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Massage for mechanical neck disorders (Review)

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TABLE OF CONTENTS

[Intervention Review]

Massage for mechanical neck disorders

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ABSTRACT

Background

The prevalence of mechanical neck disorders (MND) is known to be both a hindrance to individuals and costly to society. As such, massage is widely used as a form of treatment for MND.

Objectives

To assess the effects of massage on pain, function, patient satisfaction, global perceived effect, adverse effects and cost of care in adults with neck pain versus any comparison at immediate post-treatment to long-term follow-up.

Search methods

We searched *The Cochrane Library* (CENTRAL), MEDLINE, EMBASE, MANTIS, CINAHL, and ICL databases from date of inception to 4 Feburary 2012.

Selection criteria

Studies using random assignment were included.

Data collection and analysis

Two review authors independently conducted citation identification, study selection, data abstraction and methodological quality assessment. Using a random-effects model, we calculated the risk ratio and standardised mean difference.

Main results

Fifteen trials met the inclusion criteria. The overall methodology of all the trials assessed was either low or very low GRADE level. None of the trials were of strong to moderate GRADE level. The results showed very low level evidence that certain massage techniques (traditional Chinese massage, classical and modified strain/counterstrain technique) may have been more effective than control or placebo treatment in improving function and tenderness. There was very low level evidence that massage may have been more beneficial than education in the short term for pain bothersomeness. Along with that, there was low level evidence that ischaemic compression and passive stretch may have been more effective in combination rather than individually for pain reduction. The clinical applicability assessment showed that only 4/15 trials adequately described the massage technique. The majority of the trials assessed outcomes at

immediate post-treatment, which is not an adequate time to assess clinical change. Due to the limitations in the quality of existing studies, we were unable to make any firm statement to guide clinical practice. We noted that only five of the 15 studies reported side effects. All five studies reported post-treatment pain, discomfort and soreness as a side effect and one study (Irnich 2001) showed that 22% of the participants experienced low blood pressure following treatment.

Authors' conclusions

No recommendations for practice can be made at this time because the effectiveness of massage for neck pain remains uncertain.

As a stand-alone treatment, massage for MND was found to provide an immediate or short-term effectiveness or both in pain and tenderness. Additionally, future research is needed in order to assess the long-term effects of treatment and treatments provided on more than one occasion.

PLAIN LANGUAGE SUMMARY

Massage for mechanical neck pain

Neck pain is common and can limit a person's ability to participate in normal daily activities. Massage is a widely used treatment for neck pain. In this review, it was defined as touching or manipulating the soft tissues surrounding the neck with the hand, foot, arm or elbow. There are a number of different types of massage. This review included studies that looked at Traditional Chinese massage, ischaemic compression, self-administered ischaemic pressure using a J-knob cane, conventional Western massage and occipital release, among other techniques. It did not include studies that examined techniques such as Reiki or Polarity.

We included 15 trials in this review that assessed whether massage could help reduce neck pain and improve function. Results showed that massage is safe, and any side effects were temporary and benign. However, massage did not show a significant advantage over other comparison groups. Massage was compared with no treatment, hot packs, active range-of-movement exercises, acupuncture, exercises, sham laser, manual traction, mobilization, and education.

There were a number of challenges with this review. Overall, the quality of the studies was poor and the number of participants in most trials was small. Most studies lacked a clear definition, description, or rationale for the massage technique used. Details on the credentials or experience of the person giving the massage were often missing. There was such a range of massage techniques and comparison treatments in the studies that we could not combine the results to get an overall picture of the effectiveness of massage. Therefore, no firm conclusions could be drawn and the effectiveness of massage for improving neck pain and function remains unclear.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Massage compared with placebo /no treatments

Patient or population: Patients with subacute/chronic mechanical neck pain
Settings: Community
Intervention: Conventional western massage (effleurage, petrissage, friction, tapotement) for generalised neck muscles
Comparison: Sham laser

Outcomes	Effect	No of Participants (studies)	Quality of the evidence (GRADE)
Pain Intensity - short-term follow-up	One trial showed no difference in pain intensity [SMD: -0.01 (95% CI -0.38 to 0.36)]	106 (1 study)	⊕⊕◯◯ **low** *Design*:0 *Limitations*:0 *Inconsistency*:0 *Indirectness*:0 *Imprecision*:−1 *Other*:−1
Function	Not measured		
Tenderness	Not measured		
Global Perceived Effect	Not measured		
Satisfaction	Not measured		
Quality of life	Not measured		
Overall well-being	Not measured		
Adverse effects	Slight pain or lowered blood pressure reported by 4 patients in the intervention group, 12 patients in the comparison group		

Low quality: Conventional western massage is no different than Sham laser in reducing pain intensity at short-term follow-up. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

BACKGROUND

Description of the condition

Neck pain is a very common condition. Approximately 70% of the American population experiences neck pain at some point in their lives (Makela 1991; Strine 2007). A simple neck pain in adults has a 12-month prevalence between 30% to 50% (Hogg-Johnson 2008). Neck pain has a tendency to become chronic and affects 10% of males and 17% of females (Haraldsson 2006a). Individuals with neck pain have a limited ability to participate in activities of daily living. Thus, neck pain is associated with large healthcare costs and loss of productivity attributable to sick leave taken from work. Three per cent to 11% of claimants are off work each year due to neck pain (Côté 2008). It has been reported previously that chronic neck pain accounts for $150 to $215 billion US each year in economic loss (National Res 2001). Although disabling, little is known about the effectiveness of treatment for neck pain.

Description of the intervention

Massage therapy (MT) involves the manipulation of the soft tissues of the body through touch (Sherman 2006). It consists of techniques such as gentle effleurage, pétrissage, and myofascial trigger point release (Kutner 2008). These techniques vary in the manner in which touch is applied, as well as the amount of pressure and intensity which is applied (Kutner 2008). Since there is a wide spectrum of interventions and techniques that fall under the umbrella term of massage therapy, specific definitions for the techniques are lacking and there is substantial overlap among them. As such, Sherman et al proposed a three-level classification system for the different massage therapy techniques based on the goals of the treatment, the style and the technique (Sherman 2006). The treatment goals were classified into the following: relaxation massage, clinical massage, movement re-education, and energy work (Sherman 2006). These goals could be addressed by a variety of different styles and each style is characterized by specific techniques to achieve the goal (Sherman 2006).

How the intervention might work

The mechanical effects of massage involve the process of manipulating the tissues and subsequently assisting in the breakdown of adhesions (Moyer 2004). Physiological responses to MT as a result of the physical manipulation of the tissues include increased blood and lymph flow, a shift from sympathetic to parasympathetic response, prevention of fibrosis, and the reduction of pain (De Domenico 2007; Moyer 2004). Massage produces local biochemical changes such as increased blood flow and oxygenation to the muscles (Sagar 2007). This local response leads to increased neural activity at the spinal cord level and also at the subcortical nuclei which in turn affects mood and pain perception (Sagar 2007). As such, MT could potentially reduce anxiety, depression, and pain through the increase of serotonin and endorphins (Moyer 2004).

Why it is important to do this review

In the previous version of this review on massage for mechanical neck disorders (Haraldsson 2006a), we included six trials that assessed massage as a stand-alone treatment and 14 trials that assessed massage as a part of a multimodal treatment. There were inconsistent results for massage as a stand-alone treatment. As for massage as a part of a multimodal treatment, the amount of contribution of massage to the results could not be confirmed. Furthermore, the overall quality of the trials included in the previous review was low. Two systematic reviews (Brosseau 2012; Furlan 2010) supported the benefit of massage compared with a control or placebo for improving pain intensity in the immediate to short term. But the recommendations of both the reviews were based on low level evidence. Additionally, neither of the reviews commented on the clinical applicability of the included trials. It is of great importance to do this update as there have been additional trials conducted since our last review, and to further assess the quality and the clinical applicability of all the trials.

OBJECTIVES

The objectives were to assess the effect of massage on pain, neck-related function, disability, patient satisfaction and global perceived effect in adults with mechanical neck disorders. Where appropriate, to conduct sensitivity analyses to assess the influence of study methodological quality, symptom duration and subtypes of the disorder on the magnitude of treatment effects.

METHODS

Criteria for considering studies for this review

Types of studies

We included published or unpublished randomised controlled trials (RCTs), either in full text or abstract form.

Types of participants

The participants were adults who suffered from acute (less than 30 days), sub-acute (30 days to 90 days) or chronic (longer than 90 days) neck disorders categorized as:

1. Neck pain without radiculopathy, including non-specific (mechanical, simple) neck pain of unidentified etiology (Spitzer 1987, Spitzer 1995, Tsakitzidis 2009) whiplash associated disorders (WAD), (Spitzer 1987, Spitzer 1995), neck pain associated with myofascial pain syndrome and neck pain with degenerative changes (Klippel 2008)
2. Cervicogenic headache (Olesen 1997, Sjaastad 1990); and
3. Neck disorders with radiculopathy (Spitzer 1987, Spitzer 1995).

Studies were excluded if they investigated neck disorders with

- definite or possible long tract signs (e.g. myelopathies),
- neck pain caused by other pathological entities (e.g. rheumatoid arthritis, ankylosing spondylitis, spasmodic torticollis, fractures and dislocations) (Klippel 2008),
- headache not of cervical origin but associated with the neck,
- co-existing headache, when either neck pain was not dominant or the headache was not provoked by neck movements or sustained neck postures, or
- 'mixed' subtypes of headache (i.e. migraine and cervicogenic headache);
- Grade IV neck pain (Haldeman 2008)

Types of interventions

Massage in this review was defined as contact with, or manipulation of, the soft tissues of the human body with the hand, foot, arm or elbow on the structures of the neck. Studies using massage and contrasted against a control or comparison group were included in this review. Massage techniques included Swedish techniques, fascial or connective tissue release techniques, cross fibre friction, and myofascial trigger point techniques. Techniques based on subtle energy manipulations, with or without physical contact with the patient (Reiki, Polarity), were excluded.

Control treatments included (a) sham or placebo, (b) no treatment control, (c) active treatment control (i.e. massage + ultrasound (US) versus US) or (d) inactive treatment control (i.e. massage + sham US versus sham US).

Other active treatments included (a) one active treatment versus another very different active treatment (i.e. massage versus exercise), (b) one type of treatment (i.e. Chinese massage) versus another type of a similar treatment (i.e. Western massage) or (c) one dosage of a treatment versus another dosage of the same treatment (i.e. three weeks with nine sessions of Chinese massage versus three weeks with three sessions of Chinese massage).

Types of outcome measures

Primary outcomes

The primary outcomes of interest were patient-reported pain relief, neck-related disability and function (Turk 2004). We did not set any restriction on the type of measures used in the studies to assess these outcomes as there were no universally accepted measurement tools available. Function and disability could be measured using either patient self-report measures or observer-based physical performance tests (Beattie 2001; Finch 2002). Measures of physical performance had to test the participant's ability to execute a simple activity in a standardised environment using a standardised test and scoring procedure; they were concerned with the testing of a co-ordinated set of functions, which formed a component of functional purposeful activity (e.g. reaching, walking, driving).

Secondary outcomes

Our secondary outcomes were patient satisfaction, quality of life and global perceived effect. When available, we also extracted data on adverse events and cost.

The duration of the follow-up period was defined as:

- *immediately post-treatment:* up to one day,
- *short-term follow-up:* between one day and three months,
- *intermediate-term follow-up:* between three months and one year,
- *long-term follow-up:* one year and beyond.

Search methods for identification of studies

A research librarian searched the computerised bibliographic databases of the medical, chiropractic, and allied health literature from their inception to 4 Feburary 2012, without language restrictions. Review authors of trials were excluded from inclusion decisions.

Electronic searches

CENTRAL, MEDLINE, AMED, Index to Chiropractic Literature, CINAHL, LILACS, and EMBASE were searched using subject headings (MeSH) and key words including anatomical terms, disorder or syndrome terms, treatment terms, and methodological terms consistent with those advised by the Cochrane Back Review Group (See Appendix 1 - MEDLINE search). Newly identified trials were considered alongside the four trials our previous update. Only four trials from the previous update were included as they assessed massage as a stand-alone treatment and they met the inclusion criteria.

Searching other resources

We also screened references, communicated with the Cochrane Back Group Managing Editor, contacted content experts (AG) and searched our own personal files to identify studies. Relevant references were retrieved and final inclusion decisions were made

on full-text articles. Since this review was one of a series on manual therapies, this search was part of a comprehensive search for all manual therapies. Potential trials for massage therapy were separated from the total search results. Key conference proceedings were searched (NG) for in the relevant grey literature((i.e. International Federation of Manual Therapy).

Data collection and analysis

Selection of studies

Pairs of review authors, each with one or more areas of expertise from medicine, physiotherapy, chiropractic, massage therapy, statistics or clinical epidemiology, independently identified citations and selected studies. We assessed agreements for study selection using the quadratic weighted Kappa statistic (Kw); Cicchetti weights (Cicchetti 1976). A third review author was consulted in case of persisting disagreement.

Data extraction and management

Two review authors independently extracted data using a pre-piloted standardised form. We contacted primary authors if data were not reported. When data could not be retrieved from the author, the author's report of significance was reported in tabular form (See Characteristics of included studies). We also assessed clinical applicability criteria in this review, based on Cochrane Back Review Group standards (Furlan 2009). Data are presented in the Characteristics of included studies table.

Assessment of risk of bias in included studies

We used a calibrated team of assessors with at least two assessors who independently assessed the pre-piloted 'Risk of bias' assessment tool (Appendix 2). The quadratic weighted Kappa (Kw) statistic was used to assess agreement on 'Risk of bias' assessment (Kw 0.23 to 1.00). Disagreements were resolved by group consensus and the final decisions presented here represent team consensus decisions. 'Risk of bias' tables were presented and discussed by the broader validity assessment team to maximize inter-rater reliability (Graham 2012). The 'Risk of bias' assessment tool has 12 criteria, which are rated as high, low, or unclear. A study is classified as having a low risk of bias when it meets six or more criteria, in the absence of other obvious serious methodological flaws. The 'Risk of bias' criteria considered included: randomisation; concealment of treatment allocation; blinding of patients, care providers and outcome assessors; data completeness; selective outcome reporting; similarity at baseline; similarity of co-interventions; acceptable compliance; and similar timing of assessment. We did not exclude studies from further consideration in this review on the basis of the 'Risk of bias' assessment, although we did use this information to inform our recommendations.

Measures of treatment effect

We provided descriptive statistics of the patient groups, interventions, outcomes, adverse effect of treatments, and cost of care. We reported all results based on the sample size analysed using the "intention-to-treat" principle (the sample randomised in the study). We assumed the minimum clinically important difference to be 10 on a 100-point pain intensity scale (Farrar 2001; Felson 1995; Furlan 2009; Goldsmith 1993). We considered the effect to be small when it was less than 10% of the Visual analogue scale (VAS), medium when it was between 10% and 20% of the VAS, and large when it was 20% to 30% of the VAS. For the neck disability index, we used a minimum clinically important difference of 5/50 neck disability index units for non-complicated neck pain and 10/50 for cervical radiculopathy (MacDermid 2009; Stratford 1999). For other outcomes (i.e. global perceived effect and quality of life scales), where there is an absence of clear guidance on the size of clinically important effect sizes, we used the common hierarchy of Cohen 1988: small (0.20), medium (0.50) or large (0.80).

Unit of analysis issues

For continuous data, we calculated standardised mean differences (and 95% confidence intervals (SMD; 95% CI) using a random-effects model. For continuous outcomes reported as medians, we calculated effect sizes based on Kendall (Kendall 1963 (p 237)). We calculated risk ratios (RR) for dichotomous outcomes. To facilitate analysis, data imputation rules were used when necessary (Gross 2002). The number needed to treat to benefit (NNTB) and treatment advantage calculations were planned for primary findings when a clear positive effect was seen; however, this was not carried out for most trials because most of them did not demonstrate strong evidence of benefit. All calculated analyses are reported in the Characteristics of included studies table under the subheading 'Calculated Results'. If more than one time period was reported in the paper, only our calculations of the longest follow-up time are reported in the table. Results reported in the manuscript appear as 'Results'.

Dealing with missing data

To facilitate analysis, we only used data imputation rules when necessary, following prior decisions and statistical principles (Appendix 3).

Assessment of heterogeneity

Prior to calculation of a pooled effect measure, we used clinical judgment to assess the reasonableness of pooling. We had planned to assess statistical heterogeneity using a Chi^2 test between groups, using a random-effects model. In the absence of heterogeneity (P greater than 0.05), we planned to pool the SMD or RR. Due

to insufficient data in any one treatment category, this was not feasible.

Assessment of reporting biases

Reporting bias was considered to be present when evidence of reporting bias was shown in Results. Sensitivity analysis was planned but not performed to check the influence on the meta-analysis results.

Assessment of Clinical applicability and relevance

Clinical applicability assesses the ability of clinicians to incorporate the methods and results of the trial into clinical practice. Clinical applicability of each study was evaluated by at least two review authors, using the questions in Table 1 and Appendix 4. Final scores were assigned after reaching consensus in accordance with the recommendations of Furlan 2009. Each of the six questions was further reviewed and summarised to evaluate how clinically informative individual studies were, as well as to report on how well described these clinical features were in neck pain clinical research (Malmivaara 2006). Guidelines for effect size were based on the work of Furlan 2009.

Data synthesis

We assessed the quality of the body of the evidence using the GRADE approach (Furlan 2009; Appendix 5). Domains that may decrease the quality of the evidence are: 1) the study design, 2) risk of bias, 3) inconsistency of results, 4) indirectness (not generalisable), 5) imprecision (insufficient data), other factors (e.g. reporting bias). The quality of the evidence was reduced by a level based on the performance of the studies against these five domains. All plausible confounding factors were considered as were their potential effects on the demonstrated treatment responses and the treatment dose-response gradient (Atkins 2004).
Levels of quality of evidence were defined as:

- **High quality evidence**: Further research is very unlikely to change our confidence in the estimate of effect. There are consistent findings among 75% of RCTs with low risk of bias that generalise to the population in question. There are sufficient data, with narrow confidence intervals. There are no known or suspected reporting biases. (i.e. All of the domains are met.)

- **Moderate quality evidence**: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. (i.e. One of the domains is not met.)

- **Low quality evidence**: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. (i.e. Two of the domains are not met.)

- **Very low quality evidence**: We are very uncertain about the estimate. (i.e. Three of the domains are not met.)

- **No evidence**: no RCTs were identified that measured the outcome of interest.

We also considered a number of factors to place the results into a larger clinical context: temporality, plausibility, strength of association, dose response, adverse events, and costs.

Subgroup analysis and investigation of heterogeneity

There were insufficient data to carry these out.

Sensitivity analysis

Sensitivity analysis or meta-regression for the factors of symptom duration, methodological quality and subtype of neck disorder were planned but not carried out because we did not have enough data in any one category.

RESULTS

Description of studies

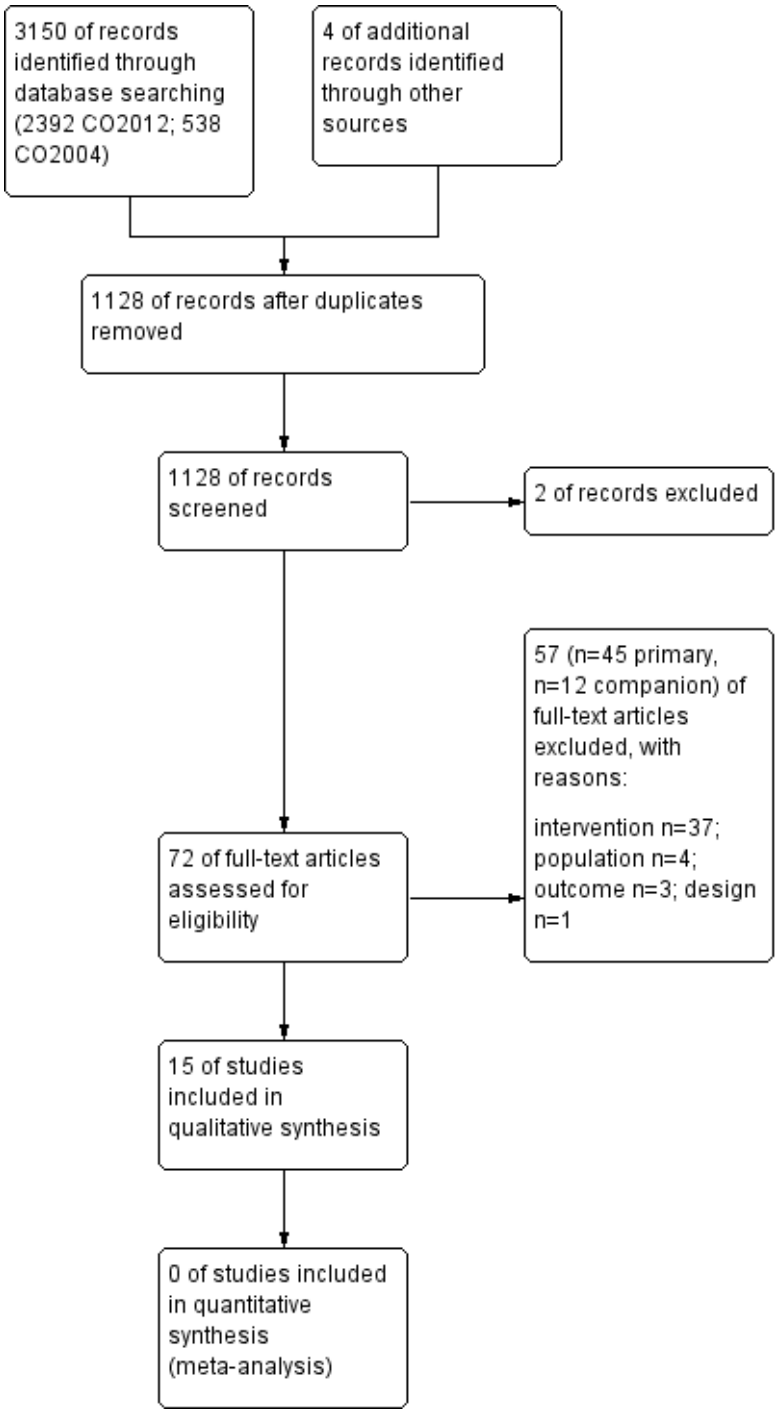
The participants were adults who suffered from acute (less than 30 days), sub-acute (30 days to 90 days) or chronic (longer than 90 days) neck disorders categorized as:

1. Neck pain without radiculopathy:
   i) Subacute/ chronic mechanical neck pain: n = 9 trials (Irnich 2001, Gemmell, 2008 (p175-181), Gemmell 2008 (p 30-36), Blikstad 2008, Cen 2003, Zaproudina 2007, Sherman 2009, Fernandez 2006, Yagci 2004)
   ii) Mecanical neck pain of unknown duration: n = 6 trials (Hanten 1997, Hanten 2000, Briem 2007, Meseguer 2006, Fryer 2005, Kostopoulous 2008)
   iii) Whiplash associated disorders (WAD): n = 0
   iv) Neck pain associated with myofascial pain syndrome and with degenerative change: n=0
2. Cervicogenic headache : n = 0
3. Neck disorders with radiculopathy : n = 2 Gemmell, 2008 (p175-181), Gemmell 2008 (p 30-36)

Results of the search

We identified 15 trials (810 participants) from 1128 citation postings and 72 full text screenings (See Figure 1).

Figure 1. Study flowchart for massage therapy update 2012



See 'Characteristics of included studies' table for further details on treatment characteristics, co-interventions, baseline values, absolute benefit, reported results, SMD, NNTB, side effects and cost of care. We excluded 45 studies after reviewing the full text, based on the type of participants (4), intervention (37), outcome (3) and design (1). See 'Characteristics of excluded studies' table for details.

Briem 2007 and Sherman 2009 were contacted to request for mean and standard deviation data on primary outcomes. Irnich 2001 was contacted to provide details on treatment technique.

Included studies

Trials were small with a range from nine to 56 participants per randomised arm. We were not able to pool trials due to substantial heterogeneity in the massage treatment and different control groups. We were also unable to carry out sensitivity analysis for symptom duration, methodological quality and disorder subtype because we did not have enough data in any one category of massage. However, effect sizes of individual trials are shown in the Characteristics of included studies' table.

Excluded studies

We excluded 57 articles (n = 45 primary references, n = 12 companion references) at full-text screening for the following reasons: intervention n = 37 (multimodal massage n = 28; massage both arms n = 4; other treatment n = 5); design n = 1, population n = 4; and outcome n = 3.

Risk of bias in included studies

Refer to Figure 2 and Figure 3 for detailed report.

Figure 2. 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

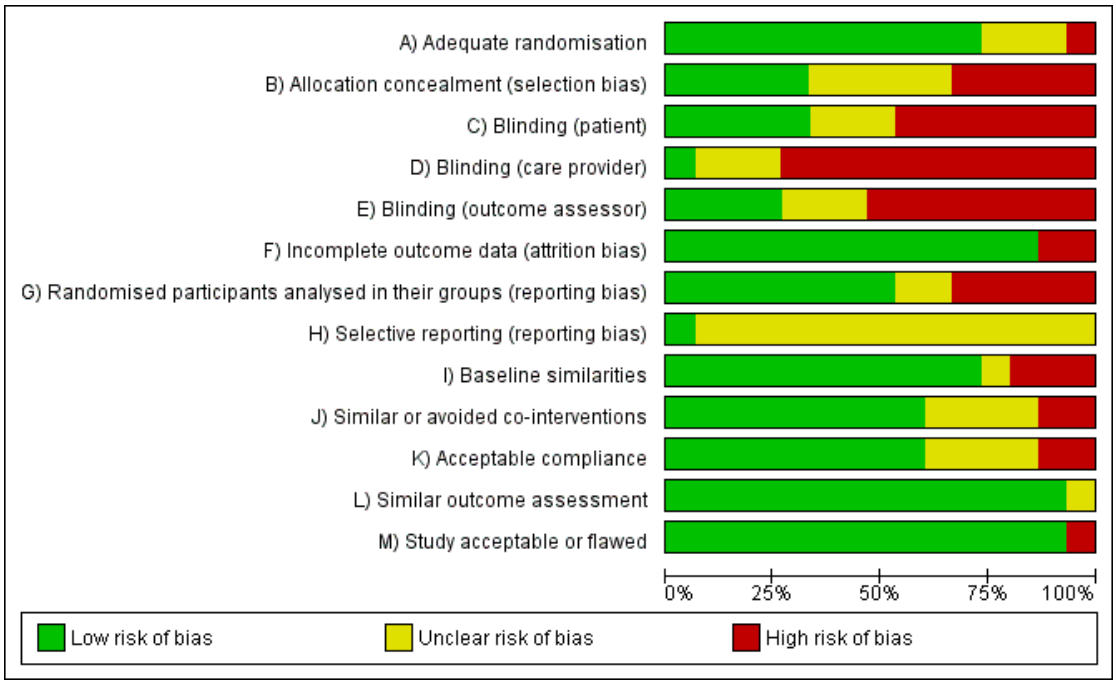
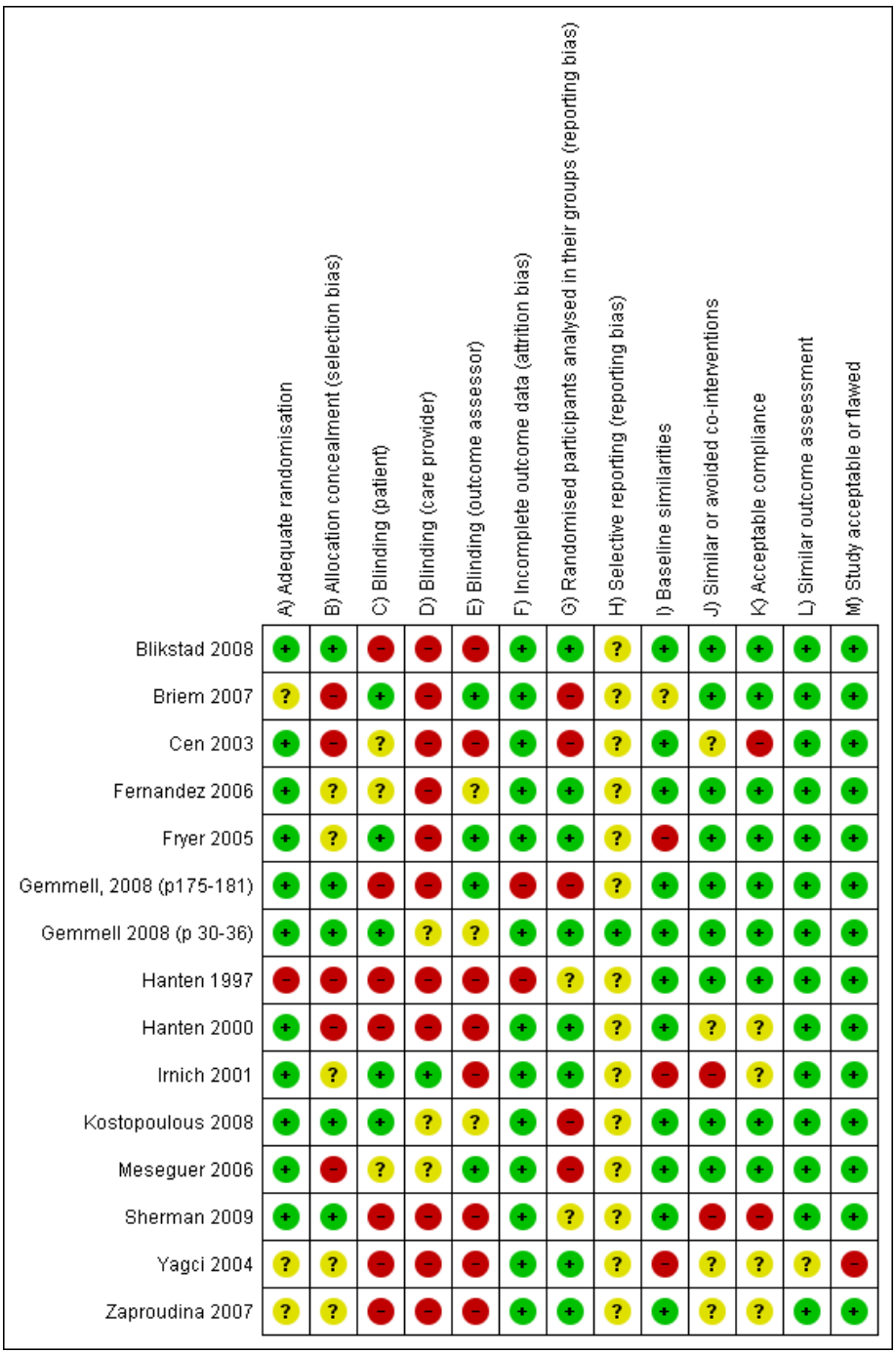


Figure 3. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.



Allocation

Of the 15 studies assessed, four were rated as "unclear risk", and six were rated as "high risk." In order for a study to receive a "low risk" rating, adequate concealment to ensure blinding needs to occur. In particular, blinding should have been performed by an independent person not responsible for determining the eligibility of the patients.

Blinding

An apparent bias in all of the 15 studies was the inability to adequately blind the patient, therapist, and outcome assessor. Due to the nature of the study, blinding of the therapist was not possible. Likewise, the blinding of the outcome assessor (who is the participant in this case) was also not possible because of the need for self-report.

All of the studies relied on subjective outcomes such as the self-report of pain, disability, function, and/or satisfaction. As a result, eight of the 15 studies assessed were rated "high risk" for patient blinding, three as "unclear." and four as "low risk." Twelve of the 15 studies assessed were rated as "high risk" for therapist blinding. In relation to blinding the outcome assessor, seven of the studies assessed were rated as "high risk" and three as "unclear."

Incomplete outcome data

The majority of studies had adequately reported the drop-out rate with the use of tables or flow charts. Two of the fifteen studies assessed were rated "high risk." Overall, there was a low risk of attrition bias associated with the studies due to their type. Most studies were Pre/Post Designs and conducted on only one occasion.

Selective reporting

The selective reporting of outcomes was a common bias among 14 of the 15 studies assessed. As such, fourteen of the studies were rated as unclear. In order to receive a low risk score, all of the pre-specified outcomes should have a previously published protocol prior to the initiation of the study. This ensures that the investigators do not selectively report outcome measures that support their hypothesis while ignoring those that contradict their hypothesis.

Other potential sources of bias

The studies received a "low risk" score if the patient groups were similar at baseline regarding the most important prognostic indicators, co-interventions were avoided or similar, patient compliance was acceptable in all groups and the timing of outcome assessment was similar in all groups. One study was rated as unclear and two studies were rated "high risk" with regard to ensuring the similarity of patients at baseline. Four studies were rated as unclear in regards to avoiding co-interventions, while one study was rated as "high risk." Three studies were rated "high risk" for patient compliance, while three additional studies assessed were rated as "unclear".

Internal validity

The internal validity of the studies was assessed with the Risk of Bias tool. Most treatments were just one application. Therefore, they were not reproducible or reproduced more than once. Most of the trials lost points due to performance bias and reporting bias. An apparent bias in all of the fifteen studies was the inability to adequately blind the patient, therapist, and outcome assessor. This lowered the values of the studies as most studies assessed were rated as high risk. An additional area of inherent bias was in regards to selective outcome reporting. At least fourteen of the fifteen studies were rated as unclear risk due to their lack of an established protocol.

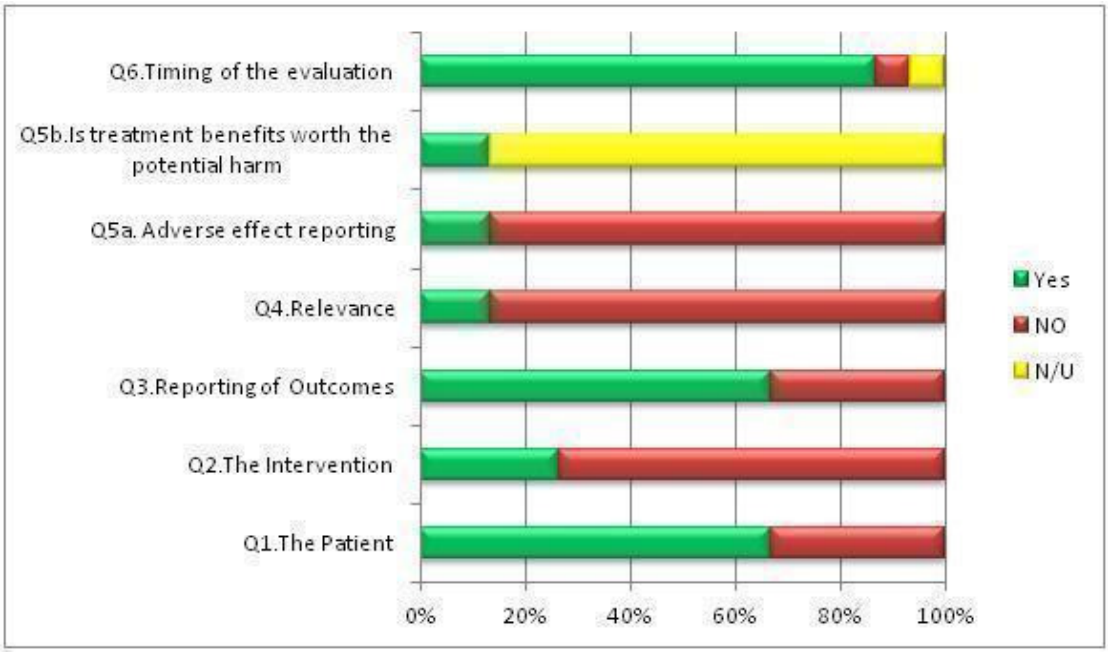
External validity

The results of the trials were not generalisable due to imprecision, and the size of the study. Most of the trials were single trials, and did not have any data on long-term effects.

Clinical Applicability

Table 2 and Figure 4 shows the results of the clinical applicability assessment. The characteristics of the study participants (i.e., gender, age) (10/15 trials), reporting of outcomes (10/15 trials) and the timing of evaluation (13/15 trials) were well reported. The characteristics of the massage technique was only reported in four out of the 15 trials assessed. Details of the credentials or experience of the person administering the massage and the setting/environment were reported only in one of the studies.

Figure 4. Clinical Applicabilty



Ten of 15 studies reported adequate selection of outcome measure. 13/15 studies assessed post-treatment evaluation at an adequate time. The majority of the studies reported it at immediate post-treatment which is not an adequate time to assess clinical change. Adverse effects were infrequently reported, with only 2/15 trials reporting adverse effects to massage treatment. Due to poor reporting of adverse effects, there is uncertainty if the benefit is more important than the adverse effect. But based on clinical experience about common adverse effect to massage, it can be assumed that the benefit of massage is stronger than the rare adverse effects such as immediate pain or soreness.

Effects of interventions

See: **Summary of findings for the main comparison**; **Summary of findings 2**; **Summary of findings 3**

1. Subacute/chronic mechanical neck pain

Massage therapy versus controls

We found four trials that compared massage with a control. There was very low to low quality evidence of no difference in pain when three approaches for massage were evaluated at immediate and short-term follow-up. However, we noted very low quality evidence of improvement in function when Chinese massage was compared with no treatment at immediate post-treatment.

Pain

We found very low quality evidence (one trial, 106 participants, Irnich 2001) that showed that conventional western massage (effleurage, petrissage, friction, tapotement) for generalized neck muscles was no different in the short term when compared to sham laser for pain standardised mean difference (SMD): -0.01 (95% confidence interval (CI) -0.38 to 0.36).

Our group found low evidence (one trial, two arms, 60 participants, Gemmell 2008 (p 30-36)) that ischaemic compression and pressure release to upper fibre of trapezius trigger point were no different from sham ultrasound immediately post-treatment for pain SMD: 0.02 (95% CI -0.69 to 0.74) and 0.33 (95% CI -0.39 to 1.06) respectively.

There is very low quality evidence (one trial, 30 participants, Blikstad 2008) that showed no difference between myofascial band therapy to upper fibre of trapezius trigger points versus sham ultrasound immediately post-treatment for pain RR: 1.00 (95% CI (0.76 to 1.32).

Function

We found very low quality evidence (one trial, 20 participants, Cen 2003) that favoured traditional Chinese therapeutic massage versus no treatment to generalized neck muscles for physical function SMD: -1.75 (95% CI -2.82 to -0.68).

2. Mechanical neck pain of unknown duration

Massage therapy versus controls

We found two trials for pain, one trial (two arms) for tenderness (VAS) and one trial for tenderness (pain pressure threshold (PPT)) that examined the effectiveness of massage versus a control. There was very low to low quality evidence of no difference in pain when two approaches for massage were evaluated at immediate post-treatment. There is very low evidence of effectiveness of two approaches of massage at immediate post-treatment for tenderness (VAS). There is low evidence of effectiveness of massage at immediate post-treatment for tenderness (PPT).

Pain

We found very low quality evidence (one trial, 60 participants, Hanten 1997) of no difference between occipital release to suboccipital muscles and no treatment immediately post-treatment for pain SMD: -0.07 (95% CI -0.69 to 0.55).

Our group determined that there was a low level of evidence (one trial, 40 participants, Briem 2007) that showed no difference between sham manual procedure and inhibitive distraction to the suboccipital muscles immediately post-treatment (SMD: 0.33 (95% CI -0.29, 0.96).

Tenderness (VAS)

We found very low quality evidence (one trial, 36 participants, Meseguer 2006) that showed that both modified strain/counter strain and classical strain/counter strain to UFT were more effective when compared with no treatment immediately post-treatment for pain tenderness SMD:-1.83 (95% CI -2.62 to -1.04), -1.04 (95% CI -1.74 to -0.34) respectively].

Tenderness (PPT)

We found low quality evidence (one trial, 37 participants, Fryer 2005) that showed that manual pressure release was more effective when compared to sham myofascial release immediately post-treatment for tenderness (PPT) SMD: -1.23 (95% CI -1.94 to -0.52).

3. Subacute/chronic mechanical neck pain

Massage therapy versus other therapy

We found six trials (one with three arms) for pain and four trials (one with three arms) for function that examined the effectiveness of massage versus other therapies. There was very low to low quality evidence for pain when five approaches for massage were evaluated at immediate- and short-term follow-ups . In four of the trials, we found no difference in results. One trial showed low evidence that favoured the comparison, (activator trigger point therapy). Another trial showed low evidence for massage when compared with education. There is very low to low evidence for two approaches of massage for function at immediate- and short-term follow-up . All trials showed no difference in results.

Pain

Massage versus acupuncture

Our group determined very low quality evidence (one trial, 106 participants, Irnich 2001) that showed no difference between conventional western massage (effleurage, pétrissage, friction, tapotement) for generalized neck muscles and acupuncture (traditional Chinese) on pain at the short-term follow-up SMD: 0.24 (95% CI -0.14 to 0.62).

Massage versus manual therapy

We found three trials that compared massage therapy to manual therapy with very low to low quality evidence in immediate to short-term follow-up for pain.

One trial (52 participant, Gemmell, 2008 (p175-181)) compared ischaemic compression with activator trigger point therapy and found no difference in effectiveness SMD: -0.19 (95% CI -0.73 to 0.36). The second trial (30 participants, Blikstad 2008) examined myofascial band therapy with UFT and trigger points versus activator trigger point therapy and found massage therapy was less effective than the activator trigger point therapy, Risk Ratio (RR): 1.86 (95% CI 1.04 to 3.30). The third trial (64 participants, Zaproudina 2007) compared massage versus generalized neck muscles versus traditional bone setting therapy and found no difference in effectiveness, SMD: 0.37 (95% CI -0.11 to 0.85).

Massage versus multimodal therapy

We found very low quality evidence (one trial, 67 participant, Zaproudina 2007) that compared massage with multimodal conventional physiotherapy. This study found no difference in results between the two groups standard error of the mean (SEM): 0.18 (95% CI -0.66 to 0.30).

Pain Bothersomeness

Massage versus education

We found low evidence (one trial, two arms, 60 participants, Sherman 2009) that showed no difference in effectiveness of massage therapy and education on pain bothersomeness in the intermediate- and long-term follow-ups SMD: -0.43 (95% CI -0.95 to 0.09) and SMD: -0.04 (95% CI -0.55 to 0.48) respectively.
At the short-term follow-up the results favoured massage therapy for pain bothersomeness SMD: -0.73 (95% CI -1.26 to -0.21).

Function

Massage versus manual therapy

There is very low quality evidence (one trial, 68 participants, Zaproudina 2007) that showed that traditional bone setting is no different in the short-term when compared to generalized neck massage for physical function SMD: 0.37 (95% CI -0.11 to 0.85).

Massage versus exercise

We found one very low quality study, which compared traditional therapeutic Chinese massage to exercise (17 participants, Cen 2003). This study showed that traditional therapeutic Chinese massage had no different immediate effect on physical function SMD: -0.55 (95% CI -1.53 to 0.42).

Massage versus multimodal

Our group determined there is very low quality evidence (one trial, 67 participants, Zaproudina 2007) that found no difference in benefit of generalized neck massage and conventional physiotherapy at the short-term follow-up for physical function SMD: -0.35 (95% CI -0.83 to 0.14).

Massage versus education

We found low quality evidence (one trial, two arms, Sherman 2009) that had no difference in effectiveness between massage and education on physical function in the short term (60 participants, SMD: -0.38 (95% CI -0.89 to 0.13), intermediate-term (59 participants, SMD: -0.40 (95% CI -0.92 to 0.12) also long term (58 participants, SMD: -0.33 (95% CI -0.85 to 0.19).

Quality Of Life

Massage versus education

We found low quality evidence (one trial, two arms, Sherman 2009) that found no difference in effectiveness of massage therapy and education at the intermediate-term follow up 59 participants, SMD: 0.37 (95% CI -0.15 to 0.89) and the long-term follow-up 58 participants, SMD: 0.33 (95% CI -0.18 to 0.85).

4. Mechanical neck pain of unknown duration

Massage therapy versus other therapy

Our group found two trials that evaluated the effectiveness of massage therapy versus other therapies on pain. There is very low quality evidence that showed no differences in effectiveness of two approaches of massage therapy compared with other therapies for pain.

Pain

Massage versus exercise

There is very low quality evidence (one trial, 60 participants, Hanten 1997) that indicated that occipital release to the suboccipital muscles was no different to exercise at the immediate-term follow-up SMD: -0.24 (95% CI -0.87 to 0.38).
We found very low quality evidence (one trial, 60 participants, Hanten 2000) that indicated, that self-ischaemic compressions with a hand-held J shaped tool to UFT provided no difference in effectiveness as active neck movement exercises at the short-term follow-up SMD: -0.61 (95% CI -1.24 to 0.03).

5. Subacute/chronic mechanical neck pain

Massage therapy versus massage therapy

We found two trials that evaluated the effectiveness of massage therapy versus other massage therapies on pain and one trial that compared two different massage therapy techniques for tenderness (VAS). There is very low to low quality evidence that showed no differences in effectiveness of three approaches of massage therapies for pain. There is very low evidence of no difference in tenderness (VAS) between two different massage therapy techniques.

Pain

Our group determined there is very low quality evidence (one trial, 40 participants, Fernandez 2006) that indicated that ischaemic compression to upper fibre of trapezius trigger point was no different at immediate post-treatment SMD: -0.29 (95% CI -0.91 to 0.34) when compared to transverse friction massage to upper fibre

of trapezius. We found low quality evidence (one trial, 30 participants, Gemmell 2008 (p 30-36)) that indicated that ischaemic compression to upper fibre of trapezius provided no difference in effect compared with trigger point pressure release to upper fibre of trapezius trigger point SMD: -0.28 (95% CI -1.00 to 0.44) at immediate post-treatment follow-up.

Tenderness (VAS)

Our group determined that there is very low quality evidence (one trial, 40 participants, Yagci 2004) that indicated that connective tissue massage from sacral region to neck was no different at immediate post-treatment SMD: -0.17 (95% CI -0.79 to 0.45) when compared with spray and stretch.

6. Mechanical neck pain of unknown duration

Massage therapy versus massage therapy

We found one trial (three arms) for pain and one trial for tenderness that examined the effectiveness of different massage approaches individually and combined. There is low quality evidence that a combination of two massage approaches is beneficial for pain relief. There is very low evidence that showed no difference between individual massage approaches on pain. There is very low evidence that showed no difference between two different approaches of massage for pain tenderness.

Pain

We found very low quality evidence (one trial, 60 participants, Kostopoulous 2008), that indicated that ischaemic compression to UFT trigger points, was no different in providing a short-term effect SMD: -0.07 (95% CI -0.58 to 0.43) when compared with passive stretch to UFT alone.

Our group found low evidence (one trial, 60 participants, Kostopoulous 2008) that showed a beneficial effect of combined ischaemic compression and passive stretch to UFT compared with ischaemic compression SMD: 0.68 (95% CI 0.16 to 1.20) and passive stretch SMD: 0.72 95% (CI (0.20 to 1.24) individually at the short-term follow-up.

Tenderness (VAS)

We found very low quality evidence (one trial, 36 participant, Meseguer 2006) that indicated there was no difference between modified strain/ counter strain and classical strain/ counter strain to UFT at short-term follow-up SMD: 0.35 (95% CI -0.31 to 1.01).

7. Adverse events and cost of care

We noted that only five of the 15 studies reported side effects (Blikstad 2008; Gemmell, 2008 (p175-181); Gemmell 2008 (p 30-36); Irnich 2001; Sherman 2009). All five studies reported post-treatment pain, discomfort and soreness as a side effect, and one study (Irnich 2001) reported 22% of participants experienced low blood pressure following treatment.

None of the studies reported the cost of care.

ADDITIONAL SUMMARY OF FINDINGS [Explanation]

Massage compared with other therapy

Patient or population: Patients with subacute/chronic mechanical neck pain
Settings: Community
Intervention: Conventional western massage (effleurage, petrissage, friction, tapotement) for generalised neck muscles
Comparison: Traditional Chinese acupuncture

Outcomes	Effect	No of Participants (studies)	Quality of the evidence (GRADE)
Pain Intensity: short-term follow-up	One trial showed no difference in pain intensity [SMD: 0.24 (95% CI -0.14 to 0.62)]	108 (1 study)	⊕⊕◯◯ **low** *Design*:0 *Limitations*:0 *Inconsistency*:0 *Indirectness*:0 *Imprecision*:−1 *Other*:−1
Function	Not measured		
Tenderness	Not measured		
Global Perceived Effect	Not measured		
Satisfaction	Not measured		
Quality of life	Not measured		
Overall well-being	Not measured		
Adverse effects	Slight pain or lowered blood pressure reported by 4 patients in the intervention group, 17 patients in the comparison group		

Low quality: Conventional western massage is no different than Traditional Chinese acupuncture in reducing pain intensity at short-term follow-up. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

Massage compared with another massage therapy technique			
Patient or population: Patients with unknown duration of mechanical neck pain **Settings:** Community **Intervention:** Ischaemic compression and Passive stretch to Upper Fibers Trapezius (UFT) **Comparison:** Ischaemic compression and Passive stretch were compared with each other and also in combination			
Outcomes	**Effect**	**No of Participants (studies)**	**Quality of the evidence (GRADE)**
Pain Intensity: **Short term follow up**	One trial comparing Ischaemic compression with passive stretch showed no difference in pain intensity [SMD: -0.07 (95% CI -0.58 to 0.43)] Two trials showed medium reduction in pain intensity when combination of Ischaemic compression and passive stretch was compared with each technique individually. [SMD: 0.68 (95% CI 0.16 to 1.20) to SMD: 0.72 (95% CI 0.20 to 1.24)]	180 participants (1 study - 3 arms)	⊕⊕◯◯ **low** *Design*:0 *Limitations*:0 *Inconsistency*:0 *Indirectness*:0 *Imprecision*:−1 *Other*:−1
Function	Not measured		
Tenderness	Not measured		
Global Perceived Effect	Not measured		
Satisfaction	Not measured		
Quality of life	Not measured		
Overall well-being	Not measured		
Adverse effects	Measured but not reported		

Low quality: Ischaemic compression is no different than passive stretch to UFT in reduction of pain intensity at short-term follow-up. Combination of Ischaemic compression and passive stretch to UFT is better in reducing pain intensity when compared with Ischaemic compression and passive stretch individually at short-term follow-up. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

DISCUSSION

Although there has been a marked increase in the number of publications that incorporate massage since a previous review (Gross 1996), the contribution of massage to managing cervical pain remains unclear. Our paper did not find strong or moderate level of evidence for massage alone relative to a control. Our findings are similar to the Cochrane review on conservative treatments for whiplash, which also found a predominance of low-quality, underpowered trials leading to their conclusion that "no firm conclusions could be drawn" (Verhagen 2004).

Six studies in our review assessed massage as a single treatment; however, each study used a different form of "massage" (e.g. Traditional Chinese massage, ischaemic compression, self-administered ischaemic pressure using a J-knob cane, conventional Western massage and occipital release). Attempt was made to use the three-level classification system by Sherman et al to classify the different types of massage therapy techniques based on the goals of the treatment, the style and the technique (Sherman 2006). But due to the lack of sufficient studies in each subcategory, it was hard to compile the data of the studies. Moreover, of the trials with non-significant findings, one gave only one treatment session (Hanten 1997), and one only assessed a self-administered massage (Hanten 2000), practices that are likely to be considered sub-optimal in the clinical setting. It is also likely that the small sample sizes (median 20 per arm) and the inability to pool data made it difficult to find any statistically significant effect.

Our review also did not find a strong or moderate level of evidence for or against massage in studies that combined massage with other modalities. Several difficulties undermined our understanding of the contribution of massage to the overall effect. Primarily, the designs were not such that the relative contribution of massage could be ascertained from other therapies with which it was combined. Factorial designs would be needed to tease out the contribution of massage from other therapies, and these were not done. For example, two commonly used neck-pain modalities are deep tissue massage and manipulation. A 2x2 factorial design randomising first to massage or no treatment, and then randomising each of those groups to manipulation or no treatment would yield a study that allows comparison of four experimental situations: no treatment, massage alone, manipulation alone and the two treatments combined. In the absence of factorial designs, we aimed to find a superior multimodal treatment in general, but no such trend emerged.

Moreover, most studies lacked a definition, description, or rationale for massage as a treatment or the massage technique selected. There are numerous massage techniques and these techniques can have different physiological effects. A massage taxonomy with vocabulary, definitions and mechanisms of action of various massage approaches would significantly assist researchers in selecting appropriate techniques and interpreting the results of massage studies.

In addition to massage technique, researchers need to establish optimal parameters for the other components of the massage treatment, including frequency (number of MT sessions per week), duration (length of time of each massage session) and dosage (depth/pressure and duration of application of depth). Pilot studies of massage to establish an optimal, or at least adequate treatment, should be conducted prior to doing a larger trial. These pilot studies would serve a purpose similar to the small dose-finding studies conducted in pharmaceutical trials that are used to establish a minimally effective dose.

Some of the treatment components may affect pain outcomes as suggested in the meta-analysis by Moyer and colleagues (Moyer 2004). When assessing the total number of treatments, the authors reported no effect on pain immediately after a single massage, but significant pain reduction days to weeks after multiple massages. They found no significant trend for the duration of a session, but emphasize that in massage for pain relief, neither the optimal frequency, optimal duration of session, nor the "decay" time in analgesic effect is known.

The massage treatment components need to be reported in the manuscript in a transparent, standardised way. We note that many of the trials in this review did not report sufficient details on the massage characteristics to permit replication. To address the reporting and methodological issues that are inherent to the design of massage trials, reporting conventions such as those proposed in the CONSORT statement (Altman 2001) for clinical trials, or the STRICTA statement (MacPherson 2002) for clinical trials of acupuncture specifically, are needed for massage trials. We also note the lack of reporting on the qualifications or experience of those performing the massage. This may reflect the lack of consideration given to this issue. Individuals who do massage range from those with no formal training to those with doctoral degrees in massage therapy. Potential variability in outcomes may be associated with the level of experience or training of those who performed the massage. Future trials need to provide justification for the therapist(s) selected to perform the intervention. To ensure the competence of the massage professional(s), investigators in recent studies have set minimal credential and experience criteria and even conducted a working interview (Eisenberg 2002).

The majority of trials did not report adverse events. From the trials reporting them, adverse effects of massage appear to be minimal and transient. It was not clear from the reports whether adverse effects had been measured or not. In order to achieve a balanced discussion between efficacy and harm, trials need to document all adverse events in a standardised format and, equally important, to document if none occur.

In our review, no trials met the criteria of double-blinding (blinded patients and care providers). This is because in massage studies, blinding patients can be difficult and blinding care providers is impossible. Therefore, other design features must attempt to com-

pensate for the lack of blinding. Treatments need to be equally credible and acceptable to patients to minimize placebo effects and high dropout rates. It is also necessary to collect and report information on patients' previous experience with massage, or their expectations of massage, in order to assess the impact of expectations. Finally, although it is difficult to blind the patients and therapists, the outcome assessor can and always should be blinded.

The outcome measures in the studies described in our review were diverse, and several were not validated. The use of reliable and valid outcome measures is essential in order to reduce bias, provide precise measures and allow for comparisons across trials. Disability-oriented outcomes such as 'return-to-work', 'activities of daily living' and 'function' were rarely reported. We suggest these be included in future studies.

Our approach to summarizing the literature has several strengths. We conducted a comprehensive, librarian-assisted search of multiple databases. A minimum of two people extracted data, while the principal investigator verified data entry. In addition, to minimize bias, we used a group consensus approach coupled with the Sackett (Sackett 2000) and Van Tulder (Van Tulder 2003) hierarchy on the strength of the evidence.

The weakness of this review rests with limitations of the primary studies. We were unable to make any firm statements about the strength of the evidence due to four cardinal limitations of the studies: (a) number of studies that were of low methodological quality; (b) the majority of studies used massage as one component in a multimodal treatment but failed to use a research design such as a factorial design that could ascertain the relative contribution of massage; (c) no study provided pilot data justifying the minimal effective 'amount' of massage (frequency, duration, dose, technique), thus there is little information on what constitutes a beneficial amount of massage and (d) many studies were underpowered but could not be pooled due to heterogeneous populations, massage techniques, treatment combinations and control groups.

Summary of main results

Since the last Cochrane review update (Haraldsson 2006a), 15 trials relating to massage were reviewed for the current Cochrane review. As of yet, there has not been an established ideal massage therapy approach to managing cervical pain both specific and non-specific.

The most commonly treated disorder type was specific myofascial pain or non-specific neck pain with positive trigger points. Different forms of "massage" were compared with a placebo, to no treatment or to an adjunct treatment. Our systematic review did not find strong or moderate levels of evidence for massage alone relative to a control.

When massage was compared with no treatment or placebo treatment, there was no difference found in pain intensity (Blikstad 2008; Briem 2007; Gemmell 2008 (p 30-36); Hanten 1997; Irnich 2001). Low level evidence showed that Traditional Chinese massage was better at improving function than no treatment for patients with subacute/chronic neck pain (Cen 2003).

Classical and modified-strain/counter-strain massage improved pain tenderness in the immediate term (Meseguer 2006). However, the low levels of evidence in these studies due to poor methodological quality preclude making any generalisable statement about the effectiveness of massage even when massage has been found to be superior to control.

There is no difference in pain intensity, physical function and quality of life when massage is compared with other therapies such as manual therapy, acupuncture, education, exercise and multimodal intervention. However, studies that compare one active treatment versus another active treatment require larger sample sizes than studies that compare an active treatment with a placebo. Thus, it is impossible to determine whether the 'no difference' findings in the studies comparing active treatment with active treatment reflect true equivalence or merely sample sizes too small to detect a difference. No difference was found when different massage therapy techniques were compared among each other (Fernandez 2006; Gemmell 2008 (p 30-36); Kostopoulous 2008).

Even when statistical significance was found, such as an improvement in pain with the combination of ischaemic compression and passive stretch compared with individual treatment (Kostopoulous 2008), the lack of replicability of the study precludes making a statement about the effectiveness of one massage technique over another.

Overall completeness and applicability of evidence

The application of the massage techniques can be remarkably different in research trials relative to how it is applied in clinical practice. A standardised taxonomy continues to be needed for massage. Although one has been suggested (Sherman 2006), there is no movement to adopt this within the research community.

Beyond the normal methodological quality issues, such as proper randomisation and blinding that are indispensable in all randomised trials, massage trials present additional challenges. In these studies, often only the frequency of the intervention was reported. Yet, treatment parameters need to be detailed beyond treatment frequency (sessions per week) and should include the type of massage, the duration of a massage session, and the intensity or grade/depth of pressure at a minimum. There also needs to be detailing of the technique and the prior experience and training of clinician, as this could be a valuable source of heterogeneity and affect outcomes. In practice, practitioners use a broad range of treatment approaches and may treat patients for a longer time. This means that for studies to reflect practice, the studies may need

to combine treatment approaches using factorial designs, also treat and follow up patients for longer periods of time.

Measures that promote rigor in clinical trials such as careful control of the intervention may produce results that are less relevant for clinicians in typical practice and decision makers.

For example, the timing of the outcomes measurement in the sequence of care immediately post-treatment may not be optimal to depict the effect of massage on outcome domains. It may be clinically relevant to measure outcomes days after the treatment, or after multiple treatments. Moyer et al makes the case for assessing outcomes after multiple treatments by noting in their meta-analysis of massage studies that there was no effect on pain immediately after a single massage, but significant pain reduction days to weeks after multiple massage (Moyer 2004).

Thus, Moyer and colleagues' meta-analysis challenges an assumption that immediate post-treatment is the only interval where a biologic effect occurs; thus, biologically based paradigms for measuring outcomes may need to be established (Moyer 2004). Additionally, Moyer's meta-analysis found no significant trend based on the duration of a session, and thus emphasize that neither the optimal frequency nor duration of massage treatments for pain reduction and the "decay" in analgesic effect on pain is yet known. Further research in establishing these parameters would immensely benefit future massage trials.

Quality of the evidence

The following represents a key feature of concern to massage. The majority of the studies were rated "high risk" in regards to blinding. One bias inherent in all trials is that blinding of patient, care provider, and often outcome assessor was often not achieved and can lead to exaggerated treatment effect estimates. Blinding of the therapist is not possible, so significant effort to blinding the outcome assessor is needed. In most studies reported in this review, the primary outcome is a "self-report" outcome such as pain, global perceived effect, disability/function or quality of life, in other words a "subjective" outcome type.

The bottom-line is that blinding is impossible for some procedures unless a viable placebo procedure exists. The care giver cannot be blinded. The outcome assessor may in main outcomes like pain be "the patient" and cannot be blinded to their previous score, especially if the timing of the outcome immediately post-treatment or at short-term follow-up.

In addition, the reporting of outcomes for most of the trials was rated "unclear," with the exception of one trial (Gemmell 2008 (p 30-36)). The majority of the studies did not have a previously published (and referenced in the current paper) protocol initiated prior to the start of the study.

Potential biases in the review process

Our approach to summarising the literature has several strengths. We conducted a comprehensive, librarian-assisted search of multiple databases. A minimum of two people extracted data, and the principal investigator verified data entry. In addition, we used a group consensus approach coupled with 'Risk of bias' analysis to minimise bias and gain internal validity of the included studies. The external validity of the studies was assessed using GRADE analysis.

The weakness of this paper rests with limitations of the primary studies. The majority of studies were of high risk of bias; no study provided pilot data justifying the minimal effective "amount" of massage (frequency, duration, dose, technique) thus there is little information as to what constitutes a beneficial amount of massage; and many studies were underpowered but could not be pooled. Difficulties arose due to heterogeneous populations and perhaps inappropriate "weighting" of variables. The majority of the studies used pain tenderness as an outcome measure and assessed only the immediate post-treatment effect of a single application of treatment, which is not clinically relevant. The studies were heterogeneous in the types of massage technique that were used, and there were only single low level trials on massage technique. Thus, it was hard to determine the effectiveness of those treatments. In the study by Dechartres 2011, it was found that the treatment effects of single centre trials were larger than the effects of large scale multicentre trials. Taking into account that the trials used in the Dechartres 2011 study had large sample size compared to the trials used in our review, we should be cautious of our results as they were mostly single centre trials with extremely small sample size.

Agreements and disagreements with other studies or reviews

Based on the review of reviews, multiple reviews showed no difference or no benefits when massage was compared with other treatments such as acupuncture, education and exercise (Haraldsson 2006a; Furlan 2010). These results are consistent with the results of our review. The review Furlan 2010 is the most recent review done on Massage therapy for neck pain. The recommendations of the Furlan 2010 review state that there is low grade evidence that massage is more effective in reducing pain than control or placebo treatment. This recommendation contrasts from the results of our review. This contrast is because our review has excluded a few studies that Furlan 2010 had included. Along with that, though both reviews included the study Blikstad 2008, our review considered the activator trigger point therapy as a form of manipulation while Furlan 2010 considered it as a massage therapy technique. Clinical applicability was not assessed in any of the other previous reviews, but it was assessed in our review.

The previous version of this Cochrane review (Haraldsson 2006a) and review by Ezzo 2007 , which is a precursor to the Cochrane review, noted limited implications for clinical practice. No recom-

mendations could be made due to unclear evidence and the difficulty in comparing remarkably different massage forms. Four different massage therapy approaches, all in trials of very low quality and of moderate clinical applicability showed evidence of no benefit in pain relief when compared to different forms of control. The trials within these two reviews included ischaemic compression; the use of a J-cane tool; Western massage; and occipital release for typically subacute or chronic neck pain.

Most commonly, there was no uniform definition, no definition of the massage technique and no related dosage. This latter finding was also observed in our review.

AUTHORS' CONCLUSIONS

Implications for practice

The results of the review showed that certain massage techniques (traditional Chinese massage, classical and modified strain/counterstrain technique) were more effective than control or placebo treatment for improving function and tenderness. Massage was also more beneficial than education in the short term for pain bothersomeness. Along with that, it was also found that ischaemic compression and passive stretch are more effective in combination rather that individually for pain reduction. These results are not clinically applicable as they only looked at the immediate post-treatment effect on clinically irrelevant outcome measures such as pain tenderness and bothersomeness. Due to the limitations of existing studies, we are unable to make any firm statement to guide clinical practice.

Implications for research

Massage was primarily applied for a single session and immediate effect on outcomes was measured which does not match typical practice. Short-, intermediate- and long term-term are needed. There is a need to assess more global outcome measures that patients can relate to such as physical function and quality of life rather than considering outcomes such as pain intensity or tenderness. Pilot trials characterising the massage treatment including the frequency, duration, number of sessions, and massage technique are needed. The optimal massage treatment to be used in subsequent larger trials must be established. Along with that, future trials should adequately report on the qualification of the practitioner providing massage. Factorial design including randomisation first to massage or no treatment, and then randomising to other treatment modalities would prove most informative to delineate the additive/subtractive and individual effect of massage to any given treatment combination. The Cochrane 'Risk of bias' tool is based on six domains: sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and other sources of bias; vigilance to these domains must underpin future trials.

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Haraldsson B, Gross A, Myers CD, Ezzo J, Morien A, Goldsmith CH, et al. Cervical Overview Group. Massage for mechanical neck disorders. *Cochrane Database of Systematic Reviews* 2006, Issue 3. [DOI: 10.1002/14651858.CD004871.pub3

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Blikstad 2008

Methods	RCT Number Analysed/Randomised: GA: 15/15, GB: 15/15, GC: 15/15, Total: 45/45 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Non-specific cervical disorders and mechanical neck pain without radicular signs present between 4 to 12 weeks
Interventions	INDEX TREATMENT: Group A (GA): Myofascial band therapy: firm thumb pressure in a slow stroking motion from lateral shoulder to mastoid process along the upper trapezius muscle and through active trigger points COMPARETOR TREATMENT Group B (GB): Activation of trigger point therapy: AAI hand held device was placed perpendicular over the trigger point using a force setting of 3 (170N) Frequency: 1 session Dose: 3 (170N), 10 thrusts, 1 thrust per session CONTROL TREATMENT: Group C (GC): sham ultrasound: Medi Link Systems ultrasound machine was used. Patients were informed that a pulsed ultrasound was going to be applied, they were notified that they should not feel any heat or pain with the ultrasound Duration: two minutes Duration of Follow-up: Immediate
Outcomes	Pain: NPRS Pain Pressure Threshold: Pressure Pain Algometer Baseline Mean: Pain: GA: 4.6, GB: 4.6 GC: 4.7 Timing of outcomes: GA, GB, GC: Baseline, within 5 minutes of treatment Reported Results: statistically significant results in pain reduction favouring the GB with NNT = 3 RR (GA vs GB): 1.86 (95% CI 1.04 to 3.30) RR (GA vs GC): 1.00 (95% CI 0.76 to 1.32) ADVERSE EVENT: reported, post-treatment pain COST OF CARE: NR
Notes	Country: Bournemouth, England
Risk of bias	

Blikstad 2008 (*Continued*)

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Low risk	The randomisation scheme was generated by using the website Randomization.com To ensure equal numbers in the groups; participants were randomised in blocks of three Sealed opaque envelopes were prepared containing the assigned treatment and numbered consecutively. Participants were allocated to the next available envelope number
B) Allocation concealment (selection bias)	Low risk	Assignment generated by an independent person not responsible for determining the eligibility of the patients (The randomisation scheme was generated by using the website Randomization.com)
C) Blinding (patient)	High risk	Although the participants were randomised to three groups, they would be able to tell if they were receiving activator trigger point therapy, myofascial band therapy or sham ultrasound (control group) based on the information provided to them in order to join the study
D) Blinding (care provider)	High risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	High risk	Only the control group would have been blinded since they received sham ultrasound. The other intervention groups would be able to recognize that they were not allocated to receive ultrasound
F) Incomplete outcome data (attrition bias)	Low risk	All of the participants completed the study
G) Randomised participants analysed in their groups (reporting bias)	Low risk	Clinically significant improvement was determined using an odds ratio and number needed to treat (NNT) with 95% confidence intervals
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study

Blikstad 2008 (*Continued*)

I) Baseline similarities	Low risk	Well specified inclusion criteria
J) Similar or avoided co-interventions	Low risk	The participants were randomly assigned to one of three treatment groups: activator trigger point therapy, myofascial band therapy or sham ultrasound (control group) intervention well specified in the procedure section of the study
K) Acceptable compliance	Low risk	Participant adherence to the intervention specified in the procedures section of the study
L) Similar outcome assessment	Low risk	All outcomes were assessed at the same time for each group
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Briem 2007

Methods	RCT Number Analysed/Randomised: GA: 20/20, GB: 20/20, Total: 40/40 Intention-to-treat Analysis: NR Power Analysis: beta value per comparison: 80% (1-tailed test=1B=15.6%)
Participants	Non-specific neck pain with/without cervicogenic headache (pain in the cervical region)
Interventions	INDEX TREATMENT: Group A (GA): Inhibitive Distraction (ID): patient rests in supine. therapist places fingertips onto suboccipital musculotendinous structures just caudal to the superior nuchal line and induce a sustained force in a ventro-cranial direction, thus exerting compressive forces as well as distraction to cervical and suboccipital structures. Pressure was applied slowly, maintained and released slowly. pressure was applied perpendicular to longitudinal axis of muscles and tendons. pressure was less than what would excite a muscle and was applied at an increasingly deeper level. Amount of pressure was individualised according to therapist perception of the patient's tolerance as reflected by muscle response Dose: pressure ranged from light pressure and no distraction force applied with the weight of the participant's head partially supported by therapist's thenar eminence to the full weight of the participant's head resting on therapist's finger tips and distraction applied. CONTROL TREATMENT: Group B (GB): Placebo: patient supine and rested their head in palms of clinician for the same duration to mimic treatment position. Participants received effects of touch, warmth and rest Timing: 11:00 PM and 3:00 PP in the same private exam room Frequency: 1 time

Briem 2007 (*Continued*)

	Duration: 3 to 3.5 minutes Duration of Follow-up: Immediate
Outcomes	Pain: Numeric Pain Rating Scale (NPRS) Baseline Mean: GA: 4.0 (2.1), GB: 3.7 (2.1) SMD (GA vs GB): 0.33 (95% CI -0.29 to 0.96) Reported Results: No significant improvement in ROM within and between groups Calculated Results: SMD (GA vs GB): -0.11 (95% CI -0.73 to 0.51) ADVERSE EVENT: NR COST OF CARE: NR
Notes	Country: Iceland Author provided pre and post data on pain rating for treatment and control group

Risk of bias

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Unclear risk	The clinic's receptionist supervised a list of 40 consecutive numbers, to which an intervention or placebo treatment had been randomly assigned (p84) The study does not mention a example of an adequate method of randomisation such as, coin toss (for studies with two groups), rolling a dice (for studies with two or more groups), drawing of balls of different colours, drawing of ballots with the study group labels from a dark bag, computer-generated random sequence, pre-ordered sealed envelopes, sequentially-ordered vials, telephone call to a central office, and pre-ordered list of treatment assignments
B) Allocation concealment (selection bias)	High risk	Not explicitly mentioned or described in the study
C) Blinding (patient)	Low risk	Use of a control group, to ensure blinding
D) Blinding (care provider)	High risk	The clinic's receptionist informed the therapist providing the intervention whether the experimental or the placebo technique was to be administered on the day of treat-

Briem 2007 (*Continued*)

		ment
E) Blinding (outcome assessor)	Low risk	Yes, because they (participants) were randomised to either the intervention group or the control group
F) Incomplete outcome data (attrition bias)	Low risk	All of the participants completed the study
G) Randomised participants analysed in their groups (reporting bias)	High risk	Intention-to-treat analysis was not performed
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Unclear risk	Not clearly outlined in the study regarding pain duration, author accepted a broad range of possible neck conditions for inclusion into the study
J) Similar or avoided co-interventions	Low risk	The authors randomised participants into one of two groups; intervention or control. Study mentions that no other intervention was provided to either group
K) Acceptable compliance	Low risk	Yes, participants adhered to their programs, no drop-outs reported
L) Similar outcome assessment	Low risk	NPRS and cervical ROM measurements were collected at the same time for both groups
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity.

Cen 2003

Methods	RCT cross-over (1st period data used) Number Analysed/Randomised: GA: 9, GB: 8, GC: 11, Total: 28/31 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Chronic MND
Interventions	INDEX TREATMENT: Group A (GA): Traditional Chinese Therapeutic Massage using the following two techniques: One finger mediation massage that uses tip and/or whole surface of thumb, Rolling massage uses the fifth metacarpophalangeal joint and hypothenar eminence,

Cen 2003 (*Continued*)

	both use swinging back and forth motion 120 times per minute Duration: 30 minutes Timing: 3 times per weeks for 6 weeks. COMPARISON TREATMENT: Group C (GC): No treatment control Group B (GB): Therapeutic exercise program; specific stretching (head tilt, trapezius stretch, neck flexion, shoulders and neck rolls) for 10 minutes directed by physician with weekly follow-up for 6 weeks Duration: 10 minutes Treatment Schedule: GA = 6 weeks, 18 total sessions; GB = 1 initial visit, 5 telephone follow-ups; Duration of Follow-up: Immediate
Outcomes	Function: Northwick Park Pain Questionnaire (score 0 to 100) Baseline Mean: GA: 32.4, GB: 27.8, GC: 31.5 Reported Results: significant difference favours group GA compared to GB and GA compared to GC Calculated Results: SMD (GA vs GC): -1.75 (95% CI -2.82 to -0.68)* SMD (GA vs GB): -0.55 (95% CI -1.53 to 0.42) ADVERSE EVENT: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	The study utilised a pre-generated list of treatment assignments. The participants were assigned to 3 groups (A, B, C)
B) Allocation concealment (selection bias)	High risk	Not explicitly mentioned or described in the study
C) Blinding (patient)	Unclear risk	Use of a control group to ensure blinding , however it is hard to determine whether or not the participants in the exercise group or Traditional Chinese Therapeutic Massage (TCTM) group were unaware of the type of treatment they were receiving
D) Blinding (care provider)	High risk	No, it is hard to blind the care provider during a study examining manual therapy techniques or therapeutic exercise as an intervention

E) Blinding (outcome assessor)	High risk	Both the participants in the TCTM and exercise groups would be able to detect a change in their cervical ROM and pain post intervention. Therefore, it would have been hard to blind the participants in the TCTM and exercise program from what effects they should be experiencing
F) Incomplete outcome data (attrition bias)	Low risk	The researchers provided an adequate explanation why the participants dropped out from the study such as, orthopedic surgeon's recommendation, and/ or for personal reasons
G) Randomised participants analysed in their groups (reporting bias)	High risk	Intention-to-treat analysis was not performed, and the study does not indicate how soon the measurement effects were obtained
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria of the study
J) Similar or avoided co-interventions	Unclear risk	Not indicated or explicitly stated within the study
K) Acceptable compliance	High risk	During Phase 1 of the study, only the participants in the exercise group were checked on by the physician to ensure their compliance with the intervention. However, the study does not mention if this occurred for the remaining groups. Additionally, the compliance to the interventions was not stated for Phase 2.
L) Similar outcome assessment	Low risk	Northwick Park pain questionnaire and cervical ROM measurements were collected at the same time for all groups e.g. baseline, post Phase 1 and 2
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Fernandez 2006

Methods	RCT Number Analysed/Randomised: GA: 20/20, GB: 20/20, Total: 40/40 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Mechanical neck pain for at least 2 weeks and diagnosed with Myofascial trigger points, either latent or active in the upper fibres of trapezius
Interventions	INDEX TREATMENT: Group A (GA): Ischemic compression technique: Patient in supine with cervical spine in neutral. Therapist applies gradually increased pressure to the Myofascial trigger points until the sensation of pressure becomes one of pressure and pain. At that moment, the pressure was maintained until the discomfort and/ or pain eased by around 50% perceived by the patient, at that time the pressure is increased until discomfort appears again. This process was repeated for 90 seconds Treatment schedule: 1 session Duration: 90 seconds Duration of follow-up: Immediate COMPARISON TREATMENTS: Group B (GB): Transverse friction massage: Transverse friction massage was applied with the forefinger and reinforced with the middle finger. This technique was executed with the muscle in the relaxed position, and was applied for 3 minutes. Frictions were applied slowly with a pressure slightly painful, approximately at the pressure pain threshold (PPT) level of each patient Treatment schedule: 1 session Duration: 3 minutes Duration of follow-up: Immediate Co-intervention: avoided in the trial design by excluding participants who have undergone myofascial pain therapy within the previous month
Outcomes	Pain: Visual Analog Scale (VAS) Baseline Mean: GA: 4.6 mm, GB: 3.8 mm Timing of outcome: Baseline and 2 minutes post-treatment Reported Results: Significant improvement for pain within each group but no difference between groups (P > 0.4) Pain: GA: P=0.03, Effect size(intra group Cohen's d)= 2.6 GB: P=0.04, Effect size(intra group Cohen's d)= 1.75 SMD (GA vs GB): -0.29 (95% CI -0.91 to 0.34) ADVERSE EVENT: NR COST OF CARE: NR
Notes	Country: Alcorcon, Spain

Risk of bias

Fernandez 2006 (*Continued*)

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Low risk	A random (unpredictable) assignment sequence. For example, participants were divided randomly into two groups, using a table of random numbers: group A was treated with ischaemic compression technique, and group B was treated with a transverse friction massage
B) Allocation concealment (selection bias)	Unclear risk	Not explicitly mentioned or described in the study
C) Blinding (patient)	Unclear risk	Unsure if participants did not know what intervention they were receiving
D) Blinding (care provider)	High risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	Unclear risk	Unsure if participants did not know what intervention they were receiving, as they are the individuals to report their experience of a change in pain etc
F) Incomplete outcome data (attrition bias)	Low risk	All of the participants completed the study
G) Randomised participants analysed in their groups (reporting bias)	Low risk	VAS and Pain Pressure Threshold (PPT) values were recorded both at baseline/ pre-treatment and immediately post-treatment. An independent t-test was also used to detect any differences between the groups post-treatment
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Well specified inclusion criteria, for example similar pain durations, presence of a myofascial trigger point etc
J) Similar or avoided co-interventions	Low risk	None reported
K) Acceptable compliance	Low risk	Explicitly explained in the procedure section
L) Similar outcome assessment	Low risk	Explicitly explained in the results section

Fernandez 2006 (*Continued*)

M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Fryer 2005

Methods	RCT Number Analysed/Randomised: GA: 20/20, GB: 17/17, Total: 37/37 Intention-to-treat Analysis: Power Analysis: NR
Participants	Mechanical cervical disorder (myofascial pain upper trapezius)
Interventions	INDEX TREATMENT: Group A (GA): Manual pressure release: Slow pressure was applied to myofascial trigger point the until the participant reported a 'moderate but easily tolerable' pain value of 7 out of 10. Manual pressure release pressure sustained for 60 seconds. Pressure applied at the end of the 60 seconds treatment was recorded CONTROL TREATMENTS: Group B (GB): Sham myofascial release: Extremely light pressure of no greater than 2N/cm^2 was applied to the myofascial trigger point. Pressure was held for 60 seconds Treatment schedule: 1 session Duration: GA and GB: 60 seconds Duration of follow-up: Immediate Co-interventions: NR
Outcomes	Tenderness (pain pressure threshold): Mean change (N/cm^2): pain pressure threshold: GA: -2.05 N/cm^2, GB: 0.083 N/cm^2 Timing of outcomes: GA and GB: Baseline, Immediate post-treatment Reported Results: statistical significant change in pain pressure threshold after Manual pressure release ($P < 0.001$) and within-group effect size was large (d= 1.35) SMD (GA vs GB): -1.23 (95% CI -1.94 to -0.52) ADVERSE EVENT: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	p 251, R column P5, adequate

Fryer 2005 (*Continued*)

B) Allocation concealment (selection bias)	Unclear risk	Not described
C) Blinding (patient)	Low risk	p251, R, P2, blinding of pt adequate
D) Blinding (care provider)	High risk	Not possible
E) Blinding (outcome assessor)	Low risk	Patient is the outcome assessor
F) Incomplete outcome data (attrition bias)	Low risk	Yes, due to pre/ post design
G) Randomised participants analysed in their groups (reporting bias)	Low risk	Yes, pre/post design
H) Selective reporting (reporting bias)	Unclear risk	No protocol
I) Baseline similarities	High risk	Not described
J) Similar or avoided co-interventions	Low risk	Yes, pre/ post
K) Acceptable compliance	Low risk	Yes, pre/ post
L) Similar outcome assessment	Low risk	Immediate post
M) Study acceptable or flawed	Low risk	Acceptable

Gemmell 2008 (p 30-36)

Methods	RCT Number Analysed/Randomised: GA: 15/15, GB: 15/15, GC: 15/15 Total: 45/45 Intention-to-treat Analysis: Yes Power Analysis: NR
Participants	Non specific cervical disorders or mechanical neck pain for greater then three months and diagnosed with myofascial trigger point (both active or latent) in the upper fibres of trapezius
Interventions	INDEX TREATMENT: Group A (GA): Ischemic Compression: sustained deep pressure with thumb to trigger point. Pressure was released when there was a decrease in tension in the trigger point or when the trigger point was no longer tender or when one minute had passed. Done to upper fibres of trapezius Group B (GB):Trigger Point Pressure Release: a non painful slowly increasing pressure with the thumb was given until a tissue resistance barrier was felt. The pressure was increased until a new barrier was felt. This process was repeated until there was no more trigger point tension or tenderness or until 90 seconds had passed. Done to trigger points in upper fibres of trapezius CONTROL TREATMENTS:

Gemmell 2008 (p 30-36) (*Continued*)

	Group C (GC): Sham Ultrasound: A de-tuned Medi-Link Systems ultrasounds machine was used. Patients were told a pulsed ultrasounds was going to be used. Ultrasounds was applied over UFT Treatment schedule: GA and GB 1 session Duration: GA 30 to 60 seconds, GB 90 seconds Duration of follow-up: Immediate Co-interventions: NR
Outcomes	Pain: VAS Baseline Mean: Pain: GA: 41.3 mm, GB: 43.8 mm, GC: 38.1 mm Timing of outcomes: GA, GB, GC: Baseline, within 5 minutes of treatment Reported Results: No statistical significant results between groups. There was a clinical significant difference between the GA and GC in the number needed to treat. GA: NNT = 3; vs GC: NNT = 5 SMD (GA vs GB): -0.28 (95% CI -1.00 to 0.44) SMD (GA vs GC): 0.02 (95% CI -0.69 to 0.74) SMD (GB vs GC): 0.33 (95% CI -0.39 to1.06) ADVERSE EVENT: reported, post-treatment pain COST OF CARE: NR
Notes	Country: Bournmouth, England

Risk of bias

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Low risk	The study was a randomised, single-blind, placebo-controlled trial, and the randomisation scheme was generated by using the website Randomization.com.
B) Allocation concealment (selection bias)	Low risk	To ensure equal numbers in the groups, participants were randomised in blocks of three. Sealed opaque envelopes were prepared containing the assigned treatment and numbered consecutively. Participants were allocated to the next available envelope number
C) Blinding (patient)	Low risk	The participants were unaware of the method of treatment application, e.g. Ischemic Compression vs. Trigger Point Release. In addition, a de-tuned ultrasound

Gemmell 2008 (p 30-36) (*Continued*)

		was used, therefore although the patient was aware that they were receiving ultrasound, they were unaware that it was sham
D) Blinding (care provider)	Unclear risk	No, it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	Unclear risk	Unsure, only the participants receiving the manual therapy techniques would be unaware as to the type. However, it is hard to ascertain that the participants in the ultrasound group were unaware that they were not allocated to the manual therapy technique groups
F) Incomplete outcome data (attrition bias)	Low risk	All participants completed the study, no drop-outs were reported
G) Randomised participants analysed in their groups (reporting bias)	Low risk	Study explicitly explains that statistical analysis was conducted using INSTAT TM for Windows. The primary outcome was clinical improvement, which was defined as a reduction of 20 mm on the VAS for pain. Clinically significant effect size was determined using an OR and NNT with 95% CI.
H) Selective reporting (reporting bias)	Low risk	Yes, all outcomes were reported
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria
J) Similar or avoided co-interventions	Low risk	None reported in the study
K) Acceptable compliance	Low risk	Yes, as it was the examiners applying the treatment.
L) Similar outcome assessment	Low risk	Yes, the measure was based on immediate effect.
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Gemmell, 2008 (p175-181)

Methods	RCT Number Analysed/Randomised: GA: 25/25, GB: 27/27, Total: 52/52 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Non specific cervical disorders and myofascial pain syndrome for no more then 12 weeks
Interventions	INDEX TREATMENT: Group A (GA): Ischemic Compression: continuous perpendicular deep thumb pressure to identified trigger point. Pressure was released according to which occurred first: a palpable decrease in trigger point was felt or 60 seconds had surpassed. Done to upper fibres of trapezius COMPARISON TREATMENT: Group B (GB): Activation Trigger Point: the Activator Adjusting Instrument IV was used. It has four force setting and the third was used (170N) to treat the trigger point. The instrument was placed perpendicular to the trigger point and 10 trusts were given at a rate of 1 thrust per second. Done to upper fibres of trapezius Treatment schedule: GA and GB 1 session Duration: GA 30-60 seconds, GB none Dose: GA none, GB Force 3 (170N), 10 thrusts, 1 thrust/ second Duration of follow-up: Immediate Co-interventions: NR
Outcomes	Pain: NPRS Patient satisfaction: Patient Global Impression of Change (7-point scale) Baseline Mean: Pain: GA 5, GB 5 Timing of outcomes: GA and GB: Baseline, between 5 and 10 minutes of treatment Reported Results: Pain: there was a statistically significant difference post-treatment in both groups. GA P = 0.0059, GB P < 0.001 RR PGIC: 1.00 (95% CI 0.73 to 1.37) RR NPRS: 1.13 (95% CI 0.57 to 2.26) SMD (GA vs GB): -0.19 (95% CI -0.73 to 0.36) ADVERSE EVENT: reported, post-treatment pain COST OF CARE: NR
Notes	Country: Bournemouth, England

Risk of bias

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Low risk	The randomisation schedule was generated using the website: http://www.ran-

Gemmell, 2008 (p175-181) (*Continued*)

		domization.com. Sealed opaque envelopes were prepared by the clinician (HG) and numbered consecutively, containing the assigned treatment. Participants were given the assigned treatment based on the consecutively numbered envelope
B) Allocation concealment (selection bias)	Low risk	The examiner was blind to treatment allocation while the clinician and patient were not. The randomisation scheme was concealed from the examiner until data analyses were complete. Success of blinding was evaluated by asking the examiner if she was able to determine assignment; she was not able to do so
C) Blinding (patient)	High risk	No, because the patient would be able to tell the difference between having an instrument applied to the skin or the examiners hands
D) Blinding (care provider)	High risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	Low risk	Yes, because they would be unaware as to how much pressure was to be applied to receive an effect
F) Incomplete outcome data (attrition bias)	High risk	Initially 70 participants were screened, and 18 excluded. This figure exceeds the 20% cut-off for a short-term follow-up
G) Randomised participants analysed in their groups (reporting bias)	High risk	The primary outcome measure; Patient Global Impression of Change (PGIC) calculations not provided, only the result are indicated
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria.
J) Similar or avoided co-interventions	Low risk	None reported in the study
K) Acceptable compliance	Low risk	Yes, as it was the examiners applying the treatment.

Gemmell, 2008 (p175-181) (*Continued*)

L) Similar outcome assessment	Low risk	Yes, the measure was based on immediate effect.
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Hanten 1997

Methods	RCT Number Analysed/Randomised: 60/60 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Mechanical neck disorder of unknown duration
Interventions	INDEX TREATMENT Group 1 : Occipital release, patient in supine with patients head in examiner's hands, fingers extending upward, maintaining a slight amount of traction COMPARISON TREATMENT Group 2: Active head retraction in sitting 10 repetitions, followed by retraction/extension for a total of five sets (McKenzie neck protocol) Group 3: Control group, no treatment Treatment Schedule: 1 session Duration of Follow-up: Immediate
Outcomes	Pain Pressure Threshold Baseline Mean: Group 1: 2.1, Group 2: 2 , Group 3: 2.2 Reported Results: There was no significant difference between the treatment groups and the control group (p > 0.05) Calculated Results: SMD (1 vs 3): -0.07 (95% CI -0.69 to 0.55) SMD (1 vs 2): -0.24 (95% CI -0.87 to 0.38) ADVERSE EVENT: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	High risk	The study does not mention a example of an adequate method of randomisation such as, coin toss (for studies with two groups) , rolling a dice (for studies with two or more groups), drawing of balls of different

Hanten 1997 (*Continued*)

		colours etc
B) Allocation concealment (selection bias)	High risk	Not explicitly mentioned or described in the study
C) Blinding (patient)	High risk	No, they were asked to point to their most painful area of the neck and upper back at or above T6, next the participants received a familiarisation session to become acquainted with the sensation of the pressure algometer on all marked trigger points before the primary trigger point was determined. Therefore, the participants were aware as to what the intervention would encompass
D) Blinding (care provider)	High risk	No it is hard to blind the care provider during a study examining manual therapy techniques
E) Blinding (outcome assessor)	High risk	No, the outcome assessor would be able to tell a difference between a decrease in pain of an active trigger point compared to no change at all
F) Incomplete outcome data (attrition bias)	High risk	All of the participants completed the study, no drop-outs were reported
G) Randomised participants analysed in their groups (reporting bias)	Unclear risk	Not indicated and stated with examples in the study
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria of the study.
J) Similar or avoided co-interventions	Low risk	None were reported
K) Acceptable compliance	Low risk	Yes, participants adhered to their intervention, and reports of non-compliance among study groups
L) Similar outcome assessment	Low risk	The outcome was an immediate effect of a release of an active trigger point

Hanten 1997 (*Continued*)

M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Hanten 2000

Methods	RCT Number Analysed/Randomised: 40/40 Intention-to-treat Analysis: NA Power Analysis: NR
Participants	Mechanical neck disorder of unknown duration without radicular symptoms
Interventions	INDEX TREATMENT Group 1: verbal and written instruction on Self-ischaemic compressions with a hand-held J shaped tool (sustained pressure until the participant felt a release), sustained stretches to cervical spine and upper back muscles (30 to 60 seconds) COMPARISON TREATMENT Group 2: verbal and written instruction on Active neck movements (flexion, lateral flexion, rotation) repeated 10 times, 2 times per day for 5 days Treatment schedule: 5 days Duration of follow-up: 3 days Duration of treatment: 5 days Duration of follow-up: 8 days
Outcomes	Pain: VAS (mean over 24 hours) Baseline Median: G1: 15.3, G2: 19.1 Reported Results: favouring G1 (ANCOVA p=0.043) Calculated Results: SMD: -0.61 (95% CI -1.24 to 0.03) ADVERSE EVENT: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	The examiners used a table of random numbers to randomise participants to either one of two groups: intervention or control
B) Allocation concealment (selection bias)	High risk	Not explicitly mentioned or described in the study

Hanten 2000 (*Continued*)

C) Blinding (patient)	High risk	Participants were informed how to actively release an active myofascial trigger point and what sensation they should experience
D) Blinding (care provider)	High risk	No it is hard to blind the care provider during a study examining manual therapy techniques
E) Blinding (outcome assessor)	High risk	No, the outcome assessor was informed as to what effect should be received from the intervention
F) Incomplete outcome data (attrition bias)	Low risk	All of the participants completed the study, they returned on day 2 for a re-examination and on the final day of the study
G) Randomised participants analysed in their groups (reporting bias)	Low risk	Yes, VAS, Percentage of time of pain and PPT measurements were conducted on all participants' pre- and post-treatment
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria
J) Similar or avoided co-interventions	Unclear risk	Not explicitly stated within the study
K) Acceptable compliance	Unclear risk	Although it was stated within the study that patients reported adherence, it is not explicitly stated how they adhered to their intervention
L) Similar outcome assessment	Low risk	VAS, Percentage of time of pain and PPT measurements were conducted on all participants at baseline and again at the end of the study 8 days later
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Irnich 2001

Methods	RCT Number Analysed/Randomised: GM: 49/56, GA: 59/60, GS: 57/61 Total: 165/177 Intention-to-treat Analysis: Conducted Power Analysis: NR
Participants	Subacute/chronic Mechanical neck disorder without radicular symptoms
Interventions	INDEX TREATMENT: Group M (GM): Massage: Conventional Western massage [effleurage, pétrissage, friction, tapotement] COMPARISON TREATMENTS: Group (GA): Accupuncture:Traditional Chinese approach [ear acupuncture and dry needling] Group (GS): Sham Laser: Laser pen that was inactivated by manufacturer Seirin International Treatment schedule: 30 minutes sessions, 3 times/weeks for total of 5 sessions Duration of follow-up: 1 week, 3 months
Outcomes	Pain: VAS Baseline Mean: GM: 54.71, GA: 54.15, GS: 57.15 Reported Results: Significant favouring GA compared to GM (P = 0.0052) (Dunnett's test) at 1 week post intervention; NS at 3 months Calculated Results: SMD (M vs S): -0.01 (95% CI -0.38 to 0.36) SMD (M vs A): 6.49 (95% CI -3.42 to 16.40) ADVERSE EVENT: Slight pain or lowered blood pressure reported by 4 patients in GM, 17 patients in GA, 12 patients in GS COST OF CARE: NR
Notes	Author provided details on treatment technique.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	Randomisation is adequate
B) Allocation concealment (selection bias)	Unclear risk	Allocation was not described
C) Blinding (patient)	Low risk	Patients were properly blinded
D) Blinding (care provider)	Low risk	Care providers were blinded
E) Blinding (outcome assessor)	High risk	Patient is the assessor.

Irnich 2001 (*Continued*)

F) Incomplete outcome data (attrition bias)	Low risk	Patient flow chart provided, and explanation provided for drop-outs
G) Randomised participants analysed in their groups (reporting bias)	Low risk	Intention-to-treat analysis was performed and described within the study
H) Selective reporting (reporting bias)	Unclear risk	No protocol
I) Baseline similarities	High risk	Baseline similarities not present
J) Similar or avoided co-interventions	High risk	Although pain medication was avoided in the protocol, they did not monitor co-interventions
K) Acceptable compliance	Unclear risk	Compliance was not monitored
L) Similar outcome assessment	Low risk	Primary outcome measure: improvement of pain related to motion was taken one week after treatment and compared with baseline measurements
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Kostopoulous 2008

Methods	RCT Number Analysed/Randomised: GA: 30/30; GB: 30/30; GC: 30/30; Total: 90/90 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Non specific neck pain or headaches
Interventions	INDEX TREATMENT: Group A (GA): Ischemic Compression: application of slowly increasing non-painful pressure over a trigger point until a barrier of tissue resistance is encountered. Contact is maintained until the tissue barrier releases and pressure is increased to reach a new barrier to eliminate trigger point tension and tenderness Frequency: three applications of 60 seconds, following 30 seconds rest Duration: 15 minutes on each trigger point Dose: 6 sessions Route: trigger point on upper trapezius muscle Group B (GB): Passive stretch: the targeted muscle is stretched until tension is sensed at the end of ROM. The patient exhales allowing the muscle to relax, increasing the stretch. The newly gained range is held while the patient inhales. A further stretch in reached with successive exhalations allowing muscles to relax Frequency: 45 seconds at the rate of 3 to 4 mm /seconds

	Dose: 6 sessions Duration: 15 minutes each session Route: specific muscle COMPARISON TREATMENTS: Group C (GC): ischemics compression and passive stretch combines according to the above techniques Frequency: alternate between ischaemic compression and passive stretch with 30 seconds rest intervals Dose: 6 sessions Duration: 15 minutes Route: as above Duration of follow-up: 2 weeks
Outcomes	Pain: VAS Baseline Mean: GA: 6.8, GB: 7.08, GC: 7.33 Reported Results at 2 week: Found a significant improvement within groups P < 0.05 in all groups GC was significantly better then GA (p < 0.05) and (GB P < 0.01) for pain SMD (GA vs GB): -0.07 (95% CI -0.58 to 0.43) SMD (GA vs GC): 0.68 (95% CI 0.16 to 1.20) SMD (GB vs GC): 0.72 (95% CI 0.20 to 1.24) ADVERSE EFFECTS: NR COST OF CARE: NR
Notes	Country: New York, United States of America

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	Group assignment was conducted serially
B) Allocation concealment (selection bias)	Low risk	Group assignment was conducted serially generated by an independent person not responsible for determining the eligibility of the patients
C) Blinding (patient)	Low risk	Although participants were told the type of treatment they were to receive, they did not know that other participants were assigned to alternative groups receiving other forms of invention
D) Blinding (care provider)	Unclear risk	No it is hard to blind the care giver during a study examining manual therapy techniques

Kostopoulous 2008 (*Continued*)

E) Blinding (outcome assessor)	Unclear risk	Unsure, only the participants receiving the manual therapy techniques would be unaware as to the type. However, it is hard to ascertain that the participants in the IC + PS group were unaware that they were not allocated to a single manual therapy technique group
F) Incomplete outcome data (attrition bias)	Low risk	All participants completed the study, no drop-outs were reported
G) Randomised participants analysed in their groups (reporting bias)	High risk	Not indicated and stated with examples
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria.
J) Similar or avoided co-interventions	Low risk	None reported in the study
K) Acceptable compliance	Low risk	Yes, as it was the examiners applying the treatment
L) Similar outcome assessment	Low risk	Yes, the measure was based on immediate effect.
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Meseguer 2006

Methods	RCT Number Analysed/Randomised: GA: 18/18, GB: 18/18, GC: 18/18; Total: 54/54 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	mechanical neck pain; duration NR
Interventions	INDEX TREATMENT: Group A (GA): Classical Strain/counterstrain: participant is seated with cervical spine in neutral. Therapist locates the tender point on the upper trapezius muscle by palpation. Therapist applied gradually increased pressure until sensation became painful. Participants were passively placed into a position that reduced tension by 70%. The position that reduced pain was usually cervical flexion, ipsilateral side flexion and contralateral rotation. Participants' arms were placed in a position of passive abduction. Position was

	maintained for 90 seconds Group B (GB): Modified Strain/counterstrain: Patients were seated with cervical spine in neutral. Therapists located tender points in the upper trapezius and applied gradually increased pressure until pressure became painful. At that point participants were positioned into a position of reduced tension by 70% (same position as above). Participants' arms were passively abducted. In this position the therapist applied longitudinal strokes divergent to the location of the tender points during the 90 seconds COMPARISON TREATMENTS: Group C (GC): no treatment: received no treatment or a manual sham procedure where participants lay in supine for 5 minutes Treatment schedule: 1 session Duration of follow-up: Immediate post-treatment
Outcomes	Tenderness: Pressure Threshold Meter at 4.5 kg/cm^2 (VAS 0 to 10 cm) Baseline Mean: GA: 5.9, GB: 5.1, GC: 5.7 Reported Results: Significant favouring classical or modified strain/counterstrain vs control ($p < 0.001$) at immediate post intervention; NS for classical vs modified strain/counterstrain Calculated Results: SMD (A vs C): -1.04 (95% CI -1.74 to -0.34) SMD (B vs C): -1.83 (95% CI -2.62 to -1.04) SMD (A vs B): 0.35 (95% CI -0.31 to 1.01) ADVERSE EVENT: NR COST OF CARE: NR
Notes	Country: Spain

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	After the pre-treatment measurement, participants were divided randomly into 3 groups, using a table of random numbers: group A was treated with the classical strain/counterstrain technique, group B was treated with the proposed modification of the strain/counterstrain technique, and group C was a control group
B) Allocation concealment (selection bias)	High risk	Not explicitly stated within the study.
C) Blinding (patient)	Unclear risk	Unsure, if the participants were unaware of the treatment types

Meseguer 2006 (*Continued*)

D) Blinding (care provider)	Unclear risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	Low risk	Yes, because they would be unaware as to how much pressure was to be applied to receive an effect
F) Incomplete outcome data (attrition bias)	Low risk	Six participants, two per group, were excluded: four participants were excluded as their neck pain began after a motor vehicle accident; another one was excluded as she exhibited a cranio-cervical fracture, and the last one was excluded since he had been diagnosed with cervical radiculopathy one year prior to the study
G) Randomised participants analysed in their groups (reporting bias)	High risk	Not indicated and stated with examples in the study
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria.
J) Similar or avoided co-interventions	Low risk	None reported in the study
K) Acceptable compliance	Low risk	Yes, as it was the examiners applying the treatment.
L) Similar outcome assessment	Low risk	Yes, the measure was based on immediate effect.
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Sherman 2009

Methods	RCT Number Analysed/Randomised: GA: 30/32, GB: 28/32, Total: 58/64 Intention-to-treat Analysis: Yes Power Analysis: Yes
Participants	Mechanical neck pain without radicular symptoms; duration greater then 12 weeks

Interventions	INDEX TREATMENT: Group A (GA): Theraputic Massage (including 4 to 15 of the following; kneading, friction, gliding, traction and trigger point release) COMPARISON TREATMENTS: Group B (GB): Education: participants were given a self care book called What To Do For A Pain In the Neck by Jerome Schfferman. This book explained potential causes of neck pain, neck related headaches whiplash, recommended strengthening exercises, body mechanics and posture and conventional treatment for pain, first aid and flare ups Treatment schedule: 1 session / week for 10 weeks Duration: 75m first session, 60 minutes for the remaining 9 sessions Outcome measure schedule: 4, 10, 26 weeks Duration of follow-up: 26 weeks Co-interventions: not avoided, participants took medications and saw other health care providers such as chiropractors throughout
Outcomes	Function: Neck Related Disability Index (NDI) Pain bothersomeness (Numeric rating scale) Patient Rated Quality of Life measured on SF-36 (physical component only) Baseline Mean: NDI: GA: 14.2, GB: 14.2 Bothersomeness: NRS: GA: 4.8, GB: 4.9 SF-36: GA 46.0 GB 44.1 Reported Results: Significant results seen on both the NDI and the NRS at 4 weeks but not significant in either at 10 or 26 weeks Calculated Results: 4 weeks SMD NDI (GA vs GB) : -0.38 (95% CI -0.89 to 0.13) SMD Numeric rating scale (GA vs GB): -0.73 (95% CI -1.26 to -0.21) SMD SF-36 (GV vs GB): NR 10 weeks SMD NDI (GA vs GB): -0.40 (95% CI -0.92 to 0.12) SMD NRS (GA vs GB): -0.43 (95% CI -0.95 to 0.09) SMD SF-36 (GV vs GB): 0.37 (95% CI -0.15 to 0.89) 26 weeks SMD NDI (GA vs GB): -0.33 (95% CI -0.85 to 0.19) SMD NPRS (GA vs GB): -0.04 (95% CI -0.55 to 0.48) SMD SF-36 (GV vs GB): 0.33 (95% CI -0.18 to 0.85) ADVERSE EVENT: 5 participants reported discomfort or pain after massage treatments, 3 participants reported increased soreness after treatment and 1 participant, who had migraines, reported nausea for a day after each treatment. One of these participants discontinued treatments because of pain after the first treatment COST OF CARE: NR
Notes	Country: Washington and Idaho, United Stated of America Author provided mean and standard deviations for primary outcomes

Sherman 2009 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Low risk	Randomisation was conducted by using a computer program with variable block sizes of 4 or 6, treatment assignments were randomly generated and placed in opaque, sequentially numbered envelopes. The envelopes were stored in a locked filing cabinet until needed for randomisation
B) Allocation concealment (selection bias)	Low risk	Using a computer program with variable block sizes of 4 or 6, treatment assignments were randomly generated and placed in opaque, sequentially numbered envelopes by a researcher not involved in patient recruitment or randomisation
C) Blinding (patient)	High risk	Patients had received information describing the study, and those who were interested were offered an opportunity to participate
D) Blinding (care provider)	High risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	High risk	No it is hard to blind the outcome assessor during a study examining manual therapy techniques vs. an exercise book for neck pain, because the outcome assessor would need to report a change in their status
F) Incomplete outcome data (attrition bias)	Low risk	Yes, a patient flow chart is provided and drop-outs were indicated as individuals who refused follow-up
G) Randomised participants analysed in their groups (reporting bias)	Unclear risk	Not indicated and stated with examples in the study
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria.

Sherman 2009 (*Continued*)

J) Similar or avoided co-interventions	High risk	It would be difficult to determine if the control group engages in other interventions in addition to their home exercises
K) Acceptable compliance	High risk	The Control group was provided with a book for exercises, there was not a specified intervention protocol, or logbook for the participants to record their participation. Moreover, it would be hard to adequately determining participant compliance with a home program
L) Similar outcome assessment	Low risk	Follow-up telephone interviews after 4, 10, and 26 weeks assessed outcomes including dysfunction and symptoms. Neck Disability Index, Copenhagen Scale, SF-36 were completed at a similar time for each group
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

Yagci 2004

Methods	RCT Number Analysed/Randomised: GA: 20/20, GB: 20/20, Total: 40/40 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Sub-acute cervical myofascial pain syndrome
Interventions	INDEX TREATMENT: Group GA (GA): Connective tissue massage: massage starts at sacral region and ends in shoulder and neck region Dose: 15 session Patient also received active exercise program 10 repetition 3 times/day COMPARISON TREATMENT Group B (GB): Spray and stretch: As described by Travell and Simons; using ethyl chloride for 4 to 5 seconds to each muscle, where a trigger point was found in stretched position of the muscle, from a distance of 30cm and a 45 degree angle Dose: 6 session Patient also received active exercise program 10 repetition 3 times/day Co-Intervention: NR
Outcomes	Tenderness: VAS Baseline Mean: GA: 5.85, GB: 7.36 Reported Results: Significant decrease in pain intensity at trigger point in the spray and

	stretch group Calculated Results: SMD (GA vs GB): -0.17 (95% CI -0.79 to 0.45) ADVERSE EVENT: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
A) Adequate randomisation	Unclear risk	Not described
B) Allocation concealment (selection bias)	Unclear risk	Not described
C) Blinding (patient)	High risk	Perceivably different
D) Blinding (care provider)	High risk	Not possible
E) Blinding (outcome assessor)	High risk	Patient outcome assessor not blinded
F) Incomplete outcome data (attrition bias)	Low risk	No comment
G) Randomised participants analysed in their groups (reporting bias)	Low risk	No comment
H) Selective reporting (reporting bias)	Unclear risk	No protocol
I) Baseline similarities	High risk	Table 1 VAS significantly different
J) Similar or avoided co-interventions	Unclear risk	Not stated
K) Acceptable compliance	Unclear risk	Not stated
L) Similar outcome assessment	Unclear risk	One group after 6/52 and other after 15/52 outcome measure not stated
M) Study acceptable or flawed	High risk	Reporting issues, other sources of potential bias listed

Zaproudina 2007

Methods	RCT Number Analysed/Randomised: GA: 33/35, GB: 29/35, GC: 31/35, Total: 93/105 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Chronic neck pain/ tension neck without radicular arm symptoms, and experienced pain for a mean of 11 years at baseline
Interventions	INDEX TREATMENT: Group A (GA): massage Dose: 5 session Duration: 1 hour Route: upper body Monitoring: by registered therapist Duration of treatment: 1 month COMPARISON TREATMENT Group B (GB): Conventional physiotherapy; includes massage, stretching, exercise therapy. Physiotherapist was free to choose kind of treatment. Patient also received autostretching exercise programs for home training Dose: 5 session Duration: 45 minutes Route: global Monitoring: by experienced physiotherapist Group C (GC): Traditional bone setting; soft and painless manual mobilization of extremities and spine begins from toes and feet of a lying person and continues in seated participants, vertebrae by vertebrae and muscle by muscle up to neck and shoulders, arms, hands and head Frequency: 5 session with 1 to 2 weeks intervals Dose: 5 session Duration: 90 minutes Route: global Monitoring: by Finnish bone setters Duration of Follow-up: 1 month, 6 month, 12 month Co-Intervention: any therapy in previous month were excluded
Outcomes	Pain Intensity: VAS (0 to 100) Baseline Mean: GA: 26.0 , GB: 27.41, GC: 24.11 Reported Results: Pain improved within groups but not between groups Calculated Results: Pain: SMD (GA vs GB): -0.18 (95% CI -0.66 to 0.30) SMD (GA vs GC): 0.37 (95% CI -0.11 to 0.85) NDI: SMD (GA vs GB): -0.35 (95% CI -0.83 to 0.14) SMD (GA vs GC): 0.37 (95% CI -0.11 to 0.85)

	ADVERSE EVENT: NR COST OF CARE: NR	
Notes	Country: Finland	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
A) Adequate randomisation	Unclear risk	Not clearly described
B) Allocation concealment (selection bias)	Unclear risk	Not clearly described
C) Blinding (patient)	High risk	No, due to the nature of the interventions participants would be able to determine which intervention type they were receiving i.e. traditional bone setting in chronic neck pain compared with conventional physiotherapy and massage
D) Blinding (care provider)	High risk	No it is hard to blind the care giver during a study examining manual therapy techniques
E) Blinding (outcome assessor)	High risk	No it is hard to blind the outcome assessor during a study examining manual therapy techniques because the outcome assessor would need to report a change in their status
F) Incomplete outcome data (attrition bias)	Low risk	Yes, a patient flow chart is provided on p433, Fig. 1
G) Randomised participants analysed in their groups (reporting bias)	Low risk	VAS, NDI, and cervical ROM scores/values we adequately reported
H) Selective reporting (reporting bias)	Unclear risk	No previously published (and referenced in current paper) protocol initiated prior to the start of the study
I) Baseline similarities	Low risk	Yes, based on the inclusion criteria.
J) Similar or avoided co-interventions	Unclear risk	Not indicated or explicitly stated within the study.
K) Acceptable compliance	Unclear risk	Not indicated or explicitly stated within the study.

Zaproudina 2007 (*Continued*)

L) Similar outcome assessment	Low risk	Yes, the measure was based on immediate effect.
M) Study acceptable or flawed	Low risk	Acceptable: No major threat to the study's internal validity

NR = Not reported, NPRS = numeric pain rating scale, NNT = number needed to treat, RCT = randomised controlled trial, NS = Not significant, vs = versus, SMD = standardised mean difference, PTT = pain, pressure threshold, ROM = range of MOTION, RR = risk ratio, 95%CI = 95% Confidence interval, VAS = visual analogue scale, ANCOVA = analysis of covariance, mm=millimetre, UFT = Upper fibers of trapezius

Record of Personal Communications / Unpublished data:

a)Briem 2007, Irnich 2001, and Sherman 2009 provided additional data on baseline measures and clarification on follow-up.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Ammer 1990	Intervention: multimodal which includes massage
Brodin 1985	Intervention: multimodal which includes massage
Coppieters 2000	Intervention: Main mode of therapy was cervical joint mobilization using neural tension positioning as secondary part of the treatment. No distinction was made between the two modalities in data
Durianova 1977	Outcome: the outcome measure used was not clearly stated
Fernandez-delasPenas2004a	Intervention: multimodal which includes massage; this is the comparison group
Fernandez-delasPenas2004b	Intervention: multimodal which includes massage; craniosacral and myofascial trigger point manual therapy
Ferrante 2005	Intervention: both the active and the control group received myofascial release technique
Fialka 1989	Intervention: multimodal which includes massage
Fitz-Ritson 1994	Population: unsure, sample not adequately described [query whiplash associated neck disorder]. Intervention: No soft tissue therapy was used
Gam 1998	Intevention: Multimodal which includes massage
Gurumoorthy 2000	Intervention: No soft tissue therapy used
Haas 2010	Intervention: both groups received massage

(*Continued*)

Hakkinen 2007	Intervention: multimodal including massage
Hemmila 2005	Intervention: multimodal including massage; massage and bone setting
Hou 2002	Intervention: For Stage 1: Eight women were randomise to each group. 14 trigger points were assessed per group. Although the unit of randomisation was 8 women per group the analysis was done on 14 trigger points per group - a different unit of analysis For Stage 2: All treatments were multimodal with one treatment item being massage
Hoving 2002	Intervention: multimodal which includes massage
Jahanshahi 1991	Population: no sample with neck disorder meeting inclusion criteria [torticollis]
Jellad 2009	Intervention: multimodal which includes massage; manual traction which includes standard care
Jordan 1998	Intervention: multimodal which includes massage
Karlberg 1996	Intervention: multimodal which includes massage
Klaber Moffett 2006	Intervention: multimodal which includes massage; this is the control arm of this trial
Koes 1992	Intervention: multimodal which includes massage
Kogstad 1978	Intervention: multimodal which includes massage
Konig 2003	Outcome: Range of motion is not one of the included outcomes
Leboeuf 1987	Population: no sample with neck disorder meeting inclusion criteria [repetitive strain injury of upper limb]
Levoska 1993	Intervention: multimodal which includes massage
Lin 2004	Intervention: both groups received massage
McReynolds 2005	Intervention: multimodal which includes massage
Mezaki 1995	Design: unsure RCT Population: no participants with neck disorder meeting inclusion criteria [spasmodic torticollis]
Nilsson 1997	Intervention: multimodal which includes massage
Palmgren 2006	Intervention: multimodal which used massage (myofascial technique)
Parkin-Smith 1997	Intervention: Unclear how many participants received “non therapeutic pre manipulative soft tissue massage” for muscle spasm
Persson 2001	Intervention: multimodal which used massage; massage use varied between patients in PT group

(*Continued*)

Provinciali 1996	Intervention: multimodal which used massage
Reginiussen 2000	Intervention: multimodal which used massage
Schenk 1994	Population: no sample with neck disorder meeting inclusion criteria [normal cervical spine]
Schnabel 2002	Intervention: multimodal which used massage
Skargren 1998	Intervention: multimodal which used massage; Only 36% of PT group received massage
Vasseljen 1995	Intervention: No soft tissue therapy used
Vassiliou 2006	Intevention: multimodal including massage
Ventegodt 2004	Intervention: multimodal including massage; combination of alternative therapies - gestalt therapy, Rosen Body Work, cranio sacral therapy
Yip 2006	Intervention: multimodal including massage
Zhang 2005a	Intervention: both groups received massage
Zhang 2005b	Outcome: It is **unclear** which construct the outcome Cervical Spondylopathy Treatment Effect Rating Scale is measuring; it is a composite of clinical symptoms, physical examination and activities of daily life. Clarification on the outcome was sought but not resolved
Zylbergold 1985	Intervention: Not clear if the manual traction used a halter or was performed manually

DATA AND ANALYSES

Comparison 1. Main Results: Massage v Control Treatments for unknown duration neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity	2		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Inhibitive Distraction v Placebo treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 occipital release to suboccipital muscles v no treatment at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Tenderness (VAS)	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 modified strain/counter strain to UFT v no-treatment control at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.2 classical strain/counter strain to UFT v no-treatment control at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Tenderness (PPT)	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 manual pressure release v sham at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 2. Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity	2		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 conventional western massage (effleurage, petrissage, friction, tapotement) to generalized neck muscles v sham laser control at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 ischemic compression to UFT trigger point v sham ultrasound at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.3 pressure release to UFT trigger point v sham ultrasound at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

2 Pain: massage v control	1	Risk Ratio (M-H, Random, 95% CI)	Totals not selected
2.1 myofascial band therapy to UFT / trigger points v sham ultrasound at immediate post treatment	1	Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]
3 Physical Function	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 traditional Chinese therapeutic massage to generalized neck muscles v no treatment at immediate post treatment	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 3. Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity: massage v acupunture	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 conventional western massage (effleurage, petrissage, friction, tapotement) to generalized neck muscle v acupuncture [traditional Chinese] at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity: massage v manual therapy	2		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 ischemic compression to UFT trigger point v activator trigger point therapy at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.2 massage to generalized neck muscles v traditional bone setting at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain: massage v manual therapy	1		Risk Ratio (M-H, Random, 95% CI)	Totals not selected
3.1 myofascial band therapy to UFT / trigger points vs activator trigger point at immediate post treatment	1		Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]
4 Pain Intensity: massage v multimodal treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 massage to generallized neck muscles v conventional physiotherapy at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Pain bothersomeness: massage v education	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

5.1 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at short-term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5.2 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at intermediate term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5.3 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at long term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Physical Function: massage v manual therapy	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 massage to generalized neck muscles v traditional bone setting at short-term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7 Physical Function: massage v exercise	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
7.1 traditional Chinese therapeutic massage to generalized neck muscles v exercise at immediate post treatment	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8 Physical Function: massage v multimodal therapy	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
8.1 massage to generalized neck muscles v conventional physiotherapy at short-term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9 Physical Function: massage v education	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
9.1 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at short-term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9.2 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at intermediate term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

9.3 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at long term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
10 Quality of Life: massage v education	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
10.1 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at intermediate term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
10.2 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at long term follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 4. Main Results: Massage v Comparison Treatments for unknown duration mechanical neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity: massage v exercise	2		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 occipital release to suboccipital muscles v exercise [McKenzie] at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 self-ischemic comprssion with hand held J-shaped tool v active ROM exercise at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 5. Main Results: Massage v Massage subacute/chronic mechanical neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Tenderness (Pain): massage v massage	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 connective tissue massage to sacral region ending at neck v spray and strech at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

2 Pain Intensity: massage v massage	2	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 ischemic compression to UFT trigger point v transverse friction massage to UFT at immediate post treatment	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.2 Ischemic compression to UFT v trigger point pressure release to UFT trigger point at immediate post treatment	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 6. Main Results: Massage v Massage unknown duration mechanical neck pain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity: massage v massage	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Ischemic compression to UFT trigger point v passive stretch to UFT at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 ischemic compression to UFT trigger point v ischemic compression + passive stretch to UFT at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.3 passive stretch to UFT v ischemic compression + passive stretch to UFT at short-term follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Tenderness (VAS)	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 classical strain/ counterstrain to UFT vs modified strain/counterstrain to UFT at immediate post treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Analysis 1.1. Comparison 1 Main Results: Massage v Control Treatments for unknown duration neck pain, Outcome 1 Pain Intensity.

Review: Massage for mechanical neck disorders

Comparison: 1 Main Results: Massage v Control Treatments for unknown duration neck pain

Outcome: 1 Pain Intensity

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Inhibitive Distraction v Placebo treatment						
Briem 2007	20	3.6 (2.2)	20	2.9 (1.9)		0.33 [-0.29, 0.96]
2 occipital release to suboccipital muscles v no treatment at immediate post treatment						
Hanten 1997 (1)	20	2.5 (1.1)	20	2.6 (1.5)		-0.07 [-0.69, 0.55]

(1) 1 vs 3

Analysis 1.2. Comparison 1 Main Results: Massage v Control Treatments for unknown duration neck pain, Outcome 2 Tenderness (VAS).

Review: Massage for mechanical neck disorders

Comparison: 1 Main Results: Massage v Control Treatments for unknown duration neck pain

Outcome: 2 Tenderness (VAS)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 modified strain/counter strain to UFT v no-treatment control at immediate post treatment						
Meseguer 2006 (1)	18	2.5 (1.2)	18	5.7 (2.1)		-1.83 [-2.62, -1.04]
2 classical strain/counter strain to UFT v no-treatment control at immediate post treatment						
Meseguer 2006 (2)	18	3.3 (2.4)	18	5.7 (2.1)		-1.04 [-1.74, -0.34]

(1) Group B - Modified strain/counterstrain vs cntl

(2) Group A - Classical Strain/counterstrain vs Group C - cntl

Analysis 1.3. Comparison 1 Main Results: Massage v Control Treatments for unknown duration neck pain, Outcome 3 Tenderness (PPT).

Review: Massage for mechanical neck disorders

Comparison: 1 Main Results: Massage v Control Treatments for unknown duration neck pain

Outcome: 3 Tenderness (PPT)

Study or subgroup	manual pressure release N	Mean(SD)	sham N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 manual pressure release v sham at immediate post treatment						
Fryer 2005	20	-2.05 (1.7)	17	0.08 (1.7)		-1.23 [-1.94, -0.52]

Analysis 2.1. Comparison 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain, Outcome 1 Pain Intensity.

Review: Massage for mechanical neck disorders

Comparison: 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain

Outcome: 1 Pain Intensity

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 conventional western massage (effleurage, petrissage, friction, tapotement) to generalized neck muscles v sham laser control at short-term follow-up						
Imich 2001 (1)	57	41.34 (27.53)	57	41.65 (28.79)		-0.01 [-0.38, 0.36]
2 ischemic compression to UFT trigger point v sham ultrasound at immediate post treatment						
Gemmell 2008 (p 30-36) (2)	15	22.93 (12.76)	15	22.67 (8.21)		0.02 [-0.69, 0.74]
3 pressure release to UFT trigger point v sham ultrasound at immediate post treatment						
Gemmell 2008 (p 30-36) (3)	15	27.13 (16.4)	15	22.67 (8.21)		0.33 [-0.39, 1.06]

(1) M vs S

(2) A vs C

(3) B vs C

Analysis 2.2. Comparison 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain, Outcome 2 Pain: massage v control.

Review: Massage for mechanical neck disorders

Comparison: 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain

Outcome: 2 Pain: massage v control

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
1 myofascial band therapy to UFT / trigger points v sham ultrasound at immediate post treatment				
Blikstad 2008 (1)	13/15	13/15		1.00 [0.76, 1.32]

(1) A vs C

Analysis 2.3. Comparison 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain, Outcome 3 Physical Function.

Review: Massage for mechanical neck disorders

Comparison: 2 Main Results: Massage v Control Treatments for subacute/chronic mechanical neck pain

Outcome: 3 Physical Function

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 traditional Chinese therapeutic massage to generalized neck muscles v no treatment at immediate post treatment						
Cen 2003	9	13.24 (11.88)	11	35.64 (12.54)		-1.75 [-2.82, -0.68]

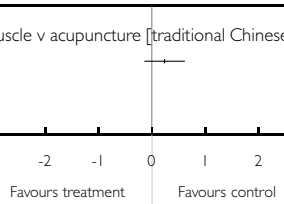
Analysis 3.1. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 1 Pain Intensity: massage v acupunture.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 1 Pain Intensity: massage v acupunture

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 conventional western massage (effleurage, petrissage, friction, tapotement) to generalized neck muscle v acupuncture [traditional Chinese] at short-term follow-up						
Irnich 2001	57	41.34 (27.53)	51	34.85 (25.04)		0.24 [-0.14, 0.62]



Analysis 3.2. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 2 Pain Intensity: massage v manual therapy.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 2 Pain Intensity: massage v manual therapy

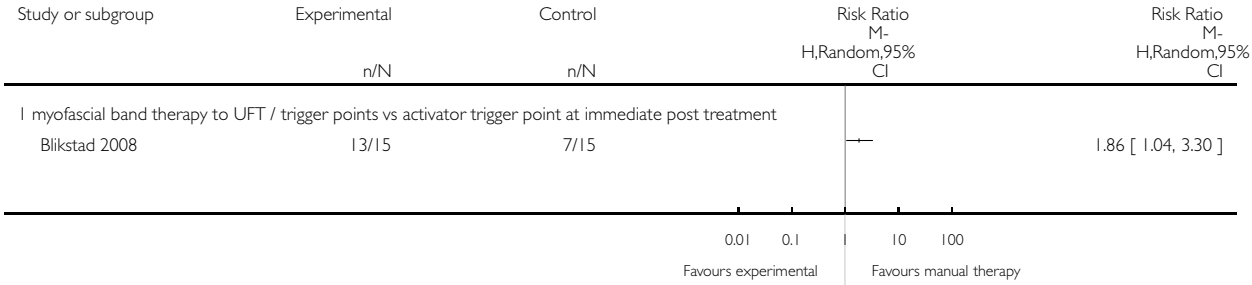
Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 ischemic compression to UFT trigger point v activator trigger point therapy at immediate post treatment						
Gemmell, 2008 (p175-181)	25	1.1 (1.9)	27	1.4 (1.2)		-0.19 [-0.73, 0.36]
2 massage to generalized neck muscles v traditional bone setting at short-term follow-up						
Zaproudina 2007	33	25.4 (22)	35	17.9 (18)		0.37 [-0.11, 0.85]

Analysis 3.3. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 3 Pain: massage v manual therapy.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 3 Pain: massage v manual therapy

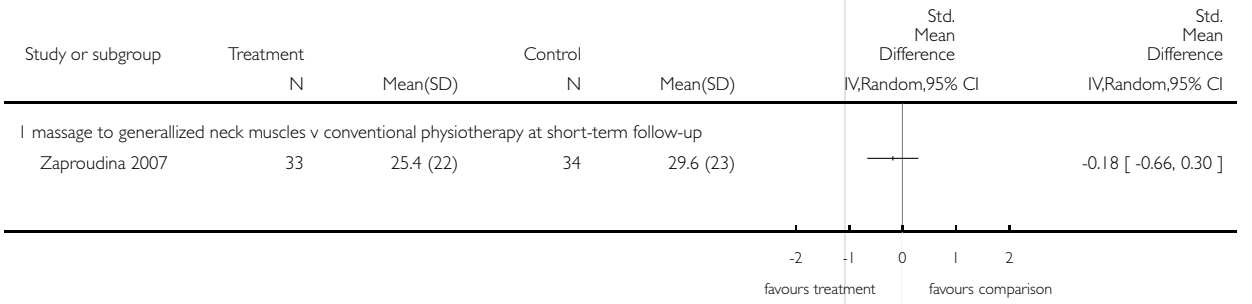


Analysis 3.4. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 4 Pain Intensity: massage v multimodal treatment.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 4 Pain Intensity: massage v multimodal treatment



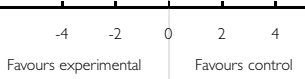
Analysis 3.5. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 5 Pain bothersomeness: massage v education.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 5 Pain bothersomeness: massage v education

Study or subgroup	Experimental N	Mean(SD)[NRS]	Control N	Mean(SD)[NRS]	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at short-term follow-up						
Sherman 2009	31	3.7 (2.1)	29	5.3 (2.2)		-0.73 [-1.26, -0.21]
2 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at intermediate term follow-up						
Sherman 2009	31	3.3 (2.87)	28	4.5 (2.6)		-0.43 [-0.95, 0.09]
3 therapeutic massage (kneading, friction, gliding, traction, trigger point release) to generalized neck muscles v education at long term follow-up						
Sherman 2009	30	4 (3)	28	4.1 (2.4)		-0.04 [-0.55, 0.48]



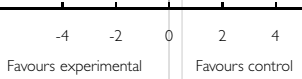
Analysis 3.6. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 6 Physical Function: massage v manual therapy.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 6 Physical Function: massage v manual therapy

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 massage to generalized neck muscles v traditional bone setting at short-term follow-up						
Zaproudina 2007	33	15.3 (10)	35	11.7 (9)		0.37 [-0.11, 0.85]



Analysis 3.7. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 7 Physical Function: massage v exercise.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 7 Physical Function: massage v exercise

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 traditional Chinese therapeutic massage to generalized neck muscles v exercise at immediate post treatment						
Cen 2003 (1)	9	13.24 (11.88)	8	20.23 (12.06)		-0.55 [-1.53, 0.42]

(1) A vs B

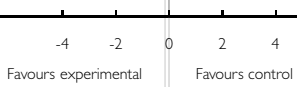
Analysis 3.8. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 8 Physical Function: massage v multimodal therapy.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 8 Physical Function: massage v multimodal therapy

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 massage to generalized neck muscles v conventional physiotherapy at short-term follow-up						
Zaproudina 2007	33	15.3 (10)	34	18.8 (10)		-0.35 [-0.83, 0.14]

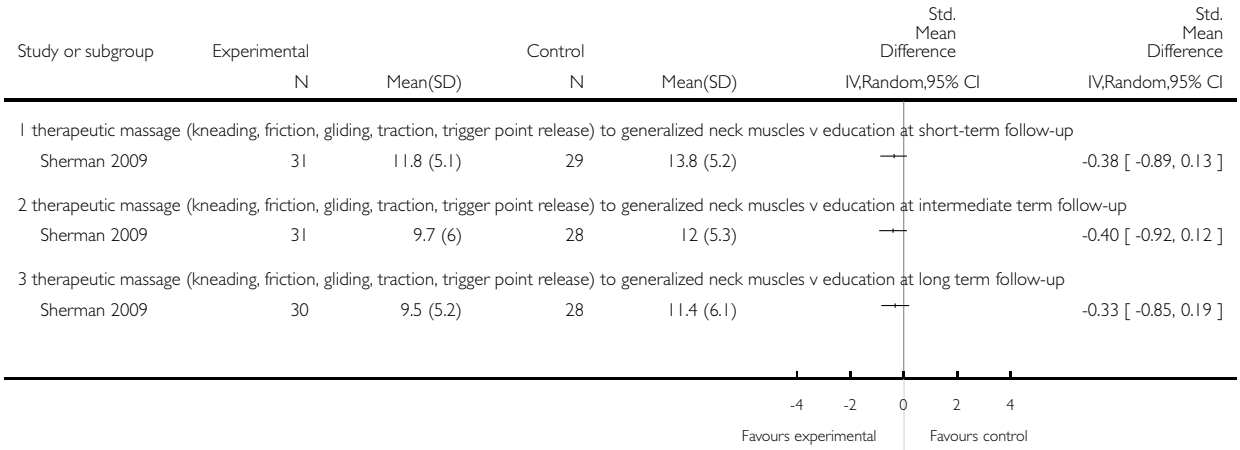


Analysis 3.9. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 9 Physical Function: massage v education.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 9 Physical Function: massage v education

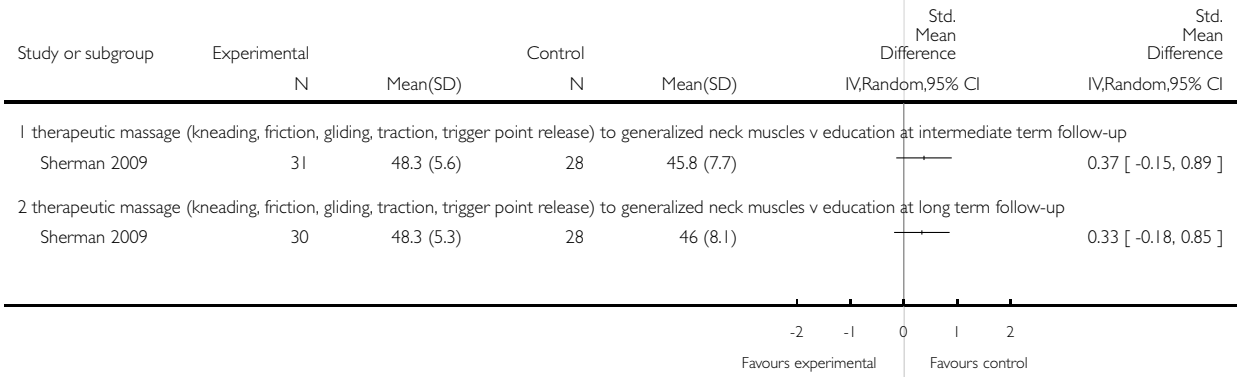


Analysis 3.10. Comparison 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain, Outcome 10 Quality of Life: massage v education.

Review: Massage for mechanical neck disorders

Comparison: 3 Main Results: Massage v Comparison Treatments for subacute/chronic mechanical neck pain

Outcome: 10 Quality of Life: massage v education



Analysis 4.1. Comparison 4 Main Results: Massage v Comparison Treatments for unknown duration mechanical neck pain, Outcome 1 Pain Intensity: massage v exercise.

Review: Massage for mechanical neck disorders

Comparison: 4 Main Results: Massage v Comparison Treatments for unknown duration mechanical neck pain

Outcome: 1 Pain Intensity: massage v exercise

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 occipital release to suboccipital muscles v exercise [McKenzie] at immediate post treatment						
Hanten 1997	20	2.5 (1.1)	20	2.8 (1.3)		-0.24 [-0.87, 0.38]
2 self-ischemic comprssion with hand held J-shaped tool v active ROM exercise at short-term follow-up						
Hanten 2000	20	13.2 (16)	20	24.7 (20.9)		-0.61 [-1.24, 0.03]

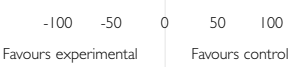
Analysis 5.1. Comparison 5 Main Results: Massage v Massage subacute/chronic mechanical neck pain, Outcome 1 Tenderness (Pain): massage v massage.

Review: Massage for mechanical neck disorders

Comparison: 5 Main Results: Massage v Massage subacute/chronic mechanical neck pain

Outcome: 1 Tenderness (Pain): massage v massage

Study or subgroup	connective tissue massage N	Mean(SD)	spray and stretch N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 connective tissue massage to sacral region ending at neck v spray and strech at immediate post treatment						
Yagci 2004	20	2.6 (1.73)	20	2.88 (1.5)		-0.17 [-0.79, 0.45]



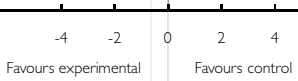
Analysis 5.2. Comparison 5 Main Results: Massage v Massage subacute/chronic mechanical neck pain, Outcome 2 Pain Intensity: massage v massage.

Review: Massage for mechanical neck disorders

Comparison: 5 Main Results: Massage v Massage subacute/chronic mechanical neck pain

Outcome: 2 Pain Intensity: massage v massage

Study or subgroup	Ischemic Compression N	Mean(SD)	Transverse Friction N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 ischemic compression to UFT trigger point v transverse friction massage to UFT at immediate post treatment						
Fernandez 2006	20	2.2 (0.6)	20	2.35 (0.4)		-0.29 [-0.91, 0.34]
2 Ischemic compression to UFT v trigger point pressure release to UFT trigger point at immediate post treatment						
Gemmell 2008 (p 30-36) (1)	15	22.93 (12.76)	15	27.13 (16.4)		-0.28 [-1.00, 0.44]



(1) A vs B

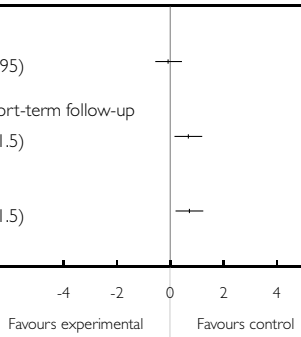
Analysis 6.1. Comparison 6 Main Results: Massage v Massage unknown duration mechanical neck pain, Outcome 1 Pain Intensity: massage v massage.

Review: Massage for mechanical neck disorders

Comparison: 6 Main Results: Massage v Massage unknown duration mechanical neck pain

Outcome: 1 Pain Intensity: massage v massage

Study or subgroup	Ischemic Compression N	Mean(SD)	Transverse Friction N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Ischemic compression to UFT trigger point v passive stretch to UFT at short-term follow-up						
Kostopoulous 2008 (1)	30	3.58 (1.78)	30	3.72 (1.95)		-0.07 [-0.58, 0.43]
2 ischemic compression to UFT trigger point v ischemic compression + passive stretch to UFT at short-term follow-up						
Kostopoulous 2008 (2)	30	3.58 (1.78)	30	2.45 (1.5)		0.68 [0.16, 1.20]
3 passive stretch to UFT v ischemic compression + passive stretch to UFT at short-term follow-up						
Kostopoulous 2008 (3)	30	3.72 (1.95)	30	2.45 (1.5)		0.72 [0.20, 1.24]



(1) A vs B

(2) A vs C

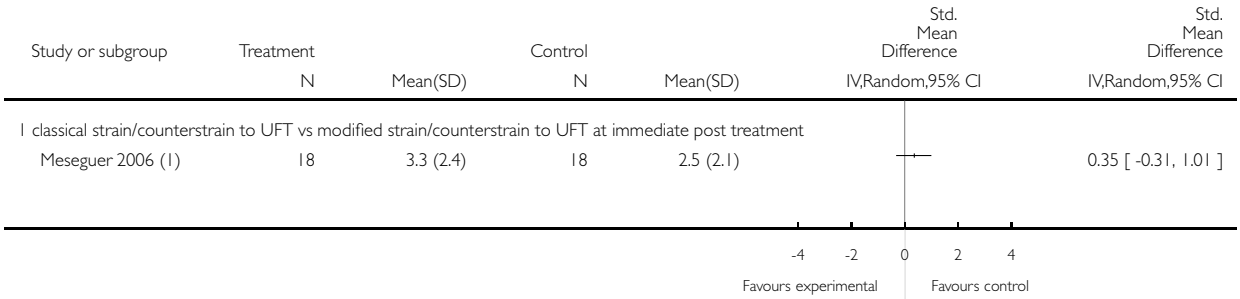
(3) B vs C

Analysis 6.2. Comparison 6 Main Results: Massage v Massage unknown duration mechanical neck pain, Outcome 2 Tenderness (VAS).

Review: Massage for mechanical neck disorders

Comparison: 6 Main Results: Massage v Massage unknown duration mechanical neck pain

Outcome: 2 Tenderness (VAS)



(1) Group A - Classical Strain/counterstrain vs Group B - Modified Strain/counterstrain

ADDITIONAL TABLES

Table 1. Clinical Applicability Assessment for Massage Therapy: Questions

1.The Patient: **Are the patients described in detail so that you can decide whether they are comparable to those that you see in your practice?** a) Age b) Gender c) Setting d) Type pf disorder/disease described e) Duration of disease/disorder f) Severity of disease/disorder g) Recruitment procedure described h) Description of inclusion/exclusion criteria including comorbidities	Score: a), b), d), and g) must be present for yes **Note:** d) should include localisation of symptoms and non-specific or radiating symptoms; for e) acute (<6 wks) vs. subacute (6 to 12 wks) vs. chronic (≥12 wks)
2. The Intervention **Are the interventions and treatment settings described well enough so that you can provide the same for your patients?** a) Intervention Type/Content including where applied b) Intensity/Dosage details (e.g. number of reps, resistance) c) Frequency of treatment d) Duration of treatment period e) Description of who delivered treatment f) Proper intervention to answer research question	Score: must have a) to e) for yes. **Note:** e) should include description of skills, training and experience

Table 1. Clinical Applicability Assessment for Massage Therapy: Questions (*Continued*)

3. Reporting of Outcomes **Were all clinically relevant outcomes measured and reported?** a) Pain b) Site-related* function or disability c) Well being (GPE) or patient satisfaction GPE = global perceived effect *Site listed of importance to the study (eg. Neck)	Score: Must have a) or b) to answer yes.
4. Relevance **Is the size of the effect clinically important?** (i.e. a Minimal Clinically Important Difference (MCID) in treatment group, and significant difference between intervention group and control at follow-up) a) * MCID in pain outcome in treatment group (at short-term or long-term follow-up) b) * MCID in disability/function in treatment group (at short-term or long-term follow-up) c) Statistically significant difference between intervention and control (at short-term or long-term follow-up)	Score: For each outcome, must have mean difference between groups (95% CI does not cross 0 or, if reported as Risk ratio or Odds Ratio, 95% CI must not cross 1) = yes *For neck pain MCID of 1.0 or greater on a 10 unit Numeric Rating Scale (25%) for large effect *For function 5 Units on a 50 unit Neck Disability Index (10%) for large effect. (Furlan 2009), for Northwick Park Neck Pain Questionnaire 20% change from baseline (see Chiu 2005) Also consider Global Perceived Effect (GPE) and patient satisfaction when scoring
5a. Benefit versus harm Reporting **Were adverse effects reported?** a) Incidence of adverse effects reported b) Severity of adverse responses reported (serious/ severe versus minor/transient) c) Adherence to treatment reported d) Dropout rate and reasons reported **5b. Given the answers to 4 and 5 above, are the likely treatment benefits worth the potential harm?**	**Score:** Must have all to answer YES.
6. Was the timing of the evaluation of the intervention sensible, given the mechanisms of action of the effect?	**Score**: Need to have reasonable timing of the evaluation to score yes (eg. Consider whether the intervention is meant to be short acting or long acting) Outcome measures for exercise must be assessed at short-term (4 to 6 weeks) and long-term (~1 year) at least for yes

N/U: Not applicable/ Unsure

Table 2. Clinical Applicability Assessment for Massage Therapy: Scores

Study	Question 1	Question 2	Question 3	Question 4	Question 5a	Question 5b	Question 6	Total max 7
Blikstad 2008	1	0	1	0	0	N/U	1	3
Briem 2007	1	0	1	0	0	N/U	1	3
Fernandez 2006	1	0	1	0	0	N/U	N/U	2
Gemmell 2008 (p30-36)	1	1	1	0	0	N/U	1	4
Fryer 2005	1	0	0	0	0	N/U	1	2
Gemmell 2008(p175-181)	1	0	0	0	0	N/U	1	2
Kostopoulos 2008	0	1	1	0	0	N/U	1	3
Zaproudina 2007	1	0	1	0	0	N/U	1	3
Yagci 2004	0	0	1	0	0	N/U	1	2
Sherman 2009	1	1	1	1	1	1	1	7
Meseguer 2006	1	0	0	0	0	N/U	1	2
Hanten 1997	0	0	0	0	0	N/U	1	1
Hanten 2000	0	0	0	0	0	N/U	0	0
Irnich 2001	1	0	1	0	1	1	1	5
Cen 2003	0	1	1	1	0	N/U	1	4

APPENDICES

Appendix 1. MEDLINE search strategy

1. Neck Pain/
2. exp Brachial Plexus Neuropathies/
3. exp neck injuries/ or exp whiplash injuries/
4. cervical pain.mp.
5. neckache.mp.
6. whiplash.mp.
7. cervicodynia.mp.
8. cervicalgia.mp.
9. brachialgia.mp.
10. brachial neuritis.mp.
11. brachial neuralgia.mp.
12. neck pain.mp.
13. neck injur*.mp.
14. brachial plexus neuropath*.mp.
15. brachial plexus neuritis.mp.
16. thoracic outlet syndrome/ or cervical rib syndrome/
17. Torticollis/
18. exp brachial plexus neuropathies/ or exp brachial plexus neuritis/
19. cervico brachial neuralgia.ti,ab.
20. cervicobrachial neuralgia.ti,ab.
21. (monoradicul* or monoradicl*).tw.
22. or/1-21
23. exp headache/ and cervic*.tw.
24. exp genital diseases, female/
25. genital disease*.mp.
26. or/24-25
27. 23 not 26
28. 22 or 27
29. neck/
30. neck muscles/
31. exp cervical plexus/
32. exp cervical vertebrae/
33. atlanto-axial joint/
34. atlanto-occipital joint/
35. Cervical Atlas/
36. spinal nerve roots/
37. exp brachial plexus/
38. (odontoid* or cervical or occip* or atlant*).tw.
39. axis/ or odontoid process/
40. Thoracic Vertebrae/
41. cervical vertebrae.mp.
42. cervical plexus.mp.
43. cervical spine.mp.
44. (neck adj3 muscles).mp.
45. (brachial adj3 plexus).mp.
46. (thoracic adj3 vertebrae).mp.
47. neck.mp.
48. (thoracic adj3 spine).mp.
49. (thoracic adj3 outlet).mp.

50. trapezius.mp.
51. cervical.mp.
52. cervico*.mp.
53. 51 or 52
54. exp genital diseases, female/
55. genital disease*.mp.
56. exp *Uterus/
57. 54 or 55 or 56
58. 53 not 57
59. 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 58
60. exp pain/
61. exp injuries/
62. pain.mp.
63. ache.mp.
64. sore.mp.
65. stiff.mp.
66. discomfort.mp.
67. injur*.mp.
68. neuropath*.mp.
69. or/60-68
70. 59 and 69
71. Radiculopathy/
72. exp temporomandibular joint disorders/ or exp temporomandibular joint dysfunction syndrome/
73. myofascial pain syndromes/
74. exp "Sprains and Strains"/
75. exp Spinal Osteophytosis/
76. exp Neuritis/
77. Polyradiculopathy/
78. exp Arthritis/
79. Fibromyalgia/
80. spondylitis/ or discitis/
81. spondylosis/ or spondylolysis/ or spondylolisthesis/
82. radiculopathy.mp.
83. radiculitis.mp.
84. temporomandibular.mp.
85. myofascial pain syndrome*.mp.
86. thoracic outlet syndrome*.mp.
87. spinal osteophytosis.mp.
88. neuritis.mp.
89. spondylosis.mp.
90. spondylitis.mp.
91. spondylolisthesis.mp.
92. or/71-91
93. 59 and 92
94. exp neck/
95. exp cervical vertebrae/
96. Thoracic Vertebrae/
97. neck.mp.
98. (thoracic adj3 vertebrae).mp.
99. cervical.mp.
100. cervico*.mp.
101. 99 or 100

102. exp genital diseases, female/
103. genital disease*.mp.
104. exp *Uterus/
105. or/102-104
106. 101 not 105
107. (thoracic adj3 spine).mp.
108. cervical spine.mp.
109. 94 or 95 or 96 or 97 or 98 or 106 or 107 or 108
110. Intervertebral Disk/
111. (disc or discs).mp.
112. (disk or disks).mp.
113. 110 or 111 or 112
114. 109 and 113
115. herniat*.mp.
116. slipped.mp.
117. prolapse*.mp.
118. displace*.mp.
119. degenerat*.mp.
120. (bulge or bulged or bulging).mp.
121. 115 or 116 or 117 or 118 or 119 or 120
122. 114 and 121
123. intervertebral disk degeneration/ or intervertebral disk displacement/
124. intervertebral disk displacement.mp.
125. intervertebral disc displacement.mp.
126. intervertebral disk degeneration.mp.
127. intervertebral disc degeneration.mp.
128. 123 or 124 or 125 or 126 or 127
129. 109 and 128
130. 28 or 70 or 93 or 122 or 129
131. animals/ not (animals/ and humans/)
132. 130 not 131
133. exp *neoplasms/
134. exp *wounds, penetrating/
135. 133 or 134
136. 132 not 135
137. Neck Pain/rh, th [Rehabilitation, Therapy]
138. exp Brachial Plexus Neuropathies/rh, th
139. exp neck injuries/rh, th or exp whiplash injuries/rh, th
140. thoracic outlet syndrome/rh, th or cervical rib syndrome/rh, th
141. Torticollis/rh, th
142. exp brachial plexus neuropathies/rh, th or exp brachial plexus neuritis/rh, th
143. or/137-142
144. Radiculopathy/rh, th
145. exp temporomandibular joint disorders/rh, th or exp temporomandibular joint dysfunction syndrome/rh, th
146. myofascial pain syndromes/rh, th
147. exp “Sprains and Strains”/rh, th
148. exp Spinal Osteophytosis/rh, th
149. exp Neuritis/rh, th
150. Polyradiculopathy/rh, th
151. exp Arthritis/rh, th
152. Fibromyalgia/rh, th
153. spondylitis/rh, th or discitis/rh, th
154. spondylosis/rh, th or spondylolysis/rh, th or spondylolisthesis/rh, th

155. or/144-154
156. 59 and 155
157. acupuncture/ or chiropractic/
158. exp Musculoskeletal Manipulations/
159. massage.tw.
160. mobili?ation.tw.
161. Acupuncture Therapy/
162. (acupuncture or acu-puncture or needling or acupressure or mox?bustion).tw.
163. ((neck or spine or spinal or cervical or chiropractic* or musculoskeletal* or musculo-skeletal*) adj3 (adjust* or manipulat* or mobiliz* or mobilis*)).tw.
164. (manual adj therap*).tw.
165. (manipulati* adj (therap* or medicine)).tw.
166. (massag* or reflexolog* or rolfing or zone therap*).tw.
167. Nimmo.mp.
168. exp Vibration/tu [Therapeutic Use]
169. (vibration adj5 (therap* or treatment*)).tw.
170. (Chih Ya or Shiatsu or Shiatzu or Zhi Ya).tw.
171. (flexion adj2 distraction*).tw.
172. (myofascial adj3 (release or therap*)).tw.
173. muscle energy technique*.tw.
174. trigger point.tw.
175. proprioceptive Neuromuscular Facilitation*.tw.
176. cyriax friction.tw.
177. (lomilomi or lomi-lomi or trager).tw.
178. aston patterning.tw.
179. (strain adj counterstrain).tw.
180. (craniosacral therap* or cranio-sacral therap*).tw.
181. (amma or ammo or effleuurage or petrissage or hacking or tapotment).tw.
182. Complementary Therapies/
183. ((complement* or alternat* or osteopthic*) adj (therap* or medicine)).tw.
184. (Tui Na or Tuina).tw.
185. or/157-184
186. 136 and 185
187. 143 or 156 or 186
188. animals/ not (animals/ and humans/)
189. 187 not 188
190. exp randomized controlled trials as topic/
191. randomized controlled trial.pt.
192. controlled clinical trial.pt.
193. (random* or sham or placebo*).tw.
194. placebos/
195. random allocation/
196. single blind method/
197. double blind method/
198. ((singl* or doubl* or trebl* or tripl*) adj25 (blind* or dumm* or mask*)).ti,ab.
199. (rct or rcts).tw.
200. (control* adj2 (study or studies or trial*)).tw.
201. or/190-200
202. 189 and 201
203. limit 202 to yr="2006 -Current"
204. limit 202 to yr="1902 -Current"
205. limit 202 to yr="1902 -2005"
206. guidelines as topic/

207. practice guidelines as topic/
208. guideline.pt.
209. practice guideline.pt.
210. (guideline? or guidance or recommendations).ti.
211. consensus.ti.
212. or/206-211
213. 189 and 212
214. limit 213 to yr="2006 -Current"
215. limit 213 to yr="1902 -2005"
216. meta-analysis/
217. exp meta-analysis as topic/
218. (meta analy* or metaanaly* or met analy* or metanaly*).tw.
219. review literature as topic/
220. (collaborative research or collaborative review* or collaborative overview*).tw.
221. (integrative research or integrative review* or intergrative overview*).tw.
222. (quantitative adj3 (research or review* or overview*)).tw.
223. (research integration or research overview*).tw.
224. (systematic* adj3 (review* or overview*)).tw.
225. (methodologic* adj3 (review* or overview*)).tw.
226. exp technology assessment biomedical/
227. (hta or thas or technology assessment*).tw.
228. ((hand adj2 search*) or (manual* adj search*)).tw.
229. ((electronic adj database*) or (bibliographic* adj database*)).tw.
230. ((data adj2 abstract*) or (data adj2 extract*)).tw.
231. (analys* adj3 (pool or pooled or pooling)).tw.
232. mantel haenszel.tw.
233. (cohrane or pubmed or pub med or medline or embase or psycinfo or psyclit or psychinfo or psychlit or cinahl or science citation indes).ab.
234. or/216-233
235. 189 and 234
236. limit 235 to yr="2006 -Current"

Appendix 2. Criteria for assessing risk of bias

Random sequence generation (selection bias)

Selection bias (biased allocation to interventions) due to inadequate generation of a randomised sequence

There is a low risk of selection bias if the investigators describe a random component in the sequence generation process such as: referring to a random number table, using a computer random number generator, coin tossing, shuffling cards or envelopes, throwing dice, drawing of lots, minimization (minimization may be implemented without a random element, and this is considered to be equivalent to being random).

There is a high risk of selection bia*s* if the investigators describe a non-random component in the sequence generation process, such as: sequence generated by odd or even date of birth, date (or day) of admission, hospital or clinic record number; or allocation by judgment of the clinician, preference of the participant, results of a laboratory test or a series of tests, or availability of the intervention.

Allocation concealment (selection bias)

Selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment

There is a low risk of selection bias if the participants and investigators enrolling participants could not foresee assignment because one of the following, or an equivalent method, was used to conceal allocation: central allocation (including telephone, web-based and pharmacy-controlled randomisation); sequentially numbered drug containers of identical appearance; or sequentially numbered, opaque, sealed envelopes.

There is a high risk of bias if participants or investigators enrolling participants could possibly foresee assignments and thus introduce selection bias, such as allocation based on: using an open random allocation schedule (e.g. a list of random numbers); assignment envelopes were used without appropriate safeguards (e.g. if envelopes were unsealed or non-opaque or not sequentially numbered); alternation or rotation; date of birth; case record number; or other explicitly unconcealed procedures.

Blinding of participants

Performance bias due to knowledge of the allocated interventions by participants during the study

There is a low risk of performance bias if blinding of participants was ensured and it was unlikely that the blinding could have been broken; or if there was no blinding or incomplete blinding, but the review authors judge that the outcome is not likely to be influenced by lack of blinding.

Blinding of personnel/care providers (performance bias)

Performance bias due to knowledge of the allocated interventions by personnel/care providers during the study

There is a low risk of performance bias if blinding of personnel was ensured and it was unlikely that the blinding could have been broken; or if there was no blinding or incomplete blinding, but the review authors judge that the outcome is not likely to be influenced by lack of blinding.

Blinding of outcome assessor (detection bias)

Detection bias due to knowledge of the allocated interventions by outcome assessors

There is low risk of detection bias if the blinding of the outcome assessment was ensured and it was unlikely that the blinding could have been broken; or if there was no blinding or incomplete blinding, but the review authors judge that the outcome is not likely to be influenced by lack of blinding, or:

- for patient-reported outcomes in which the patient was the outcome assessor (e.g. pain, disability): there is a low risk of bias for outcome assessors if there is a low risk of bias for participant blinding (Boutron 2005);
- for outcome criteria that are clinical or therapeutic events that will be determined by the interaction between patients and care providers (e.g. co-interventions, length of hospitalisation, treatment failure), in which the care provider is the outcome assessor: there is a low risk of bias for outcome assessors if there is a low risk of bias for care providers (Boutron 2005);
- for outcome criteria that are assessed from data from medical forms: there is a low risk of bias if the treatment or adverse effects of the treatment could not be noticed in the extracted data (Boutron 2005).

Incomplete outcome data (attrition bias)

Attrition bias due to amount, nature or handling of incomplete outcome data

There is a low risk of attrition bias if there were no missing outcome data; reasons for missing outcome data were unlikely to be related to the true outcome (for survival data, censoring unlikely to be introducing bias); missing outcome data were balanced in numbers, with similar reasons for missing data across groups; for dichotomous outcome data, the proportion of missing outcomes compared with the observed event risk was not enough to have a clinically relevant impact on the intervention effect estimate; for continuous outcome data, the plausible effect size (difference in means or standardised difference in means) among missing outcomes was not

enough to have a clinically relevant impact on observed effect size, or missing data were imputed using appropriate methods (if drop-outs are very large, imputation using even 'acceptable' methods may still suggest a high risk of bias) (Van Tulder 2003). The percentage of withdrawals and drop-outs should not exceed 20% for short-term follow-up and 30% for long-term follow-up and should not lead to substantial bias (these percentages are commonly used but arbitrary, not supported by literature) (Van Tulder 2003).

Selective reporting (reporting bias)

Reporting bias due to selective outcome reporting

There is low risk of reporting bias if the study protocol is available and all of the study's pre-specified (primary and secondary) outcomes that are of interest in the review have been reported in the pre-specified way, or if the study protocol is not available but it is clear that the published reports include all expected outcomes, including those that were pre-specified (convincing text of this nature may be uncommon).

There is a high risk of reporting bias if not all of the study's pre-specified primary outcomes have been reported; one or more primary outcomes is reported using measurements, analysis methods or subsets of the data (e.g. subscales) that were not pre-specified; one or more reported primary outcomes were not pre-specified (unless clear justification for their reporting is provided, such as an unexpected adverse effect); one or more outcomes of interest in the review are reported incompletely so that they cannot be entered in a meta-analysis; the study report fails to include results for a key outcome that would be expected to have been reported for such a study.

Group similarity at baseline (selection bias)

Bias due to dissimilarity at baseline for the most important prognostic indicators.

There is low risk of bia*s* if groups are similar at baseline for demographic factors, value of main outcome measure(s), and important prognostic factors (examples in the field of back and neck pain are duration and severity of complaints, vocational status, percentage of patients with neurological symptoms) (Van Tulder 2003).

Co-interventions (performance bias)

Bias because co-interventions were different across groups

There is low risk of bias if there were no co-interventions or they were similar between the index and control groups (Van Tulder 2003).

Compliance (performance bias)

Bias due to inappropriate compliance with interventions across groups

There is low risk of bias if compliance with the interventions was acceptable, based on the reported intensity/dosage, duration, number and frequency for both the index and control intervention(s). For single-session interventions (e.g. surgery), this item is irrelevant (Van Tulder 2003).

Intention-to-treat-analysis

There is low risk of bias if all randomised patients were reported/analyzed in the group to which they were allocated by randomisation.

Timing of outcome assessments (detection bias)

Bias because important outcomes were not measured at the same time across groups

There is low risk of bias if all important outcome assessments for all intervention groups were measured at the same time (Van Tulder 2003).

Other bias

Bias due to problems not covered elsewhere in the table

There is a low risk of bias if the study appears to be free of other sources of bias not addressed elsewhere (e.g. study funding).

Appendix 3. Imputation for missing data

The preliminary assumption made for imputation of missing values was that data were missing completely at random (Little 1987). In other words, it was assumed that data were not missing due to some factors confounded with the treatment effect.
Since information was solely available on change scores:

- change score treatment (T) is the difference between follow-up treatment pain score (mFT) and baseline treatment pain score (mBT);
- change score control (C) is the difference between follow-up control pain score (mFC) and pre-baseline-control pain score (mBC).

	Baseline	Follow-up	Difference
Treatment	mBT	mFT	T = mFT - mBT
Control	mBC	mFC	C = mFC - mBC
	EB = mBT - mBC	EF = mFT - mFC	E = T - C

If EB=0 then EF is equal to E.
The mean difference was calculated with the assumption that there were no baseline differences in scores (EB = 00). For the conversion, the mean post-score difference was assumed to be due to a difference in post-score values (EF), which then equals the post-follow-up difference (E).

Appendix 4. Clinical Applicability Criteria

1. The Patient: Are the patients described in detail so that you can decide whether they are comparable to those that you see in your practice? (Furlan 2009)
Each of the following criteria was rated as yes, no or unsure.
a) Age
b) Gender
c) Setting
d) Type of disorder/disease described
e) Duration of disease/disorder
f) Severity of disease/disorder
g) Recruitment procedure described
h) Description of inclusion/exclusion criteria including comorbidities
Scoring: a), b), d), and g) must be present for yes
Note: d) should include localization of symptoms and non-specific or radiating symptoms; for e) acute (< 6 wks) vs. subacute (6-12 wks), vs. chronic (≥ 12 wks);
2. The Intervention: Are the interventions and treatment settings described well enough so that you can provide the same for your patients?
Each of the following criteria was rated as yes, no or unsure.
a) Intervention Type/Content including where applied

b) Intensity/Dosage details (e.g. #reps, resistance)
c) Frequency of treatment
d) Duration of treatment period
e) Description of who delivered treatment
f) Proper intervention to answer research question

Scoring: must have a) to e) for yes.

Note: e) should include description of skills, training and experience

3. Reporting of Outcomes: Were all clinically relevant outcomes measured and reported?

Each of the following criteria was rated as yes or no.

a) Pain
b) Site-related* function or disability
c) Well being (GPE) or patient satisfaction

GPE = global perceived effect

*Site listed of importance to the study (eg. Neck)

Scoring: Must have a) or b) to answer yes.

4. Relevance: Is the size of the effect clinically important? (i.e. a minimal clinically important change (MCID) in treatment group, and significant difference between intervention group and control at follow-up)

Each of the following criteria was rated as yes or no.

a) * MCID in pain outcome in Rx group (at short-term or long term follow-up)
b) * MCID in disability/function in Rx group (at short-term or long term follow-up)
c) Statistically significant difference between intervention and control (at short-term or long term follow-up)

Scoring:

For each outcome, must have mean difference between groups (CI does not cross 0 or, if reported as Relative Risk or Odds Ratio, CI must not cross 1) = yes.

*For neck pain MCID of 1.0 or greater on a 10 unit Numeric Rating Scale (25%) for large effect.

*For function 5 Units on a 50 unit Neck Disability Index (10%) for large effect. (Furlan et. al. 2009), for Northwick Park Neck Pain Questionnaire 20% change from baseline (see Chiu 2005)

Also consider GPE and patient satisfaction when scoring.

5. Benefit versus harm Reporting

Were adverse effects reported?

Each of the following criteria was rated as yes or no.

a) Incidence of adverse effects reported
b) Severity of adverse responses reported
(serious/ severe versus minor/transient)
c) Adherence to treatment reported
d) Dropout rate and reasons reported

Scoring: Must have all to answer YES.

5b. Given the answers to 4 and 5 above, are the likely treatment benefits worth the potential harm?

This section was rated as yes or no.

6. Was the timing of the evaluation of the intervention sensible, given the mechanisms of action of the effect?

This section was rated as yes or no.

Scoring: Need to have reasonable timing of the evaluation to score yes (eg. Consider whether the intervention is meant to be short acting or long acting)

Outcome measures for exercise must be assessed at short-term (4-6 weeks) and long-term (~1 year) at least for yes.

Appendix 5. Grading the Quality of Evidence - definition of domains

Factors that might reduce the quality of the evidence

Study Design refers to type of study (i.e. randomised, observational study)

Limitations within Study Design (Quality) refers to the 12 'Risk of bias' criteria noted in Appendix 2.

Consistency (heterogeneity) refers to the similarity of results across studies. When all studies are included in the meta-analysis, 'consistency' is defined as absence of statistical heterogeneity. In the case that not all studies are combined in a meta-analysis, 'consistency' is defined when all studies for the specific outcome lead to the same decision or recommendation, and 'inconsistency' is present if the results of two or more studies lead to clinically different decisions or recommendations. Authors use their judgment to decide if there is inconsistency when only one study leads to clinically different decision or recommendation.

Directness (generalizability) refers to the extent to which the people, interventions and outcome measures are similar to those of interest.

Precision of the evidence relates to the number of studies, patients and events for each outcome. Imprecise data is defined as:

- Only one study for an outcome, regardless of the sample size or the confidence interval
- Multiple studies combined in a meta-analysis: the confidence interval is sufficiently wide that the estimate is consistent with conflicting recommendations. For rare events one should consider the confidence interval around the risk difference rather than the confidence interval around the relative risk
- Multiple studies not combined in a meta-anlaysis: the total sample size is underpowered to detect a clinically significant difference between those who received the index intervention compared to those who received the control intervention. In this case, a post-hoc sample size calculation should be performed to determine the adequate sample size for each outcome

Reporting (Publication) bias should only be considered present if there is actual evidence of reporting bias rather than only speculation about reporting bias. The Cochrane Reporting Bias Methods Group describes the following types of Reporting Bias and Definitions:

- Publication Bias: the publication or non publication of research findings, depending on the nature and direction of the results.
- Time Lag Bias: the rapid or delayed publication of research findings, depending on the nature and direction of the results.
- Language Bias: the publication of research findings in a particular language, depending on the nature and direction of the results.
- Funding Bias: the reporting of research findings, depending on how the results accord with the aspirations of the funding body.
- Outcome Variable Selection Bias: the selective reporting of some outcomes but not others, depending on the nature and direction of the research findings.
- Developed Country Biases: the non publication or non indication of findings, depending on whether the authors were based in developed or in developing countries.

WHAT'S NEW

Date	Event	Description
9 April 2013	Amended	Sherman 2009 had reported adverse events in their study in the form of adverse experiences. We have now included these adverse events that were reported in the study. In the review, Sherman 2009 was reported as 'one trial, three arms, 60 participants' but this has been corrected to 'one trial, two arms, 60 participants.'

HISTORY

Date	Event	Description
9 July 2012	New search has been performed	15 studies were included in the review. We excluded studies that assessed massage as a part of multimodal treatment. In the previous review, methodological quality was assessed using the van Tulder and Jadad scale. But for this review, the risk of bias assessment tool was used. Furthermore, the level of quality evidence was assessed using the GRADE approach
9 July 2012	New citation required but conclusions have not changed	Conclusions have not changed since the previous update. There is still a limitation in the quality of studies on massage therapy for neck pain. Furthermore due to the variability in massage techniques, there continues to be a challenge in compiling results from different studies
12 June 2008	Amended	Converted to new review format.
22 May 2006	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Primary Reviewers for this review: Patel K, Gross A, Graham N, Goldsmith CH, Ezzo J, Morien A, Peloso PMJ

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Study selection: N Graham, A Gross, D Burnowski, T Haines, O Boers

Data abstraction: M Khan, Olakunle Olabode

Synthesis and recommendations: Patel K, Gross A, Graham N, Goldsmith CH, Ezzo J, Morien A, Peloso PMJ

Conferences and publication: K Patel, A Gross

Research librarian: M Rice

DECLARATIONS OF INTEREST

None

SOURCES OF SUPPORT

Internal sources

- McMaster University, Ontario, Canada.
- Lifemark Health, Canada.

Industry Partner

External sources

- Problem Based Research Award, Sunny Brook and Womens College Health Sciences Centre Foundation, Toronto, Ontario, Canada.
- Consortial Centre for Chiropractic Research, National Institudes of Health, Bethesda, MD, USA.
- Hamilton Hospital Association, Hamilton, ON, Canada.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Multimodal care was removed from this review.

INDEX TERMS

Medical Subject Headings (MeSH)

Massage [adverse effects; *methods]; Neck Pain [*therapy]; Randomized Controlled Trials as Topic

MeSH check words

Adult; Humans