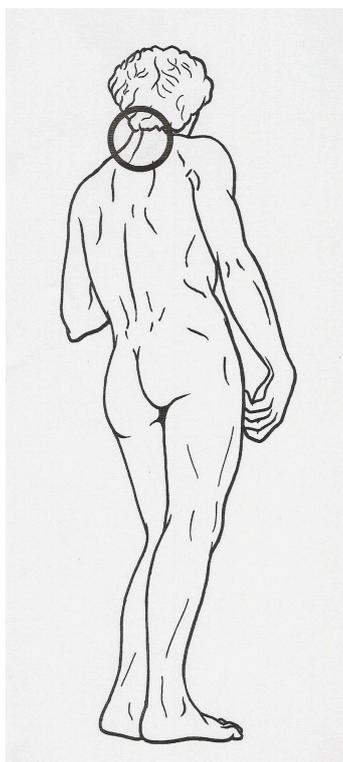


Conservative Treatment of Neck Pain

–an Updated Literature Review



MPH-studiet

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Vejleder: Seniorforsker Hanne Thorsen

Forord

Denne MPH-afhandling består af en litteraturgennemgang omhandlende konservativ behandling af nakkesmerter i søgeperioden januar 1997 til april 2004. Som appendix findes de hjælpeskemaer der er blevet benyttet til at sammenfatte den vigtigste information vedrørende den indhentede litteratur. Opgaven er skrevet på engelsk, da min oprindelige hensigt med opgaven har været at få den publiceret som en review artikel i et internationalt tidsskrift.

Emnet "Behandling af nakkesmerter" er af interesse for mig som opgaveskriver idet jeg i min dagligdag som kiropraktor på Rygcentret, Københavns Kommune beskæftiger mig med rygpatienter herunder patienter med ondt i nakken. Jeg har bestræbt mig på ikke at lade min faglige baggrund skinne igennem i bearbejdningen af datamaterialet. Jeg håber det er lykkedes.

En særlig stor tak skal lyde til min vejleder Hanne Thorsen som med sit enorme engagement, indsigt og interesse for emnet har formået at fastholde mit fokus på opgaven.

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Roskilde den. 29.7.2004

Jan Nordsteen

Introduction

Neck pain is a common condition. Although probably not as frequent and disabling as low back pain neck pain still constitutes a major burden on patients in terms of pain, disability and loss of income, and on society in terms of health care costs and time off work (Nachemson, 2000). Côté et al., (1998) estimated the lifetime prevalence of neck pain to 67% with a point prevalence of 22%. The six-month prevalence of significantly disabling neck pain in their Canadian population study was 4.6%, whereas for low intensity and low disability neck pain the 6-month prevalence was 40%. In an other survey study of a nationally representative population in the United States, Wolosko et al. (2003) found 16% having neck or upper back pain in the last year and 33% reported having both neck and low back pain.

Neck pain may be caused by a number of factors, some of which are known, and some still unknown. Known risk factors for developing neck pain include gender. Females generally are more predisposed to developing neck pain than males (Côté et al., 2000; Peterson, 2003). Other risk factors include high quantitative job demands, working overtime and unsatisfactory leisure time (Ariëns, 2001; Fredriksson, 1999). A history of previous injury associated with a motor vehicle accident predisposes to recurrent episodes of neck pain (Côté et al., 2000).

Symptoms may arise from various structures in the neck or be referred to the neck due to conditions elsewhere. Most commonly however, no specific cause or underlying pathology can be detected, and as it is the case for low back pain, neck pain often will be diagnosed as non-specific. Various imaging techniques may be helpful in diagnosing specific conditions responsible for neck pain. Usually they are of little help, when no underlying pathologic condition is suspected (Ferrari, 2003). Furthermore, cervical spine degenerative changes do not correlate with pain severity or disability levels (Peterson, 2003).

A host of health care providers including medical doctors, physiotherapists, chiropractors and others are involved in the management of patients with neck pain (Wolosko, 2003). A wide variety of treatments are usually offered to these patients. The scientific evidence regarding the effect of these treatments most often is insufficient to draw definite conclusions and thus direct health care providers to the most appropriate treatment strategies for their patients (Harms-Ringdahl, 2000; van Tulder, 2000).

Systematic reviews of clinical trials have assessed the efficacy of various treatments for neck pain. However, the search period in several of these systematic reviews ends around 1997-1998 in most cases except Sarig-Bahat (2002) and Wainer (2000). In 1997 "Neck Pain" was introduced as a Medical Subject Heading (MeSH) in Medline. It is therefore felt that an updated review on trials from this point is justified, as it will add valuable information to the evidence from most of the existing systematic reviews.

Clinical guidelines

Evidence based clinical guidelines on various conditions should be helpful as tools for clinicians in caring for their patients, and guide them to the most appropriate management strategies. Clinical guidelines on low back pain have been prepared in Europe, North America and Australia over the years (Waddell, 1998). No comprehensive evidence based clinical guidelines on conservative management of neck pain has yet been prepared despite the wide range of treatments offered to patients with neck pain. One example of an evidence based clinical practice guideline however; only on manipulation/ mobilization in treating mechanical neck disorders has been prepared by Gross et al. (2002).

The question of interest in this context is whether the quality of evidence is such that the preparation of clinical guidelines on conservative management of neck pain is feasible at this point in time.

The purpose of this study is to identify randomised studies and carry out an updated systematic review in order to establish whether the latest studies add valuable and clinically relevant information to the current knowledge about conservative treatment of neck pain.

If this systematic review gives an opportunity to put forward specific recommendations on conservative management of neck pain, the purpose of this study will include outlines on specific recommendations to be incorporated in a future comprehensive clinical guideline on conservative management of neck pain.

Methods and materials

Literature identification

With the assistance from a scientific librarian computerized databases restricted to the English language were searched, from January 1997 through April 2004. Databases searched were Medline, Embase and Cinahl (Cumulative Index to Nursing and Allied Health Literature). Also The Cochrane Collaboration Trials Register was included.

Key words and Medical Subject Headings (MeSH) were: Neck Pain (MeSH since 1997), neck ache, therapy, rehabilitation, conservative, prevention, physiotherapy, chiropractic, drug therapy.

Initially abstracts were searched electronically in order to leave out irrelevant studies. Next, the remaining abstracts were printed out and studies on conservative treatment of neck pain were identified. The results from the three databases then were coordinated with respect to references located in more than one database. Then abstracts were searched in order to leave out irrelevant studies and non- randomised studies. Finally, articles that were found to be relevant on first sight were retrieved and references in each randomised controlled trial (RCT) were searched manually in order to identify studies that were not identified electronically. Thus the search was restricted to randomised controlled trials and systematic literature reviews. However, articles considered relevant as background information on neck pain i.e. prevalence studies etcetera were also included.

Studies left out were non randomised studies, case reports, descriptive studies, pilot studies, letters to the editor, commentaries, conference proceedings, studies describing surgical and other invasive procedures, studies with main focus on whiplash disorders (WAD), paediatric studies, studies on diagnostic procedures, studies on validation of diagnostic tests, studies not reported in the English language, studies describing sequelae from traumatic injuries, studies on specific rheumatic disorders involving the cervical spine. Studies on treatment of headache as the main complaint (although of possible cervical origin) were excluded as well.

For the purposes of the present study conservative treatment is defined as: “All non-invasive treatment modalities normally used by medical doctors, physiotherapists, chiropractors and others”. Thus, surgical treatment and denervation by radio frequency procedures are not covered.

Appraisal of systematic reviews

The identified review articles were appraised with respect to overall quality using the systematic approach as described by Oxman (1991) and modified by Hoving et al. (2001). The purpose of appraising the quality of the systematic review articles was to establish a treatment-categorized base, on which to make comparisons with results from RCT's identified in the present review.

Criteria used to establish overall quality of the identified systematic review articles

1. Were the search methods used to find evidence (primary studies) on the primary question (s) stated?
2. Was the search for evidence reasonably comprehensive?
3. Were the criteria used for deciding which studies to include in the review reported?
4. Was bias in the selection of articles avoided?
5. Were criteria used for assessing validity of the studies that were reviewed reported?
6. Was the validity for each study cited assessed using appropriate criteria (either in selecting studies for inclusion or in analysing the studies that are cited)?
7. Were the methods used to combine the findings for the relevant studies (to reach a conclusion) reported?
8. Were findings of the relevant studies combined appropriately relative to the primary question the review addresses?
9. Were the conclusions made by the author(s) supported by the data or analysis reported in the review?

Each item could be scored either as “0”, “1”, or “2”. An item receiving a score of 0 would be given if "no" was the answer to the posed question. One point would be given if the posed question could be answered by "partial" or "cannot tell". Finally 2 points would be awarded if the posed question could be answered by "yes". With nine items being assessed each review article could yield a maximum score of 18 points indicating “Excellent quality” (Hoving, 2001). All review articles were scored using this method of quality assessment.

Appraisal of randomised controlled trials

The methodological quality (internal validity) of RCT's was appraised using the approach according to method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group described by van Tulder et al. (2003).

The criteria list for methodological quality assessment is

1. Was the method of randomisation adequate?
2. Was the treatment allocation concealed?
3. Were the groups similar at baseline regarding the most important prognostic indicators?
4. Was the patient blinded to the intervention?
5. Was the care provider blinded to the intervention?
6. Was the outcome assessor blinded to the intervention?
7. Were co interventions avoided or similar?
8. Was the compliance acceptable in all groups?
9. Was the dropout rate described and acceptable?
10. Was the timing of the outcome assessment in all groups similar?
11. Did the analysis include an intention-to-treat analysis?

My supervisor volunteered to assess the methodological quality of the identified RCT's, so that two reviewers independently appraised the retrieved RCT's according to these criteria. In case of disagreement, consensus was attempted by discussing discrepancies.

The criteria above were scored as being positive, negative or unclear for each randomised trial ("Yes", "No" or "Don't know"). There are no strict guidelines as to when a study is to be considered as being of low or high quality (van Tulder et al., 2003). For the purposes of this review, and bearing in mind that blinding of patients and care providers in studies regarding treatment of musculoskeletal conditions often is not possible, six or more positive scores out of 11 possible were arbitrarily chosen as the cut-off point in determining if a study would be labelled as "High quality" or "Lower quality".

Both in case of appraising review articles and RCT's a form was prepared (see appendix) so that going through each study, the relevant criteria could be identified and the reviewer's remarks noted on the form. Thus, in all articles such a form was filled out resulting in a summary of relevant methodological issues as well as conclusions pertaining to each study.

In order to make comparisons possible both review studies and RCT's were categorized according to the following treatment modalities

1. Exercise
2. Neck school
3. Manipulation/ mobilization
4. Acupuncture
5. Medication
6. Electrical stimulation/ ultrasound
7. Collar
8. Psychological counselling
9. Education
10. Mixed
11. Other

Based on the results and conclusions of the identified RCT's, and taking into account the methodological quality of these studies, it was decided whether the new studies from the search period 1997 through April 2004 add substantially new information to the existing knowledge regarding the effect of interventions for neck pain.

Results

This chapter consists of two parts.

The first part covers the identified review articles published since January 1997.

The second part reports on the randomized controlled trials from the same period.

Eleven review articles and twenty-six studies on randomised controlled trials were identified as outlined in the flowchart (Figure 1).

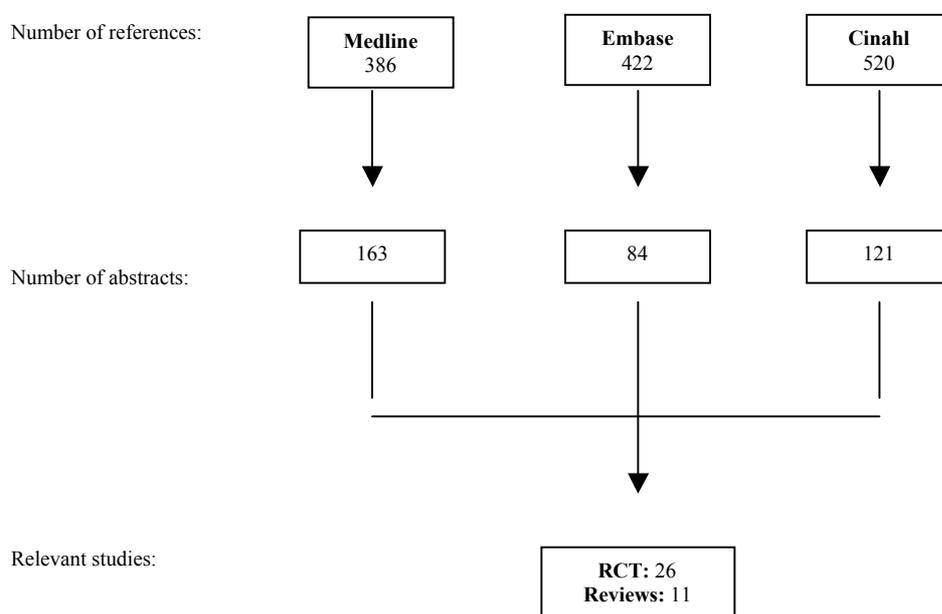


Figure 1. Results of the search process

Assessment of identified review studies

First the methodological quality of the review articles is reported. Then the results of the review studies are reported and grouped into broad treatment modalities. The relevant findings in each treatment category are followed by a brief summary.

Eleven review articles reporting on conservative treatment of neck pain were published since 1997. Eight are published as journal articles. Two of these are articles in a supplement issue on aetiology, treatment efficacy and disability management related to chronic pain (Mior, 2001). The remaining

two are published as book chapters (Harms-Ringdahl, 2000; van Tulder, 2000). These studies with respect to the condition treated and latest year included in the search period are outlined in table 1.

	Condition	Year
Ernst, 2003	Any type of non traumatic neck pain	2002
Gross, 2002	Neck disorder with headache of cervical origin. Mechanical neck disorder (MND). MND with radicular signs and symptoms. Neck disorder associated with whiplash associated disorders Neck disorder associated with degenerative changes.	1998
Harms-Ringdahl, 2000	Neck pain, Cervical spinal pain, Whiplash injuries	1997
Karjalainen, 2001	Neck and Shoulder Pain.	1998
Kjellman, 1999	Neck pain, cervical pain, disorders of the cervical spine.	1995
Mior, 2001 (manipulation)	Chronic neck pain	1998
Mior, 2001 (exercise)	Chronic neck pain	1998
Sarig-Bahat, .2003	Mechanical Neck Pain (Quebec Task Force)	2001
Van Tulder, 2000	Chronic Neck Pain >12 weeks	1998
Wainner, 2000	Lesion or disease of the cervical nerve root regardless of aetiology	1999
White, 1999	Neck pain, Neck root pain, Cervical spondylosis, Neck and back pain, Osteoarthritis, Ankylosing spondylitis, others	1997

Table 1. Systematic reviews: Condition investigated and latest year included in the search period.

Methodological quality

Only one review article reached “Excellent quality” i.e. 18 points (Gross, 2002). The remaining studies scored higher than twelve points on the quality assessment scale as outlined in table 2, except Ernst (2003) and Wainner (2000) whose articles scored “10” and “8” respectively.

	Number of studies	Quality score
Ernst, 2003	4	10
Gross, 2002	20	18
Harms-Ringdahl, 2000	18	12
Karjalainen, 2001	2	14
Kjellman, 1999	27	16
Mior, 2001 (manipulation)	6	14
Mior, 2001 (exercise)	4	14
Sarig-Bahat, .2003	16	12
Van Tulder, 2000	20	14
Wainner, 2000	Not stated	8

White, 1999	14	13
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Table 2. Systematic reviews: Number of studies and quality assessment.

Generally all review articles scored high on stating *search methods* that were used to find primary studies. Also, all review articles scored two points on the *comprehensiveness* of the literature search. Report on criteria for *inclusion* of primary studies was explicitly described by all except Wainner (2000) where it was only partially described. Methods to avoid *bias* was described adequately and avoided in six articles (Gross, 2002; Karjalainen, 2001; Mior, 2001(both); van Tulder, 2000; White, 1999). In almost all articles except Wainner (2000) and Ernst (2003) the *criteria used for assessing validity* of reviewed studies were reported adequately using *appropriate criteria* of each primary study. Only in two review articles (Gross, 2002 and Kjellman, 1999) *methods were used to combine the findings* of the relevant studies. In these two articles findings were *combined adequately* to address the purpose of the review. In all studies *conclusions* made by authors were *supported by the data* reported in the review studies.

Interventions

Interventions included in the review articles are

- Exercise,
- Neck-school
- Manipulation/ mobilization
- Medication
- Electrical stimulation/ ultrasound
- Cervical collar
- Traction
- Psychological counselling
- Education
- Mixed interventions
- Other/ miscellaneous

Exercise

In three reviews exercise was considered as intervention for conditions including neck pain.

Harms-Ringdahl and Nachemson (2000) found, that for patients with acute and sub-acute neck pain including patients with acute whiplash injury, active exercises are more effective in reducing pain and improving range of motion than passive treatment modalities such as massage, heat and stretching. In studies on exercises for chronic neck pain Mior (2001) found limited evidence in favour of exercises as an efficient treatment option for chronic neck pain based on one high quality study and three low-medium quality studies. Sarig-Bahat (2003) found strong evidence favouring proprioceptive exercises in reducing pain and disability in patients with chronic neck pain. Also strong evidence was found supporting the use of strengthening exercises in patients with recurrent or chronic neck pain. Evidence could not support the use of group exercise, neck school, home exercises or single session extension-retraction exercises in patients with recurrent or chronic neck pain.

In summary the results from the review of the review studies seem to show that it is relevant and reasonable to incorporate exercise therapy in the management of acute and chronic neck pain

Manipulation/ mobilization

Six reviews studying manipulation/ mobilization or manual therapy were identified.

In a high quality systematic review Gross et al. (2002) found inconclusive evidence as to the efficacy of manual therapies in treatment of various conditions involving mechanical neck pain, although there seemed to be evidence favouring multimodal care (manipulation/ mobilization in combination with exercise or other treatment modalities) over manipulation alone or other modalities such as collar, drug therapy or education for pain reduction. Harms-Ringdahl (2000) found insufficient evidence to support the use of manipulation/ mobilization alone and when compared to other treatments such as collar plus rest and patient education in patients with acute or sub-acute neck pain. However, the use of manipulation/ mobilization in combination with other treatment modalities including active exercises or massage led to reduced pain levels and improved cervical range of motion in acute whiplash patients, but also in patients with varying duration of pain and limited cervical movement. In two trials rated as methodologically good Kjellman (1999) noted positive outcomes in the short term for patients receiving manipulation for chronic tension-type headache or mechanical neck pain with radiation. However the low number of publications was regarded as insufficient to draw general conclusions about these treatment modalities. In a review including four RCT's of chiropractic spinal manipulation Ernst (2003) found no evidence

that this treatment modality performed by chiropractors was more effective in relieving neck pain than exercise therapy. In studies of low-medium quality Mior (2001) found contradictory evidence to support the use of manipulation/ mobilization as treatment options for chronic neck pain in the short to intermediate term. In two high quality studies and one low quality study Van Tulder (2000) found strong evidence that manipulation/ mobilization in patients with chronic non specific neck pain was no more effective than physical therapy or intensive training. In patients with cervical radiculopathy defined as a lesion or disease of the cervical nerve root, Wainer (2000) found no evidence to support the use of manipulation as treatment for patients with this condition.

In summary the use of manipulation or mobilization alone in treating neck pain based on the review articles included in the present study does not seem to give more beneficial results than reference treatments. However, favourable results seem to be achieved when this treatment modality is being used in conjunction with other treatment modalities.

Acupuncture

Acupuncture as main intervention was identified in four trials by Kjellman (1999). In one study, rated as having good methodological quality, although study population on entry was only 27, acupuncture was found to be no more effective than sham TNS in treating chronic neck pain. The three other low-quality studies all concluded that acupuncture as treatment for chronic neck pain or cervical spondylosis was effective. Van Tulder (2000) in two high quality trials found strong evidence that acupuncture is not effective in the treatment of chronic cervical osteoarthritis or chronic neck pain with or without radiation. White and Ernst (1999) assessed RCT's on acupuncture for neck pain and found acupuncture to be no better than sham treatment or placebo in five high quality studies. Three studies assessed by these authors as “high quality” favoured acupuncture. However, in one of these acupuncture was compared to waiting list controls which might have accounted for the result favouring the intervention.

Based on the included review studies acupuncture does not seem to be a treatment modality in the first line of choice for patients with neck pain, although some studies apparently report beneficial effects.

Medication/ injection therapy

In treatment of acute neck pain Harms-Ringdahl (2000) found only one small study on the effect of muscle relaxants in acute neck pain patients and concluded, that the evidence supporting drug therapy as an option is limited. In chronic neck pain patients van Tulder (2000) did not find evidence supporting the use of muscle relaxants for patients with chronic neck pain. Also, intra-articular- or epidural steroidal injections in two high quality studies were found to be ineffective in reducing pain levels. However, one low quality study reported significantly improved pain relief, improved cervical range of motion and also improved chances of returning to work. In his review of non-surgical management of cervical radiculopathy Wainner (2000) located seven studies of epidural nerve root injection as the main intervention. Except for one study, results were uniformly in favour of this treatment modality. However, only two studies were randomised clinical trials, and the methodological quality of studies was not systematically rated in this review.

In summary it seems uncertain whether medication/ injection therapy has beneficial effects on patients with neck pain. More high quality studies investigating this treatment modality are needed.

Electrical stimulation/ ultrasound/ laser therapy

These treatment modalities were assessed as main interventions in three review articles. For the purposes of this study, they are discussed together. In one RCT Harms-Ringdahl (2000) found insufficient evidence to support the use of laser therapy in sub-acute neck pain. And no evidence was found in favour of infrared light as treatment modality for acute and sub-acute neck pain. In a small study reviewed by Kjellman (1999) transcutaneous electrical nerve stimulation did not significantly reduce pain, but seemed to have a positive effect on restoration of cervical range of motion in patients with acute neck pain. In the management of chronic neck pain conflicting evidence was found by van Tulder (2000) to support the use of laser therapy.

Apparently there is insufficient evidence to support the use of the treatment modalities mentioned above in patients with neck pain.

Electromagnetic therapy

Electromagnetic therapy as main treatment modality was reviewed in three studies. In one study where electromagnetic therapy in combination with a soft collar was compared to collar alone, results favoured the combination of modalities in the short term Harms-Ringdahl (2000). Kjellman

(1999) reviewed three high quality studies on electromagnetic therapy which all reported positive outcomes from this treatment modality. This finding is in concordance with van Tulder (2000) who also reviewed two of the same high quality studies, and found evidence to support the use of electromagnetic therapy for short-term pain relief.

In summary this treatment modality seems an effective option and could ideally be used as short-term pain relief for instance in conjunction with other modalities that have proved efficient in long-term symptom relief.

Cervical collar

Four authors reviewed management with cervical collar. Harms-Ringdahl (2000) did not find evidence to support the use of a cervical collar for acute or sub-acute neck pain. In one high quality study reviewed by van Tulder (2000) authors reported less effect from cervical collar than surgery or physical therapy in patients with chronic cervical nerve root compression. Wainner (1999) in three randomized trials found no evidence in favour of using a cervical collar as primary treatment option in patients with cervical radiculopathy.

In summary using a cervical collar in the treatment of neck pain is not effective according to these studies. Intuitively, this seems to be in concordance with studies that report beneficial effects from exercise therapy. Thus, effective therapy for non-traumatic neck pain does not include immobilization.

Traction

The use of traction in the treatment for neck pain was covered by four authors. Harms-Ringdahl (2000) identified three studies investigating traction in the management of acute or sub-acute neck pain. However, studies were generally of poor methodological quality and limited evidence was found that cervical traction was not effective. In two studies rated as having good methodological quality Kjellman (1999) found that traction resulted in negative or same outcome as reference treatments. One third study of lower methodological quality also reviewed by Harms-Ringdahl found no difference between intermittent traction and isometric exercises. Van Tulder (2000) identified one low quality study on traction for chronic neck pain. This study reported no difference in effect when compared to isometric exercises and controls, which supports the conclusions made by Harms-Ringdahl (2000) and Wainner (2000).

Apparently there is no basis for supporting the use of traction in the treatment of neck pain based on the studies above.

Psychological counselling

This section covers behavioural therapy and bio-psychosocial management of neck patients. In their extensive Cochrane review Karjalainen et al. (2001) only found two relevant studies one of which was non-randomized, and both studies were rated as having low methodological quality. The studies failed to provide evidence regarding the effectiveness of incorporating psychological counselling in the rehabilitation of neck patients when compared to usual physical therapy. This conclusion is in concordance with van Tulder (2000). A more recent update by Karjalainen (2003) failed to retrieve more studies and therefore reached the same conclusions as mentioned above.

In summary, it is uncertain whether behavioural therapy and psychological counselling provides beneficial results, and clearly there is need for more studies on this intervention.

Education

Harms-Ringdahl identified two studies where patients were instructed in mobilizing- and therapeutic exercises, and in one study also received information about posture corrections, the use of analgesics, muscle relaxation etcetera. Moderate evidence was found that eight sessions of supervised exercises was more effective in achieving pain relief than a pamphlet instructing patients to exercise in patients with sub-acute neck pain. Mior (2001) in his review of exercises in the treatment of chronic pain identified two low-medium quality studies where education was combined with exercises or another treatment modality in patients with neck pain or neck/shoulder pain of unknown duration. In both studies there was no difference in pain levels between treatment and control groups.

In summary, it is not certain whether education alone will have beneficial effects on neck pain. Supervised instruction on exercises however, could be a treatment option to consider, which is in concordance with results on the section on exercise.

Mixed

Studies that include more than two treatment modalities or treatment referred to as physical therapy as the main intervention are referred to as mixed for the purposes of this study. In most cases mixed treatment consists of various forms of exercise in combination with other treatment modalities. In the review by Kjellman (1999) one high quality study reported beneficial results of physiotherapy described as active compared to passive physiotherapy or no treatment for patients with neck and shoulder symptoms. Physical therapy was assessed in the review by van Tulder (2000) who found strong evidence that in patients with chronic neck pain this treatment was no different than other treatment modalities with which it has been compared. Also, limited evidence was found that physical therapy was no better than placebo-physiotherapy consisting of detuned short-wave diathermy and detuned ultrasound or physiotherapy described as passive (heat, massage or stretching exercises). Wainner (2000) identified two randomized trials investigating mixed treatment in the management of patients with cervical radiculopathy with results showing no difference between patients receiving mixed treatment and groups treated with other modalities.

In summary, it is uncertain whether mixed treatment consisting of more than two modalities gives more favourable results than other treatment modalities with which they have been compared.

Other/ miscellaneous

Various other treatment modalities have been identified in the reviews mentioned above e.g. pillows (van Tulder, 2000), spray and stretch (Harms-Ringdahl, 2000). However, the low number of studies and their methodological quality was insufficient to draw any conclusions about these treatment modalities.

Summary of the effect of different treatment modalities identified in review studies

Some general considerations can be drawn from the review studies about non-surgical management of neck pain:

Exercises seem to have beneficial effects on some populations with neck pain, both in the acute phase (mobilising exercises), and in recurrent and chronic phases (active-, strengthening exercises). Manipulation/ mobilisation for some patients can improve various outcome measures as well as other modalities, although patients seem to fare significantly better when manipulation/ mobilisation are used in combination with other treatment modalities. Review articles on acupuncture seem to agree that this treatment modality is no better than sham treatment or placebo

in the management of neck pain. There is no evidence from these review articles to support the use of medication or injection therapy, or electrical stimulation, ultrasound or laser therapy for neck pain. Electromagnetic therapy as a modality for short-term pain relief apparently has a favourable outcome for some patients. However, the use of traction or collar cannot be recommended. It is uncertain whether psychological counselling, education or mixed treatment (physiotherapy) could be regarded as favourable treatment options by the identified studies. No evidence was identified to support the use of treatment modalities categorized as: “Other/ miscellaneous”.

The review studies with an indication of whether the treatment modalities can be recommended or not are summarized in table 3.

	Exercise	Manip./Mob.	Acupuncture	Medication/ injection therapy	El. stim/ ultrasound/ laser	Electromagnetic therapy	Collar	Traction	Psych. Counseling	Education	Mixed
Ernst, 2003		U									
Gross, 2002		U									
Harms-Ringdahl,2000	P	U		U	U	P	U/N	N		P/U	
Karjalainen, 2001									U		
Kjellman, 1999		U	U/N		U	P		N			P
Mior, 2001	U									U	
Mior, 2001		U									
Sarig-Bahat, .2003	P										
Van Tulder, 2000		U	N	U/N	U	P	N	N	U		U
Wainner, 2000		U		U			N	N			U
White, 1999			N								

Table 3. Interventions identified in review articles.

P= Positive (in favour of treatment modality);

U=Uncertain;

N=Negative (not effective or in favour of reference treatment).

Assessment of the identified randomised controlled trials

In this part the methodological quality of the randomised trials is described first. Then the results from the RCT's are reported grouped, when possible, into the same treatment categories as in the previous part of the chapter. Each treatment paragraph is followed by a brief summary and the whole chapter by a general summary

In some cases, studies were mentioned in more than one category namely when the modalities that were compared, were being used as comparison treatments.

Twenty-six articles describing and analysing twenty-two different randomised trials were identified. All studies exclusively considered effects of conservative treatment of neck pain. In the trial by Persson et al. (1997) however, surgery was also included and effects of this intervention was compared to conservative treatments in patients with radicular neck pain who were considered candidates for surgery.

In the appraising process carried out by two reviewers only minor discrepancies arose. These were discussed until consensus was reached.

Assessment of the methodological quality

The methodological quality was assessed according to the validity criteria described by van Tulder et al. (2003) (see page 5).

Eleven (41%) of the 27 identified clinical trials satisfied six or more of the 11 validity criteria and hence could be classified as high quality studies for the purposes of this study. The remaining 16 studies satisfied from two to five criteria.

The assessments of quality criteria including the number study subjects are summarized in table 4.

	Number of subjects	Adequate randomisation	Treatment allocation concealed	Groups similar at baseline	Patient blinded	Care provider blinded	Outcome assessor blinded	Co interventions avoided	Compliance acceptable	Drop out rate acceptable	Similar timing of outcome assessment	Intention to treat analysis	Number of quality criteria fulfilled
Ahlgren, 2001	126	N	U	Y	N	N	U	U	Y	Y	U	U	3
Birch, 1998	46	U	U	Y	Y	N	U	U	U	N	U	N	2
Bronfort, 2001	191	Y	Y	Y	N	N	Y	U	U	Y	U	Y	6
Cen, 2003	31	U	U	N	N	N	Y	U	Y	Y	U	N	3
Evans, 2002	191	Y	Y	Y	N	N	Y	Y	U	Y	U	Y	7
Hagberg, 2000	77	Y	U	Y	N	N	N	U	N	Y	U	N	3
Horneij, 2001	282	U	Y	Y	N	N	Y	U	Y	N	U	N	4
Hoving, 2002	183	Y	Y	Y	N	N	Y	Y	Y	Y	U	Y	8
Hurwitz, 2002	336	Y	Y	Y	U	U	U	U	U	Y	U	Y	5
Irnich, 2001	177	Y	Y	Y	U	N	Y	U	U	Y	Y	Y	7
Irnich, 2002	36	Y	Y	U	Y	Y	Y	U	Y	Y	Y	U	8
Jordan, 1998	119	Y	U	Y	N	N	U	Y	Y	Y	U	Y	6
Kjellmann, 2002	77	Y	Y	Y	N	N	U	N	U	Y	U	Y	5
Korthals-de Bos, 2003	183	Y	Y	Y	N	N	Y	Y	Y	Y	U	Y	8
Linton, 2000	272	Y	Y	Y	N	N	U	N	N	Y	U	Y	5
Linton, 2001	175	Y	Y	Y	N	N	Y	U	N	Y	U	N	5
Lundblad, 1999	97	U	U	Y	N	N	U	Y	U	N	U	N	2
Persson, 1997	81	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	9
Randløv, 1998	77	Y	U	Y	N	N	U	U	U	N	U	N	2
Skargren, 1997	411	U	Y	N	N	N	U	N	U	N	U	Y	2
Skargren, 1998	411	U	Y	N	N	N	U	N	U	N	U	Y	2
Taimela, 2000	76	Y	Y	Y	N	N	Y	U	U	Y	U	Y	6
Viljanen, 2003	393	Y	Y	Y	N	N	Y	Y	N	Y	U	Y	7
Wailing, 2000	103	U	U	Y	N	N	U	U	Y	Y	Y	N	4
Ylinen, 2003	180	U	U	Y	N	N	Y	N	U	Y	Y	Y	5
Zhu, 2002	29	U	U	U	Y	N	Y	U	U	Y	Y	U	4

Table 4. Quality assessment of randomised controlled trials. Y= Yes, satisfies quality criteria. N= No, does not satisfy quality criteria. U= Uncertain.

In almost two thirds of the trials (62%) the process of *randomisation* was assessed to be adequately described and incorporated the use of random numbers list or similar methods such that assignment of subjects was done by chance. In the same number of studies *treatment allocation* was performed by an independent person with no influence on assignment sequence or eligibility of subjects.

In 81% of trials *baseline characteristics* including most important outcome measures of intervention groups and control groups (if any) were well described with no substantial differences, ensuring that all factors that could have an impact on clinical outcomes were similar except for the intervention.

Blinding of patients and care providers in trials investigating effects of interventions for musculo-skeletal conditions usually is not possible. The same applies to the studies identified for the present review. Only in trials where various acupuncture techniques were compared, blinding of the patient was possible (12%). In one study (Irnich, 2002) care provider using an inactivated laser pen was

blinded as well (4%). Blinding of the outcome assessor was described and performed in 54% of trials.

Co interventions were avoided or described as similar in intervention groups in 27%. In the remaining trials it was not known whether study subjects received other potentially effective treatments during treatment and follow up period.

In almost two thirds of studies no description of subject *compliance* was reported or was assessed as poor (65%).

An acceptable *drop-out rate* was achieved in 77% of trials where the percentage of drop-outs did not exceed 20% in short term follow up, and 30% for long term follow up (if any). In six studies (23%) dropout rate was assessed as unacceptable. Similar *timing of outcome assessments* was achieved in 23%. Fifty eight per cent of trials included an *intention-to-treat analysis* in an effort to avoid bias due to withdrawals and dropouts.

Interventions

It was not possible to find relevant studies on all eleven categories identified in the systematic reviews. The identified treatment modalities in each study are summarised in table 5.

	Exercise	Neck-school	Manip./Mob.	Acupuncture	Medication	El.stim/ Ultrasound	Collar	Traction	Psych. counselling ^o	Mixed	Other
Ahlgren, 2001	X										
Birch, 1998				X							
Bronfort, 2001	X		X								
Cen, 2003											X
Evans,2002	X		X								
Hagberg, 2000	X										
Horneij, 2001	X										
Hoving, 2002			X							X	
Hurwitz, 2002			X								
Irnich, 2001				X							
Irnich, 2002				X							
Jordan, 1998	X		X							X	
Kjellmann, 2002	X										
Korthals-de Bos, 2003			X							X	
Linton, 2000									X		X
Linton, 2001									X		
Lundblad, 1999	X									X	
Persson, 1997							X			X	
Randlov, 1998	X										
Skargren, 1997			X							X	
Skargren, 1998			X							X	
Taimela, 2000	X										
Viljanen, 2003	X										
Wailing, 2000	X										
Ylinen, 2003	X										
Zhu, 2002				X							

Table 5. Identified treatment modalities in the randomised controlled trials

The twenty-six studies dealt with interventions that could be classified into seven categories

- Exercise
- Manipulation/ mobilization
- Acupuncture
- Collar
- Psychological counselling
- Mixed
- Other/miscellaneous

Exercise

Thirteen trials studied different forms of exercise therapy compared to either various interventions or to controls. In some instances exercise therapy would be combined with other interventions such as ergonomic advice, pain coping etc. However, exercise was judged to be the main intervention.

In a semi-randomised study Ahlgren (2001) compared strength training with endurance training and controls that studied stress reactions and were shown stretching exercises. Study population were females less than 45 years with work related pain in neck and shoulder muscles lasting more than one year. The intervention significantly improved aerobic power, physical performance and pain ratings in all three groups after a ten-week training period. However, there was no difference between groups at that time. It was concluded that all three interventions could be recommended.

Bronfort et al. (2001) compared high tech exercises with spinal manipulative therapy (SMT) combined with low tech exercises, and SMT combined with sham electrotherapy in patients with mechanical neck pain. Post treatment at 11 weeks all groups reported substantial improvement in symptoms. However, there was no difference between groups except for patient satisfaction, which was significantly higher in the group receiving SMT in combination with low-tech exercises. Neck performance measures were significantly higher for both exercise groups.

At follow up 12 months after treatment this difference remained higher. At this point patient rated pain was significantly lower for the two exercise groups compared to the group receiving SMT alone. The authors concluded that the use of strengthening exercises alone or in combination with SMT appeared to be more beneficial to patients with chronic neck pain than SMT alone.

In the same study population as above Evans et al. (2002) reported that the advantages observed in the two exercise groups remained consistent during follow up period and two years after treatment.

Jordan et al. (1998) in a randomised trial compared intensive training of neck and shoulder musculature with individual physiotherapy (massage, ultrasound, traction, mobilization, exercises and ergonomics advice) and spinal manipulative therapy including manipulation, trigger point therapy, traction, advice, and home exercise program. One hundred and nineteen patients with neck pain of more than three months duration were included in the study. Pain and disability was reduced in all groups, but no differences between groups were noted. Other outcome measures at follow up twelve months after treatment such as patient satisfaction, contact with other health care providers and medication use did not differ between groups either.

In an uncontrolled study Hagberg et al. (2000) randomised 77 female industrial workers with Cervicobrachial syndrome (trapezius myalgia) into two groups. One group (n=43) participated in endurance training, and one group (n=34) in strength training for a period of twelve weeks. Both groups improved on main outcome measures during follow up period although patients seemed to gain more advantage from strength training than endurance training.

Horneij (2001) compared an individually designed physical training programme with a work place stress management programme in a population of Swedish female nursing aides and assistant nurses with neck, shoulder and low back pain. All groups improved with respect to neck and shoulder pain at 12 month follow up but there were no significant differences between groups. This study had a large number of drop outs (40%). Furthermore, subjects had neck pain, neck-shoulder pain or low back pain, or combinations hereof, which makes interpretation somewhat difficult.

Female workers were also the subjects of study in the clinical trial by Wailing et al. (2000) where 103 subjects were randomised into four groups. One group (n=29) participated in strength training. One group (n=28) exercised endurance. One group (n=25) trained coordination, and finally one group (n=21) served as control group although they participated in discussions about stress management once a week. When compared to control group, pain at worst was significantly reduced in strength and endurance groups.

Pain at worst was significantly reduced between strength and control group, and between endurance and control group. All exercise groups when analysed together had significantly larger reductions in pain at worst and pain at present when compared to the control group. No significant differences between exercise groups in various outcome measures were found.

Another randomised controlled trial (Lundblad, 1999) reported on 97 female workers as subjects. In this study one group of subjects received physiotherapy consisting of exercises to improve strength, coordination, stability, endurance and flexibility along with advice on body awareness, posture, pain coping etc. The other group received Feldenkrais intervention (somatic education) which, according to the authors is an intervention with the purpose of teaching subjects increased awareness about sensory afferents based on the individual's experience, and also with the purpose of breaking stereotyped movement patterns thus replacing these with new motor patterns. The third group served as controls. In the Feldenkrais group the intervention generally resulted in fewer complaints from neck and shoulder and also resulted in fewer complaints previous seven days, when compared to the other groups, whereas the physiotherapy and control groups generally showed no difference or worsening of complaints. However, this study was subject to a large number of dropouts (40%) and no long-term follow up was reported.

Ylinen et al. (2003) studied 180 female office workers with chronic neck pain who were randomised into three groups: One group in which strengthening exercises along with four sessions of physical therapy consisting of massage and mobilization, another group in which endurance training was accompanied by physical therapy as well, and finally a control group in which aerobic and stretching exercises were combined. The authors found that strength and endurance training significantly reduced pain and disability compared to controls at 12 month follow up. Thus, aerobic and stretching exercises in this study were less beneficial than strength and endurance exercises.

In a study by Randløv et al. (1998) 77 subjects were randomised into two groups of similar exercise programme, but in one group (Intensive) trained with increasing resistance/ load. There were improvements in most outcome measures after the intervention in both groups. The authors found no difference between groups with respect to pain or measures of activities of daily living (ADL) however pain levels remained lower at long term follow up although these results were not statistically significant. The authors concluded that satisfactory results could be obtained using light

training. This study was also subject to a large drop out rate. Only 52 subjects completed training and 41 were available for twelve-month follow up measures. Also, there was no control group in this study and the authors note that the difference in design between interventions probably was too small to yield any significant outcome differences between the two groups.

Patients with neck pain with/ without radiation were randomised into three groups by Kjellmann and Öberg (2002). One group (n=23) participated in a general exercise programme. A second group (n=28) were treated according to the McKenzie method and a control group (n=26) received ultrasound administered at lowest possible intensity. There was no difference between groups in pain and disability outcome measures at follow up after 12 months, although subjects treated with McKenzie treatment had a tendency for faster improvement in pain intensity post treatment at three weeks and at follow up six months after treatment. Also, this group showed significant improvement in general health and in psychosomatic and depressive symptoms as the only study group in this trial.

Taimela et al (2000) studied 76 subjects experiencing chronic neck pain who were randomised into three groups. One group (ACTIVE) participated in a supervised training programme twice a week for twelve weeks consisting of behavioural support, stabilization exercises, eye fixation exercises, balancing exercises, advice and home exercises. The other group (HOME) received two sessions a week apart consisting of instructions in a home training programme, advice and a neck lecture. The control group (CONTROL) received a neck lecture and information on home exercises. The effect on self-experienced total benefit from treatment was significantly higher for the Active group. But the Home group also fared significantly higher than controls at 12 month follow up. With respect to reduction of neck symptoms, improved general health and self reported working ability the Active group also showed significant improvements at three and twelve months. Pain intensity score as measured on the VAS-scale significantly improved in Active group at three months, but not at twelve month follow up. No significant differences between groups were found at 12 months in physical/ objective measures. The authors concluded that a multimodal programme emphasizing exercises was more effective in relieving symptoms than a home exercise programme, which in turn was of greater benefit than recommendations to exercise.

In another study by Viljanen et al (2003) 393 women were randomised into three groups: Dynamic training group (n=135) consisting of strength training with dumbbells. Relaxation training group (n=128) in which subjects were taught relaxation techniques, and different techniques to activate relevant muscles for daily activities. Control group (n=130) where subjects were advised not to change physical activity during the 12 months of follow up. The authors found no significant differences between the two training groups and control group during the follow up period, and there was no effect on pain, neck disability or sick leave. Subjective recovery was greater in training groups especially at six months, but the training groups also used additional health care resources.

In summary, studies included in this category almost consistently reported beneficial effects from various forms of exercise therapy in patients with neck pain. However, interventions vary a lot both with respect to frequency, dosage and intensity. In some studies where more than one form of exercise was evaluated, a comparison between strength and endurance training was made. Five of the thirteen studies in which exercise was evaluated were scored as high quality studies (Bronfort, 2001; Evans, 2002; Jordan, 1998; Taimela, 2000; Viljanen, 2003). In all except one of these studies, exercise improved most important outcome measures post treatment and during follow up period. One study (Viljanen, 2003) reported no effect from dynamic strength training and relaxation exercises.

In two high quality studies (Bronfort, 2001; Jordan, 1998) exercise was found to be as effective as spinal manipulation and in one study (Bronfort, 2001) combining exercise with spinal manipulation proved most effective in terms of patient satisfaction.

Most of the lower quality studies also reported beneficial effects from exercise therapy. When different forms of exercise were compared, in most cases there was a tendency towards dynamic strength training giving more favourable results. However, dosage, frequency, type of exercise and combinations with other modalities show great variance between studies and need to be more standardized in order to draw more definite conclusions about exercise as a treatment option for patients with neck pain

Manipulation/ mobilization

Five trials that studied manipulation or mobilization were identified.

Bronfort et al. (2001) found that spinal manipulative therapy (SMT) as well as the other study interventions resulted in substantial improvement in subjects' symptoms at follow up. However,

high tech exercises or SMT in combination with low-tech exercises proved more advantageous in improving neck performance measures. And SMT in combination with low-tech exercises resulted in significantly higher patient satisfaction.

Hoving et al. (2002) in their study randomised 183 subjects into three groups: One group receiving manual therapy consisting of joint mobilization, soft tissue therapy, and coordination- and stabilization exercises. An other group received active exercise therapies, posture-, strength and relaxation techniques. In the third study group advice on prognosis, ergonomics and natural history of neck pain was given. The authors concluded that both manual therapy and physiotherapy were more effective than continued care for patients with neck pain. At seven weeks manual therapy scored better than the other study groups on most outcome measures, although not all were statistically significant. Korthals-de Bos et al. (2003) performed an economic evaluation on this trial and the treatments involved and also followed the subjects for 52 weeks. The differences in recovery rate in the short term between the three groups was significantly different in favour of the group receiving manual therapy, and was still significant at 26 weeks but not at 52 weeks. The authors also calculated costs and concluded that in a Dutch health care setting manual therapy was more cost-effective than the other two treatments.

Skargren et al. (1997) also evaluated costs and effectiveness of chiropractic and physiotherapy in a population of 179 subjects with low back or neck pain. Subjects were randomised either to chiropractic treatment (41 neck patients) mainly consisting of manipulation (in 80% of subjects in this group), but some also received mobilization, traction, soft tissue treatment, instruction or individualized training program, or to physiotherapy (29 neck patients) consisting of mobilization, traction, soft tissue treatment, McKenzie treatment, TENS, acupuncture, relaxation exercises, individualized training program under supervision. This study had no control group. After six months there was no significant difference between groups in either costs or clinical outcome. However, subjects receiving physiotherapy had more treatments, but more chiropractic patients visited other health care providers during follow up period. Long term follow up in this population at one year was studied in Skargren et al. (1998). The authors found no differences between groups in primary outcome measures at 6 and 12 months. Nearly 60% reported two or more recurrences during follow up period.

However, patients with a current episode lasting less than one week and who scored high on pain or difficulty had better effect with chiropractic treatment (mainly manipulation). Patients with an episode lasting more than one month and who scored low on Oswestry scale had more effect from physiotherapy.

Manipulation versus mobilization performed by chiropractors in 336 patients presenting with neck pain was studied by Hurwitz et al. (2002). At follow up six months after treatment the authors found that mobilization was as effective as manipulation with respect to pain and disability. No additional improvement in clinical outcomes were obtained when manipulation and mobilization was combined with heat or electrical muscle stimulation.

In the study by Jordan et al. (1998) spinal manipulative therapy performed by a chiropractor including manipulation, trigger point therapy, traction, advice, and home exercise program was compared to intensive training of neck and shoulder musculature with individual physiotherapy consisting of massage, ultrasound, traction, mobilization, exercises and ergonomics advice. Patients had neck pain of more than three months duration. At follow up 12 months after treatment all groups improved on primary outcome measures. However, there was no clinically significant difference between treatments.

In summary, the category just described has included manipulation/ mobilization in some instances in combination with other interventions such as traction, advice, home exercises or stabilization exercises. Five studies (Bronfort, 2001; Evans, 2002; Hoving, 2002; Jordan, 1998; Korthals-de Bos, 2003) in this category were rated "High quality". Reports in these studies were from three study populations. Studies reported favourable results from these interventions on outcome measures such as pain intensity, neck disability and others. In one study population (Bronfort, 2001; Evans, 2002) spinal manipulation alone was not as effective as exercise alone or exercise in combination with spinal manipulation. In another study population (Hoving, 2002; Korthals de-Bos, 2003) authors found favourable results including cost-effectiveness from manual therapy when compared to active exercise therapies and continued care by general practitioner in patients with neck pain of more than two weeks duration. In the third trial (Jordan, 1998) no difference between spinal manipulation and intensive exercise therapy was found.

Acupuncture

Four trials in which acupuncture was studied as the main intervention were identified. Birch and Jaminson (1998) in their study of 46 patients with chronic neck pain compared the effects of real acupuncture with irrelevant acupuncture consisting of acupuncture to points with no relevance to the neck and a control group receiving medication (NSAID). The group receiving relevant acupuncture experienced significantly reduced pain levels after treatment. However, this group had more previous experience with acupuncture than the other groups, and after controlling for this there was no difference between groups. The authors concluded that previous experience with acupuncture positively affects result of treatment.

Irnich et al. (2001) studied acupuncture in 177 subjects with neck pain of more than one month's duration who were randomised to either traditional Chinese acupuncture, massage or sham laser therapy (control). One week after receiving five treatments, the acupuncture group had significantly reduced pain related to motion when compared to massage, but not when compared to sham laser therapy. At three months there was no difference between groups. In a subgroup analysis acupuncture was more advantageous with respect to self reported pain and global complaints for chronic neck patients with pain lasting more than five years and in patients diagnosed as having myofascial syndrome. The authors concluded that acupuncture was effective in providing short-term pain relief.

In a sham-controlled crossover trial with 36 participants with neck pain of more than two months duration Irnich et al. (2002) studied the effects of non-local needle acupuncture (NLA), dry needling (DN) and sham laser acupuncture. NLA proved significantly more effective in reducing motion related pain than DN and sham laser immediately post treatment. Also, NLA and DN significantly improved cervical range of motion immediately after treatment. No long-term results were reported from this trial.

Zuh and Polus (2002) also studied the effects of acupuncture in 29 subjects in a crossover trial. Participants were given either Chinese Medicine acupuncture or sham acupuncture (in points lateral to real acupuncture points). The authors found that both treatments improved subjective outcome measures. However, there was no difference between groups post treatment and at follow up 16 weeks after treatment.

In summary, various forms of acupuncture (Real acupuncture, non local needle acupuncture, dry needling and traditional Chinese acupuncture) were evaluated in the trials identified for the present review. Study populations were relatively small except in one trial (Irnich, 2001).

In two of the four studies on acupuncture methodological quality was scored as "high". Traditional Chinese acupuncture was more beneficial than massage, but proved no better than sham laser therapy in patients with neck pain of more than one month's duration (Irnich, 2001). Positive results in a trial including 36 subjects were found for non-local needle acupuncture in reducing motion related pain immediately post treatment (Irnich, 2002).

Cervical collar

Only one trial was identified investigating the effects of wearing a cervical collar. Persson et al. (1997) studied 81 patients with cervico-brachial pain of more than three months duration. All patients had compression of a cervical nerve root by foraminal encroachment with or without accompanying disc-bulge and were considered candidates for surgery. Subjects were randomised to three groups: Surgery comprising of discectomy, decompression and fusion, physiotherapy to be decided by physiotherapist, or a rigid collar to be used during daytime. An age matched group from a previous population study served as reference group. Pre-treatment measures were equal in all three intervention groups. Differences in self reported pain and function in favour of surgery and physiotherapy was seen shortly after treatment. However, at control 12 months after treatment there was no difference between groups on primary outcome measures. The authors concluded that in patients with long lasting radicular cervicobrachial pain wearing a rigid cervical collar during daytime was as effective as surgery or physiotherapy.

In summary the study on cervical collar was scored as a high quality study. Similar effects were found from wearing a cervical collar, receiving physiotherapy or from surgery in patients with neck pain and nerve root compression.

Psychological counselling

Two trials were identified in which psychological counselling was studied as main intervention. Linton and Andersson (2000) randomised subjects with neck and back pain and with less than 3 months of sick leave during last year into three interventions: Cognitive Behaviour Therapy (CBT), back-school (Info pack) or a pamphlet on advice to stay active, positive thinking etc.

At one year follow up risk of long term sick leave was lowered nine fold in CBT group when compared to Info pack and pamphlet groups. These groups also had significantly greater use of health care use than the CBT group. Participants' own perception of long-term disability was significantly decreased within CBT group. This was not significant for the two other groups. The authors concluded that Cognitive Behaviour Therapy can lower the risk of long-term sick leave, and that this intervention can lead to decreased disability and reduced health care use.

In the other study by Linton and Ryberg (2001), Cognitive Behaviour Therapy was compared to a Treatment as usual Comparison group in which subjects were allowed (without any financial support from the study) to seek alternative care for instance from general practitioner, chiropractor or physical therapist. The 175 subjects were non-patients with neck or back pain randomly selected from the population census register. At follow up after 12 months sick absenteeism was significantly reduced in the CBT group. There was no difference between groups in number of contacts to the health care system. With respect to number of "pain free days" and "fear-avoidance behaviour", CBT group was significantly better than the Treatment as usual Comparison group. In 26 of 33 outcome variables, the CBT group had the best average result. It was concluded that in this population CBT meant fewer days off work, increased number of pain free days and better fear-avoidance behaviour than in subjects who were treated as usual.

In summary, only these two studies on psychological counselling in the search period of this study were identified. In both studies subjects were suffering from neck pain, back pain or both. And subjects in one of these were a non-patient population with symptoms who were recruited from newspaper ads (Linton, 2001). These studies were scored as lower quality studies. Subjects seemed to benefit from cognitive behaviour therapy with regards to sick leave, and in one study (Linton, 2001) also meant less health care use.

Mixed

The literature search resulted in eight trials in which an intervention that could be described as "mixed" was compared to other interventions. In this context the term mixed will most often include physical therapy consisting of different forms of exercise in combination with other interventions such as electrical stimulation, ergonomics, massage etc. The intervention in some instances would be given individually according to the discretion of the physiotherapist (Persson,

1997). All of the studies mentioned in the following section are described above in the sections on specific interventions and therefore are described more in depth above.

Hoving et al. (2002) compared manual therapy with physiotherapy, and a group receiving advice in their study on 183 subjects. Conclusion was that both manual therapy and physiotherapy were more effective than continued care for patients with neck pain. Physiotherapy was not as effective as manual therapy in some outcome measures at seven weeks. Outcome measures, although not statistically significant favoured physiotherapy over continued care at seven weeks. Physical therapy along with manual therapy resulted in significantly reduced analgesic use than continued care. In the economic evaluation on the same study population by Korthals-de Bos et al. (2003), recovery rate significantly favoured physical care group over continued care. However, recovery rate was not as high as the group receiving manual therapy. This difference was still significant at 26 weeks but not at 52 weeks. Cost effectiveness was similar in the group receiving physical therapy when compared to continued care by general practitioner. These two interventions however were significantly less cost effective than manual therapy.

Jordan et al. (1998) compared individual physiotherapy (massage, ultrasound, traction, mobilization, exercises and ergonomics advice) to intensive training of neck and shoulder musculature with spinal manipulative therapy including manipulation, trigger point therapy, traction, advice, and home exercise program. At follow up 12 months after interventions, no group-differences in outcome measures were found.

Lundblad (1999) found that physical therapy generally was not as effective as Feldenkrais intervention although pain intensity reduction in both interventions was significantly greater than controls not receiving any intervention.

Persson et al. (1997) in their study physiotherapy at the physiotherapist's own discretion was compared to a cervical collar and to surgery in patients considered candidates for surgery for long lasting cervico-brachial pain, differences in self reported pain and function favouring surgery and physiotherapy were seen shortly after treatment. However, at control 12 months after treatment there was no difference between groups on primary outcome measures. The authors concluded that in patients with long lasting radicular cervico brachial pain all three interventions were equally effective.

In the trial by Skargren et al. (1997) where an evaluation of costs and effectiveness of chiropractic and physiotherapy was made, after six months there was no significant difference between groups in either costs or clinical outcome. However, in the same study population Skargren et al. (1998) found no differences between groups in primary outcome measures at 6 and 12 months, although patients with an episode lasting more than one month and who scored low on Oswestry scale, had more effect from physiotherapy, and patients with a current episode lasting less than one week and who scored high on pain or difficulty had better effect with chiropractic treatment (mainly manipulation).

In summary, these eight studies in which interventions could be described as mixed were identified. Intervention would most often equal physical therapy. Five of these were scored as high quality studies. In general no studies reported more favourable effects from mixed interventions when compared to other treatment modalities.

Other/ miscellaneous

Two trials were identified in which interventions was studied and not found suitable for inclusion into the sections above.

Linton and Andersson (2000) compared back school (Info pack) or a pamphlet on advice to stay active, positive thinking etc. with Cognitive Behaviour Therapy (CBT). All groups showed significantly reduced pain levels at one year follow up although there were no significant differences between groups. Primary outcome measures favoured the CBT group. One-year follow up risk of long term sick leave was significantly increased in Info pack and pamphlet groups. These groups also had significantly greater use of health care use than the CBT group. It was concluded that information in the form of back school and a pamphlet reduces pain levels, and may be a cost effective intervention for some patients however, not as effective as a CBT intervention.

Cen et al. (2003) studied therapeutic massage and therapeutic exercise in a randomised crossover design with a control group. Thirty-one subjects (faculty and staff at university in which the trial was conducted) were randomised into three groups. Subjects had neck pain episodes and loss of range of motion lasting more than one year and were having daily neck pain and tightness. After treatment there was a significant improvement in pain and cervical range of motion in the

group receiving massage. This improvement continued after crossover phase with no treatment. The control group improved similarly after this phase in which this group received both massage and therapeutic exercises. It was concluded that therapeutic massage reduced pain intensity, frequency and discomfort, and improved ROM in the short term when compared to home exercise program taught by physician. However study investigator performed the massage given in this study and subjects were colleagues (faculty and staff). There was no long-term follow up on results.

In summary both of these studies were scored as lower quality studies with one (Cen, 2003) only being able to satisfy two of the 11 criteria regarding methodological quality. In one study back school or a pamphlet was compared to cognitive behaviour therapy with similar results in reducing pain levels. In the other study (Cen, 2003) massage by the study investigator was compared to therapeutic exercise and yielded results favouring massage.

Summary of the effect of different treatments included in the randomised controlled trials

The results reported in the randomised trials support and reinforce recommendations that exercise therapy leads to favourable outcomes in some patient populations with neck pain.

Manipulation/ mobilization is effective in relieving neck symptoms and improving disability, although it seems that this treatment modality ideally should be combined with other interventions. Based on the results reported in studies on acupuncture it seems fair to say that acupuncture may at best offer short-term pain relief, but effects are no better than sham therapy.

One randomised trial reporting on cervical collar found collar to be as effective as physiotherapy or surgery in patients with long lasting neck pain and nerve root compression.

Two studies on psychological counselling found that this treatment may result in reduced levels of sick leave and health care use.

Results reported in this study did not find that mixed treatment for neck pain would yield more benefits than the interventions with which they were compared.

The results are summarised in table 6.

	Exercise	Manip./Mob.	Acupuncture	Collar	Psych. Counselling	Mixed
Ahlgren, 2001	P					
Birch, 1998			U			
Bronfort, 2001	P	P/U				
Evans, 2002	P	P/U				
Hagberg, 2000	P					
Horneij, 2001	U					
Hoving, 2002		P				U/N
Hurwitz, 2002		P/U				
Irnich, 2001			U/N			
Irnich, 2002			P			
Jordan, 1998	P/U	P/U				P/U
Kjellmann, 2002	P					
Korthals-de Bos, 2003		P				U/N
Linton, 2000					P/U	
Linton, 2001					P/U	
Lundblad, 1999	U					P/U
Persson, 1997				P/U		P/U
Randløv, 1998	P/U					
Skargren, 1997		U				U
Skargren, 1998		U				U
Taimela, 2000	P					
Viljanen, 2003	N					
Wailing, 2000	P					
Ylinen, 2003	P					
Zhu, 2002			U			

Table 6. Interventions identified in randomised review articles.

P= Positive (in favour of treatment modality),

U=Uncertain,

N=Negative (not effective or in favour of reference treatment).

Discussion

As it turned out, a surprisingly large number of relevant studies were identified: Eleven review articles and twenty-six randomised controlled trials on conservative management of neck pain was the result of the search process covering a relatively short time period.

Four databases including the Cochrane Collaboration Trials Register were searched, and references in identified articles were searched manually in order to identify relevant articles that were missed in the electronic search. As no additional RCT's were identified in the manual search, it is my opinion, that all relevant studies were identified in the electronic search. Searching other databases would probably not yield more relevant studies giving rise to other conclusions, than the ones reached in the present study. However, the search process included only studies reported in the English language, which could have resulted in the exclusion of important studies reported in other languages. In review articles by other authors there were either no language restrictions (Gross, 2002), or they were much less strict (Karjalainen, 2001).

The assessment of methodological quality of randomised trials was done independently by two persons, but not blinded to the names of the authors of the clinical trials and names of the journals. Thus, authors and journal titles were known to both reviewers. However it is doubtful that knowledge of names of authors and journals constitute a major bias.

In the assessment of the methodological quality of review articles most of the studies received twelve points or higher on the quality assessment scale. The fact that only in two review articles findings of the primary controlled trials were combined statistically reflects the heterogeneity in study populations and the conditions treated. The variety in dosage, frequency, etcetera in the use of the various modalities also add to the difficulty in combining findings statistically.

Hoving et al. (2001) in their appraisal of review articles on the treatment of neck pain, found that in the articles that they assessed, the scores ranged from 0-18 on the same methodological criteria that was used in the present study.

In my opinion there are two possible explanations for the discrepancy between the scores of review articles obtained in the present review and the range of scores in the study by Hoving and colleagues. Most ideally, one explanation is that the methodological quality of review articles simply has become much better in the later years. From the results in the present review it certainly

seems so. However, the other explanation is that I have been too generous in my scoring of the identified review articles. Assessment of review articles by independent reviewers may have lead to a wider range of scores.

In the assessment of randomised clinical studies 41% of trials were assessed as high quality studies. Some criteria were fulfilled for as many as 77% (acceptable drop-out rate) and 81% (baseline characteristics). Intention-to-treat analysis being described by Karalajnainen (2001) as an "essential feature of a randomised controlled trial" was performed in 58% of the clinical trials identified for this study.

The question of whether timing of outcome assessments was identical for all study subjects was difficult to establish, and assessment of this criteria may be subject to great variation. In my opinion an outcome assessment, performed "before and after treatment" still leaves room for great variation in timing. Also, assessment and recording of baseline characteristics during a period of maybe one to two years when subjects are being recruited to a trial are subject to variations. Using terms, as "assessment immediately post treatment "or "baseline characteristics recorded no earlier than one week prior to treatment period" in my opinion, would reassure readers that timing of outcome assessments was identical.

Authors of systematic reviews (Hoving, 2001; Harms-Ringdahl, 2000, Van Tulder, 2000; Karalajnainen, 2001) have consistently demanded that future trials be of higher methodological quality in order to draw valid conclusions about effectiveness of various interventions for neck (and back) pain. The findings in the present review still leaves room for improvement of methodological quality of review studies and randomised controlled trials, and one could join the ranks of Hoving and others, and say that this demand still applies.

When compared to recommendations in the review articles included in the present study, the randomised controlled trials add some information about the efficacy of treatment modalities to the current knowledge. In concordance with Harms-Ringdahl (2000) and Sarig-Bahat (2003), recent randomised trials of higher methodological quality (Bronfort, 2001; Evans, 2002; Taimela, 2000; Ylinen, 2003) support the use of exercise therapy in the management of neck pain. One high quality study (Viljanen, 2003) reported no effect from dynamic strength training and relaxation exercises. However, in this study adherence was poor, and at twelve months subjects on average exercised only 31 minutes (dynamic strength), and 20 minutes (relaxation exercises) a week, which could account for the lack of effect.

Generally, the various forms of exercise therapy make conclusions about this modality somewhat difficult. When different forms of exercise were compared, in some cases there was a tendency towards dynamic strength training giving more favourable results. However, dosage, frequency, type of exercise and combinations with other modalities show great variance between studies and need to be more standardized in order to draw more definite conclusions about exercise as treatment option for patients with neck pain

The trials reviewed for the purposes of the present study report conflicting results regarding the use of manipulation/ mobilization in patients with neck pain. This result is supported by the recommendations in several of the review articles (Gross, 2002; Harms-Ringdahl, 2000; Van Tulder, 2000). However, the high quality studies by Hoving (2002) and Korthals-de Bos (2003) support the use of this modality in patients with neck pain as a cost-effective treatment with favourable results on most outcome measures including recovery rate.

Also, the use of manipulation/ mobilization in combination with other treatment modalities seems to be an effective treatment strategy (Bronfort, 2001; Evans, 2002; Hoving, 2002). This finding is in concordance with the recommendations suggested in the clinical guidelines put forward by Gross (2002) who found that manual therapy optimally should be used in combination with exercise therapy, and that manipulation/ mobilization alone does not seem to be better than reference treatments.

These results are relevant for clinicians, although the great variation in treatment techniques regarding exercise therapy and manipulation/ mobilization must be taken into account.

As it is the case with exercise therapy, the terms manipulation/ mobilization cover a wide range of techniques and treatment philosophies (Hoving, 2002; Ernst, 2003). When choosing exercise therapy or manipulation/ mobilization in the management of patients with neck pain, the clinician should consider if the results from relevant studies apply to the treatment techniques that he or she is trained to perform. In some instances information about specific techniques is not readily available in studies, one example being Skargren (1997), where patients treated by a chiropractor mainly were treated with “manipulation”, without specifying in more detail.

One theme that has not been covered in this study is the issue on risks versus benefit from manipulation of the neck. Although rare, it is known that manipulation of the cervical spine implies a risk of serious adverse effects namely cerebro-vascular accidents (CVA) (Mann, 2001). It is estimated that serious complications from manipulation occur from one accident in 400,000 to one in 3,000,000 manipulations (Licht, 2003); and one in 20,000 to five in 10,000,000 as reported by Gross (2002). When compared to the possible complications from interventions for other conditions, this risk may seem extremely small. However, care providers still need to consider this when managing neck pain with manipulation. Results from the present study seem to indicate that other modalities in some instances may be used as first treatment of choice before manipulation is considered (Hoving, 2002; Hurwitz, 2002).

Apart from the finding that electromagnetic therapy, although based on relatively small study populations, apparently is effective in producing short-term pain relief (Harms-Ringdahl, 2000; Van Tulder, 2000; Kjellmann, 1999), it seems, that for the remaining treatment modalities covered in the present study, evidence is not sufficient to recommend these interventions as first choice of treatment. However, based on studies on conservative treatment of neck pain, it looks as if almost any intervention described in these studies will have some beneficial results on patients' symptoms, and therefore can be recommended. The positive effect might be attributed to the intervention, when in fact the placebo effect and the natural history of the condition likely both play an important role. These issues hopefully will become clearer in future studies.

When assessing reports on interventions for neck pain other issues emerging, deal with diagnosis and classification.

In the identified trials for this study examples of the conditions that made inclusion possible are: "Unspecific mechanical neck pain that could be reproduced by neck movement or provocation tests", "Neck pain with/without radiation", "Constant or frequently occurring neck pain for more than six months", "Work related neck-shoulder pain", and others (see table 1, page 8). Since most musculo-skeletal conditions pertaining to the spine could be diagnosed, as "Unspecific" study populations are probably not homogeneous. Thus, researchers risk that effects from potentially beneficial interventions for some patients with neck pain are masked due to the heterogeneity of their study population, unless the study population is large enough for sub-group analysis.

In some instances the study populations represent certain groups characterized by their occupation

or workplace (Lundblad, 1999), and some are characterized by gender and their interest in participating in a trial (Wailing, 2000). Therefore readers of trials on interventions for neck pain including the trials identified in this study should consider the external validity when judging if treatment effects are applicable for their patients.

Buchbinder and colleagues (1996) performed an appraisal of five classification systems of soft tissue disorders of the neck and upper limb and found that none of the systems were acceptable because of incomprehensiveness and because of overlap between categories: Also, criteria for inclusion into classification categories failed to be valid and reliable. In the light of these somewhat depressing results and on the basis of the inclusion criteria in the review articles and the randomised controlled trials covered in this review, it seems that much work still needs to be done in the field of developing valid and reliable classification systems for patients with neck pain: “If we cannot be certain that the classification systems that we use to study disorders are valid and reliable, then we must question the validity of the results of investigations that have relied upon these classifications to group the entities under study” (Buchbinder, 1996).

The findings of the present review support the results from the clinical guideline put forward by Gross (2002) on manipulation or mobilisation in the treatment of adults with mechanical neck disorders. One could consider the development of clinical guidelines on other interventions, e.g. the use of exercise therapy. However in the light of the apparent difficulties in developing valid and reliable classification systems for disorders of the neck, it seems unfeasible to put forward outlines on specific recommendations at the present point in time. In my opinion, the issue of classification of neck disorders needs to be addressed first.

Obviously there is still a need for high quality studies on conservative treatment for neck pain. Some modalities need to be investigated in more studies in order to either include them on the list of options for management of neck pain, or if possible, to discard them completely as being inefficient for neck patients.

Studies on exercise therapy and manipulation/mobilisation need to include homogenous study populations and use standardised treatment regimes, in order to establish which patients benefit from these interventions, and in what way the intervention preferably should be composed in order

to ensure optimal results. As mentioned earlier the need for studies on classification systems of disorders of the neck is urgent.

In summary, the trials identified for this study were of heterogeneous methodological quality. Although some high quality studies were found, none added substantially new knowledge to the current literature on conservative management of neck pain. With one exception, in the case of exercise as treatment modality, results from the present study strengthen the current recommendations. In the case of manipulation/ mobilization this treatment modality should optimally be used in conjunction with other treatment modalities.

Therefore the conclusion of the present study is that first, the demand for valid and reliable classification systems is urgent. Second, there is a need for standardised protocols in controlled clinical trials investigating the effects of different interventions for neck pain.

English Summary

Study design. An updated systematic review of randomised controlled trials on conservative management of neck pain.

Objectives. To assess randomised trials and establish whether the latest studies add valuable and clinically relevant information to the current knowledge about conservative treatment of neck pain.

Summary of Background Data. Neck pain is common. It may be attributed to a number of factors, some which are known, and some that may still be unknown. Most commonly no specific causes or underlying pathology can be detected, and as is the case for low back pain, neck pain often will be diagnosed as non-specific. A wide variety of treatments are usually offered to these patients, but the scientific evidence regarding the effect of these treatments most often is insufficient to direct health care providers to the most appropriate treatment strategies for their patients.

Methods. Searching Medline, Embase, Cinahl and The Cochrane Library from January 1997 to April 2004 identified randomised controlled clinical trials on conservative management of neck pain. Relevant articles were retrieved and references were checked. Two reviewers assessed the methodological quality of the trials independently, and results were extracted. Systematic reviews identified from the same search period were read as well.

Results. In total 368 abstracts were read. Twenty-six relevant articles describing and analysing twenty-two randomised trials and eight systematic reviews were identified. Less than half of the identified studies on randomised trials satisfied criteria to be labelled “High quality studies”. None of the studies added substantially to the evidence on conservative management of neck pain, although clinical relevant information especially on exercise and manipulation/ mobilization were obtained.

Conclusions. Studies on conservative management of neck pain are of heterogeneous methodological quality. Furthermore the neck-conditions of study populations are often ill defined. The need for studies of high methodological quality including well defined and homogenous study populations on conservative management of neck pain is still in demand. This updated systematic review only adds marginally to the current knowledge on conservative management of neck pain.

Danish Summary

Design. Et opdateret systematisk gennemgang af randomiserede kliniske undersøgelser vedrørende konservativ behandling af nakkesmerter.

Formål. At vurdere randomiserede kliniske undersøgelser med henblik på at godtgøre om nyeste undersøgelser tilfører afgørende og klinisk relevant information til eksisterende viden vedrørende konservativ behandling af nakkesmerter.

Baggrund. Nakkesmerter er almindeligt forekommende. Symptomer kan tilskrives såvel kendte som ukendte faktorer. I de fleste tilfælde findes ingen specifik underliggende patologisk tilstand, og som det er tilfældet for lændesmerter, vil nakkesmerter ofte diagnosticeres som uspecifikke. En lang række behandlingstilbud eksisterer, men den videnskabelige evidens vedrørende effekten af dem er ofte utilstrækkelig til at vejlede behandlere i forhold til hvilke behandlingsstrategier, der vil være mest hensigtsmæssige over for deres patienter.

Metode. Randomiserede kliniske undersøgelser blev fundet ved elektronisk søgning i databaserne: Medline, Embase, Cinahl samt Cochrane databassen fra januar 1997 til april 2004. Relevante artikler blev indhentet og referencer gennemgået for yderligere litteratur. Metode kvaliteten af de enkelte undersøgelser blev uafhængigt vurderet af to personer og resultater blev uddraget. Systematiske oversigtsartikler fra samme søgeperiode blev gennemlæst og kvaliteten vurderet.

Resultater. I alt 368 abstrakts blev gennemgået. 26 relevante artikler omhandlende 22 randomiserede kliniske undersøgelser blev identificeret. Under halvdelen af de fundne undersøgelser kunne leve op til etablerede kvalitetskriterier og kaldes "Høj-kvalitetsstudier". Ingen af undersøgelserne bidrog væsentligt til den eksisterende videnskabelige evidens vedrørende konservativ håndtering af nakkesmerter, selv om der fremkom klinisk relevant information specielt vedrørende øvelser samt manipulation/mobilisering.

Konklusion. Kliniske undersøgelser vedrørende håndtering af nakkesmerter er af svingende metodologisk kvalitet. Derudover er studiepopulationernes tilstande ofte ikke veldefinerede. Der er således fortsat et stort behov for flere undersøgelser af høj kvalitet og med vel definerede undersøgelsespopulationer. Denne gennemgang bidrager kun marginalt til den eksisterende viden om konservativ håndtering af nakkesmerter.

References

1. Ahlgren C, Wailing K, Kadi F, Djupsjöbacka M, Thornell L, Sundelin G. Effects on physical performance and pain from three dynamic training programs for women with work-related trapezius myalgia. *J Rehabil Med*, 2001;33:162-169.
2. Birch S, Jaminson R N. Controlled Trial of Japanese Acupuncture for Chronic Myofascial Neck Pain: Assessment of Specific and Nonspecific Effects of Treatment. *The Clinical Journal of Pain*, 1998;14(3):248-255.
3. Bronfort G, Evans R, Nelson B, Aker P, Goldsmith C H, Vernon H. A Randomized Clinical Trial of Exercise and Spinal Manipulation for Patients With Chronic Neck Pain. *Spine*, 2001;26:788-99.
4. Buchbinder R, Goel V, Bombardier C, Hogg-Johnson. Classification System of Soft Tissue Disorders of the Neck and Upper Limb: Do They Satisfy Methodological Guidelines?. *J Clin Epidemiol*, 1996;49:141-149.
5. Cen S Y, Loy S F, Sletten E G, Mclaine A. The effect of traditional Chinese Therapeutic Massage on individuals with neck pain. *Clinical Acupuncture and Oriental Medicine*, 2003;4:88-93.
6. Côté P, Cassidy J D, Carroll L. The Saskatchewan Health and Back Pain Survey: The Prevalence of Neck Pain and Related Disability in Saskatchewan Adults. *Spine*, 1998;23:1689-1698.
7. Côté P, Cassidy J D, Carroll L. The Factors Associated With Neck Pain and Its Related Disability in the Saskatchewan Population. *Spine*, 2000;25(9):1109-1117.
8. Ernst E. Chiropractic Spinal Manipulation for Neck Pain: A Systematic Review. *The Journal of Pain*, 2003;4(8):417-421.
9. Evans R, Bronfort G, Nelson B, Goldsmith C H. Two-Year Follow-up of a Randomized Clinical Trial of spinal Manipulation and Two Types of Exercise for Patients with Chronic Neck Pain. *Spine*, 2002;27:2383-89.
10. Ferrari R, Russell A S. Neck pain. *Baillière's Best Practice & Research Clinical Rheumatology*, 2003;17(1):57-70.
11. Gross A R, Hondras M, Goldsmith C, Haines T, Peloso P, Kennedy C, Hoving J. Manual therapy for mechanical neck disorders: a systematic review Manual therapy for mechanical neck disorders: a systematic review. *Manual Therapy*, 2002;7(3):131-149.
12. Gross A R, Kay T M, Kennedy C, Gasner D, Hurley L, Yardely K, Hendry L, McLaughlin L. Clinical practice guideline on the use of manipulation or mobilization in the treatment of adults with mechanical neck disorders. *Manual Therapy*, 2002; 7(4):193-205.

13. Guyatt G H, Sackett D L, Cook D J. User's Guides to Medical Literature, II. How to Use an Article About Therapy or Prevention. *JAMA*, 1993;270(21):2598-2601.
14. Hagberg M, Harms-Ringdahl K, Nisell R, Wigeaus Hjelm E. Rehabilitation of Neck-Shoulder Pain in Women Industrial Workers: A Randomized Trial Comparing Isometric Shoulder Endurance Training With Isometric Shoulder Strength Training. *Arch Phys Med Rehabil*,2000;81:1051-58.
15. Harms-Ringdahl K, Nachemson A. Acute and Sub-acute Neck Pain: Nonsurgical Treatment: In Nachemson A L, Johnsson E. *Neck and Back Pain, The scientific Evidence of Causes, Diagnosis, and Treatment*. Philadelphia: Lippincott Williams & Wilkins, 2000.
16. Horneij E, Hemborg B, Jensen I, Ekdal C. No significant differences between intervention programmes on neck, shoulder and low back pain: A prospective randomized study among home care personnel. *J Rehabil Med*, 2001;33:170-6.
17. Hoving J L, Gross A R, Gasner D, Kay Y, Kennedy C, Hondras M A, Haines T, Bouter L M. A Critical Appraisal of Review Articles on the Effectiveness of Conservative Treatment for Neck Pain. *Spine*, 2001;26(2):196-205.
18. Hoving J L, Koes B W, de Vet H C W, van der Windt D A W M, Assendelft W J J, van Mameren H, Devillé W L J M, Pool J J M, Scholten R J P M, Bouter L M. Manual Therapy, Physical Therapy, or Continued Care by a General Practitioner for Patients with Neck Pain. *Annals of Internal Medicine*, 2002;136:713-22.
19. Hurwitz E L, Morgenstern H, Harber P, Kominski GF, Yu F, Adams AH. A Randomized Trial of Chiropractic Manipulation and Mobilization for Patients With Neck Pain: Clinical Outcomes From the UCLA Neck-Pain Study. *American Journal of Public Health*, 2002; 92:1634-1640.
20. Irnich D, Behrens N, König A, Gleditsch J, Krauss M, Natalis M, Senn E, Beyer A, Schöps P. Randomised trial of acupuncture compared with conventional massage and "sham" laser acupuncture for treatment of chronic neck pain. *BMJ (bmj.com)*,2001;322:1-6.
21. Irnich D, Behrens N, Gleditsch J M, Stör W, Schreiber M A, Schöps P, Vickers A J, Beyer A. Immediate effects of dry needling and acupuncture at distant points in chronic neck pain : Results of a randomized, double-blind, sham-controlled crossover trial. *Pain*, 2002;99:83-89.
22. Jordan A, Bendix T, Nielsen H, Rolsted-Hansen F, Høst D, Winkel A. Intensive Training, Physiotherapy, or Manipulation for Patients With Chronic Neck Pain. A Prospective, Single-Blinded, Randomized Trial. *Spine*, 1998;23:311-318.
23. Karjalainen K, Malmivaara A, van Tulder M, Roine R, Jauhianen M, Hurri H, Koes B. Multidisciplinary Biopsychosocial Rehabilitation for Neck and Shoulder Pain Among Working Age Adults -A Systematic Review Within the Framework of The Cochrane Collaboration Back Review Group. *Spine*, 2001;26(2):174-181.

24. Karjalainen K, Malmivaara A, van Tulder M, Roine R, Jauhianen M, Hurri H, Koes B. Multidisciplinary Biopsychosocial Rehabilitation for Neck and Shoulder Pain Among Working Age Adults. In: *The Cochrane Library*, Issue 2, 2003. Oxford: Update Software.
25. Kjellman G V, Skargren E I, Öberg B E. A Critical Analysis of Randomised Clinical Trials on Neck Pain and Treatment Efficacy. A Review of the Literature. *Scand J Rehab Med*, 1999;31:139-152.
26. Kjellmann G, Öberg B. A randomized clinical trial comparing general exercise, Mc Kenzie treatment and a control group in patients with neck pain. *J Rehabil Med*, 2002; 34:183-190.
27. Korthals-de Bos I B C, Hoving J L, van Tulder M W, Rutten-van Mölken M P M H, Adèr H J, de Vet H C W, Koes B W, Vondeling H, Bouter L M. Cost effectiveness of physiotherapy, manual therapy, and general practitioner care for neck pain: economic evaluation alongside a randomized controlled trial. *BMJ*, 2003;326:911-917.
28. Licht P B, Christensen H W, Høilund-Carlsen P F. Is Cervical Spinal Manipulation Dangerous ?. *J Manipulative Physiol Ther*, 2003;26:48-52.
29. Linton S J, Andersson T. Can Chronic Disability Be Prevented ?. *Spine*, 2000;25:2825-2831.
30. Linton S J, Ryberg M. A cognitive-behavioural group intervention as prevention for persistent neck and back pain in a non-patient population: a randomized controlled trial. *Pain*, 2001;90:83-90.
31. Lundblad I, Elert J, Gerdle B. Randomized Controlled Trial of Physiotherapy and Feldenkrais Interventions in Female Workers with Neck-Shoulder Complaints. *Journal of Occupational Rehabilitation*, 1999;9:179-194.
32. Mann T, Refshauge K M. Causes of complications from cervical spine manipulation. *Australian Journal of Physiotherapy*, 2001;47:255-266.
33. Mior S. Exercise in the Treatment of Chronic Pain. *The Clinical Journal of Pain*, 2001;17(4):S77-S85 (Supplement).
34. Mior S. Manipulation and Mobilization in the Treatment of Chronic Pain. *The Clinical Journal of Pain*, 2001;17(4):S70-S76 (Supplement).
35. Nachemson A, Waddell G, Norlund A I. Epidemiology of Neck and Low Back Pain: In Nachemson A L, Johnsson E. *Neck and Back Pain, The scientific Evidence of Causes, Diagnosis, and Treatment*. Philadelphia: Lippincott Williams & Wilkins, 2000.
36. Oxman A D, Cook D J, Guyatt G H. User's Guides to Medical Literature, VI. How to Use an Overview. *JAMA*, 1994;272(17):1367-1371.
37. Persson L C G, Carlsson C-A, Carlsson J Y. Long-lasting Cervical Radicular Pain managed with Surgery, Physiotherapy, or a Cervical Collar. *Spine*, 1997;22:751-758.

38. Persson L C G, Lilja A. Pain, coping, emotional state and physical function in patients with chronic radicular neck pain. A comparison between patients treated with surgery, physiotherapy or neck collar - a blinded, prospective randomized study. *Disability and Rehabilitation*, 2001;23:325-335.
39. Petersson C, Bolton J, Wood A R, Kim Humphreys B. A Cross-Sectional Study Correlating Degeneration of the Cervical Spine With Disability and Pain in United Kingdom Patients. *Spine*, 2003;28(2):129-133.
40. Randløv A, Østergaard M, Manniche C, Kryger P, Jordan A, Heegaard S, Holm B. Intensive dynamic training for females with chronic neck/shoulder pain: A randomized controlled trial. *Clinical Rehabilitation*, 1998;12:200-210.
41. Sarig-Bahat H. Evidence for exercise therapy in mechanical neck disorders. *Manual Therapy*, 2003;8(1):10-20.
42. Skargren E I, Öberg B E, Carlsson P G, Gade M. Cost and Effectiveness Analysis of Chiropractic and Physiotherapy Treatment for Low Back and Neck Pain. Six- Month Follow-Up. *Spine*, 1997;22:2167-2177.
43. Skargren E I, Öberg B E, Carlsson P G, Gade M. One-Year Follow-up Comparison of the Cost and Effectiveness of Chiropractic and Physiotherapy as Primary Management for Back Pain. Subgroup Analysis, Recurrence, and additional Health Care Utilization. *Spine*, 1998;23:1875-1883.
44. Taimela S, Takala E, Asklöf T, Seppälä K, Parviainen S. Active Treatment of Chronic Neck Pain. *Spine*, 2000;25:1021-1027.
45. Van Tulder M W, Goossens M, Hoving J. Nonsurgical Treatment of Chronic Neck Pain: In Nachemson A L, Johnsson E. *Neck and Back Pain, The scientific Evidence of Causes, Diagnosis, and Treatment*. Philadelphia: Lippincott Williams & Wilkins, 2000.
46. Van Tulder M W, Furlan A, Bombardier C, Bouter L and the editorial Board of the Cochrane Collaboration Back Review Group. Updated Method Guidelines for Systematic Reviews in the Cochrane Collaboration Back Review Group. *Spine*, 2003;28(12):1290-1299.
47. Viljanen M, Malmivaara A, Uitti J, Rinne M, Palmroos P, Laippala P. Effectiveness of dynamic muscle training, relaxation training, or ordinary activity for chronic neck pain: randomized controlled trial. *BMJ (bmj.com)*, 2003;327:1-5.
48. Waddell G. *The Back Pain Revolution*. Edinburgh: Churchill Livingstone, 1998.
49. Wailing K, Sundelin G, Ahlgren C, Järvholm B. Percieved pain before and after three exercise programs - a controlled clinical trial of women with work-related trapezius myalgia. *Pain*, 2000;85:201-207.
50. Wainer R S, Gill H. Diagnosis and Nonoperative Management of Cervical Radiculopathy. *Journal of Orthopaedic & Sports Physical Therapy*, 2000;30(12):728-744.

51. White A R, Ernst E. A systematic review of randomized controlled trials of acupuncture for neck pain. *Rheumatology*, 1999;38:143-147.
52. Wolosko P M, Eisenberg D M, Davis R B, Kessler R, Phillips R S. Patterns and Perceptions for Care for Treatment of Back and Neck Pain. *Spine*, 2003;28(3):292-298.
53. Ylinen J, Takala E, Nykänen M, Hakkinen A, Mälkiä E, Pohojolainen T, Karppi S, Kautiainen H, Airaksinen O. Active Neck Muscle Training in the Treatment of Chronic Neck Pain in Women. A Randomized Controlled Trial. *JAMA*, 2003;289(19):2509-2516.
54. Zhu X M, Polus B. A Controlled Trial on Acupuncture for Chronic Neck Pain A Controlled Trial on Acupuncture for Chronic Neck Pain. *The American Journal of Chinese Medicine*, 2002;30(1):13-28.

Appendix

Resumé of Review Articles
Author:
Title:
Journal:
Page:
Year:
Search Period:
Definition of Condition:
Intervention(s):
1. Search Strategy:
2. Comprehensiveness:
3. Criteria for Inclusion/ Exclusion:
4. Methods to avoid Bias:
5. Report of Validity Criteria for assessing included Studies:
6. Validity of Each Primary Study:
7. Methods to combine relevant Findings:
8. Were relevant Findings combined ?:
9. Were author’s Conclusions supported by Analysis of Data ?:
Conclusions:
Recommendations:

RCT resumé
Author:
Title:
Journal:
Page:
Year:
Study Population:
Def. Neck pain/ Classification:
Randomisation:
All Patients accounted for:
All Patients Included in Analysis:
Blinding of Patient and Caregiver:
Blinding of dataanalyst:
Similar Treatment except from Intervention:
Similar Baseline Properties:
Number of Participants:
Outcome Measures:
Interventions:
Results:
Conclusion:
References: