaxation training, and exercise gave significant pain relief compared with advice and rest. At eight weeks of treatment this effect disappeared.

ADVERSE EFFECTS

Adverse effects have not been well documented. If we exclude data from the three trials in which patients with neck pain were not separated from those with low back pain,^{14 15 25} 1254 patients were randomised in 21 randomised controlled trials. Six trials reported a total of 16 patients with increased symptoms or side effects resulting from treatment. No serious complications or deaths were reported.

Discussion

Current practice often lags behind available evidence. In a survey about attitudes on treatment of musculo-skeletal disease, active exercise, traction, TENS, and ultrasound were perceived to be the best methods for the treatment of neck pain.⁴⁵ The results of this overview clearly do not support these approaches nor others commonly used in practice today.^{7 8} What becomes most clear from this overview is the lack of evidence for many of the standard approaches to neck pain used in health care today. Even for the treatments found in this overview to have some early evidence of support, such as manual treatments in combination with other

Key messages

- Neck pain is a common problem
- Many treatments are available and accepted as standard forms of practice
- Systematic literature searching finds a limited number of clinical trials
- There is early evidence to support the use of manual treatments in combination with other treatments for short term pain relief, but in general, conservative interventions have not been studied in enough detail to assess efficacy or effectiveness adequately
- Further clinical trials are needed to determine optimal treatment approaches

treatments, conclusions must be made cautiously because of the small number of trials on which they are based.

The growing magnitude and socioeconomic impact of neck pain in society will demand that more research be conducted into the efficacy and effectiveness of its treatment. As more studies are accumulated, the influences of a number of factors on the results can be explored. Methodological quality, which has been shown in previous work to be related to outcome,⁴⁶ was not shown to influence the pooled estimate of effect for manual treatments in combination with other treatments. Other clinically important influences such as type or chronicity of the disorder may also be expected to influence the results of the pooled analysis in future. Regular updates through the Musculoskeletal Review Group of the Cochrane Collaboration will facilitate this.⁴⁷

In general, no treatments have been studied in enough detail to assess either efficacy or effectiveness adequately. When we consider the varied treatment approaches to neck pain, with their potential risks and costs, much further work is needed to determine optimal treatment approaches.

We are indebted to the authors of the primary studies included in this review and to Dr Eldon Tunks, Tom Flemming, Dr Deborah Cook, and Dr Bart Koes for their assistance at various stages of this work.

Funding: This study was supported in part by a grant from the McGregor Clinic Fund, Hamilton Foundation.

Conflict of interest: None.

- 1 Bovim G, Schrader H, Sand T. Neck pain in the general population. *Spine* 1994;19:1307-9.
- 2 van der Donk J, Schouten JASAG, Passchier J, Romunde LKJ, Valkenburg HA. The associations of neck pain with radiological abnormalities of the cervical spine and personality traits in a general population. *J Rheumatol* 1991;18:1884-9.
- 3 Horal J. The clinical appearance of low back disorders in the city of Gothenburg, Sweden. *Acta Orthop Scand* 1969;118(suppl):42-5.
- 4 Hult L. Cervical, dorsal and lumbar spinal syndromes. *Acta Orthop Scand* 1954;17(suppl):175-277.
- 5 Hult L. The Munkfors investigation: a study of the frequency and causes of stiff neck-brachialgia and lumbago-sciatic syndromes, as well as observations on certain signs and symptoms from the dorsal spine and the joints of the extremities in industrial and forest workers. *Acta Orthop Scand* 1954;16(suppl):12-29.
- 6 Kvarnstrom S. Occurrence of musculoskeletal disorders in a manufacturing industry with special attention to occupational shoulder disorders. *Scand J Rehabil Med* 1983;8(suppl):1-114.
- 7 Barry M, Jenner JR. ABC of rheumatology. Pain in neck, shoulder, and arm. *BMJ* 1995;310:183-6.
- 8 Tollison CD, Satterthwaite JR, eds. *Painful cervical trauma: diagnosis and rehabilitative treatment of neuromusculoskeletal injuries*. Baltimore, Maryland: Williams and Wilkins, 1992.
- 9 Gross AR, Aker PD, Goldsmith CH, Peloso P. Conservative management of mechanical neck disorders: a systematic overview and meta-analysis. *Online J Curr Clin Trials* [serial online] 1996 July 30;5. (Doc No 200 and 201.)
- 10 Spitzer WO, Leblanc FE, Dupuis M. Scientific approach to the assessment and management of activity related spinal disorders. *Spine* 1987;7:S1-59.
- 11 Hedges LV, Olkin I. *Statistical methods for meta-analysis*. Orlando, Florida: Academic Press, 1985:27-45.

- 12 Microsoft Corporation. *METANAL version 4.01*. McMaster University, Hamilton: Microsoft Corporation, 1982-8.
- 13 Breslow NE, Day NE. *Statistical methods in cancer research*. Vol 1. *The analysis of case-control studies*. Lyons: International Agency for Research on Cancer, 1980.
- 14 Basmajian JV, ed. Cyclobenzaprine hydrochloride effect on skeletal muscle spasm in the lumbar region and neck: Two double-blind controlled clinical and laboratory studies. *Arch Phys Med Rehabil* 1978;59:58-63.
- 15 Bercel NA. Cyclobenzaprine in the treatment of skeletal muscle spasm in osteoarthritis of the cervical and lumbar spine. *Curr Ther Res* 1977;22:462-8.
- 16 Brodin H. Cervical pain and mobilization. *Int J Rehab Research* 1984;7:190-1.
- 17 Brodin H. Cervical pain and mobilization. *Manual Medicine* 1985;2:18-22.
- 18 Cassidy JD, Lopes AA, Yong-Hing K. The immediate effect of manipulation versus mobilization of pain and range of motion in the cervical spine: a randomized controlled trial. *J Manipulative Physiol Ther* 1992;15:570-87. (Correction in: *J Manipulative Physiol Ther* 1993;16:279-80.)
- 19 Coletta R, Maggiolo F, Di Tizio S. Etofenamate and transcutaneous electrical nerve stimulation treatment of painful spinal syndromes. *Int J Clin Pharmacol Res* 1988;8:295-8.
- 20 Foley-Nolan D, Barry C, Coughlan RJ, O'Connor P, Roden D. Pulsed high frequency (27MHz) electromagnetic therapy for persistent neck pain: a double blind, placebo-controlled study of 20 patients. *Orthopaedics* 1990;13:445-51.
- 21 Foley-Nolan D, Moore K, Codd M, Barry C, O'Connor P, Coughlan RJ. Low energy high frequency pulsed electromagnetic therapy for acute whiplash injuries. A double blind randomized controlled study. *Scand J Rehab Med* 1992;24:51-9.
- 22 Goldie I, Landquist A. Evaluation of the effects of different forms of physiotherapy in cervical pain. *Scand J Rehab Med* 1970;2-3:117-21.
- 23 Jensen OK, Nielsen FF, Vosmar L. An open study comparing manual therapy with the use of cold packs in the treatment of post-traumatic headache. *Cephalalgia* 1990;10:242-50.
- 24 Kamwendo K, Lindten SJ. A controlled study of the effect of neck school in medical secretaries. *Scand J Rehab Med* 1991;22:143-52.
- 25 Koes BW. *Efficacy of manual therapy and physiotherapy for back and neck complaints*. den Haag: Cip-Gegevens Koninklijke Bibliotheek, 1992. (Thesis.)
- 26 Koes BW, Bouter LM, van Mameren H, Esser AH, Verstegen GM, Hofhuizen DM, et al. Randomised clinical trial of manipulative therapy and physiotherapy for persistent back and neck complaints: results of one year follow up. *BMJ* 1992;304:601-5.
- 27 Koes BW, Bouter LM, van Mameren H, Esser AH, Verstegen GM, Hofhuizen DM, et al. A blind randomized clinical trial of manual therapy and physiotherapy for chronic back and neck complaints: physical outcome measures. *J Manipulative Physiol Ther* 1992;15:16-23.
- 28 Koes BW, Bouter LM, van Mameren H, Essers AH, Verstegen GM, Hofhuizen DM, et al. The effectiveness of manual therapy, physiotherapy, and treatment by the general practitioner for nonspecific back and neck complaints. *Spine* 1992;17:28-35.
- 29 Koes BW, Bouter LM, van Mameren H, Essers AH, Verstegen GM, Hofhuizen DM, et al. A randomized clinical trial of manual therapy and physiotherapy for persistent back and neck complaints: subgroup analysis and relationship between outcome measures. *J Manipulative Physiol Ther* 1993;16:211-9.
- 30 Levoska S, Keinänen-Kiukaanniemi S. Active or passive physiotherapy for occupational cervicobrachial disorders? A comparison of two treatment methods with a 1-year follow-up. *Arch Phys Med Rehabil* 1993;74:425-30.
- 31 Lewith GT, Machin D. A randomized trial to evaluate the effect of infra-red stimulation of local trigger points, versus placebo, on the pain caused by cervical osteoarthritis. *Acupuncture and Electrotherapeutic Research International Journal* 1981;6:277-84.
- 32 Loy TT. Treatment of cervical spondylosis. Electroacupuncture versus physiotherapy. *Med J Aust* 1983;2:32-4.
- 33 McKinney LA, Dornan JO, Ryan M. The role of physiotherapy in the management of acute neck sprains following road-traffic accidents. *Arch Emerg Med* 1989;6:27-33.
- 34 McKinney LA. Early mobilisation and outcome in acute sprains of the neck. *BMJ* 1989;299:1006-8.
- 35 Mealy K, Brennan H, Fenelon GC. Early mobilisation of acute whiplash injuries. *BMJ* 1986;292:656-7.
- 36 Nordemar R, Thorner C. Treatment of acute cervical pain - a comparative group study. *Pain* 1981;10:93-101.
- 37 Pennie B, Agambar L. Whiplash injuries: a trial of early management. *J Bone Joint Surg Br* 1990;72:277-9.
- 38 Petrie JP, Langley GB. Acupuncture in the treatment of chronic cervical pain. A pilot study. *Clin Exp Rheumatol* 1983;1:333-5.
- 39 Sloop PR, Smith DS, Golderg E, Dore C. Manipulation of chronic neck pain: a double-blind controlled study. *Spine* 1982;7:532-5.
- 40 Snow CJ, Aves Wood R, Dowhopoluk V, Howdle H, Deckert C, Elfenbaum G, et al. Randomized controlled clinical trial of spray and stretch for relief of back and neck myofascial pain. *Physiotherapy Canada* 1992;44:S8.
- 41 Thorsen H, Gam AN, Svensson BH, Jess M, Jensen MK, Piculell I, et al. Low level laser therapy for myofascial pain in the neck and shoulder girdle. A double-blind, cross-over study. *Scand J Rheumatol* 1992;21:139-41.
- 42 Thorsen H, Gam AN, Jensen H, Hojmark L, Wahlstrom L. Lav-energi laserbehandling - effekt ved lokaliseret fibromyalgi i nakke- og skulderregioner. *Ugeskr Laeger* 1991;153:1801-4.
- 43 Vernon HT, Aker P, Burns S, Viljakkaenen S, Short L. Pressure pain threshold evaluation of the effect of spinal manipulation in the treatment of chronic neck pain: a pilot study. *J Manipulative Physiol Ther* 1990;13:13-6.
- 44 Waylonis GW, Wilke S, O'Toole D, Waylonis DA, Waylonis DB. Chronic myofascial pain: Management by low-output helium-neon laser therapy. *Arch Phys Med Rehabil* 1988;69:1017-20.
- 45 Rush PJ, Shore A. Physician perceptions of the value of physical modalities in the treatment of musculoskeletal disease. *Br J Rheumatol* 1994;33:566-8.
- 46 Jadad AR. *Meta-analysis of randomised trials in pain relief*. Oxford: University of Oxford, 1994. (D Phil thesis.)
- 47 Gross A, Aker P, Goldsmith C, Peloso P. Conservative management of mechanical neck disorders. In: Brooks P, Bosi-Ferraz M, de Bie R, Gillespie W, Tugwell P, Wells G, eds. *Musculoskeletal module*. In: *The Cochrane database of systematic reviews*. The Cochrane collaboration. Issue 2. Oxford: Update Software, 1995.

(Accepted 19 September 1996)